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Message from the Editor,

I am very pleased to inform you that we have published the second issue in 2021. As an editor of International Online Journal of Primary Education (IOJPE), this issue is the success of our authors, very valuable reviewers who undertook the rigorous peer review of the manuscripts, and those of the editorial board who devoted their valuable time through the review process. In this respect, I would like to thank to all reviewers, researchers and the editorial board members. The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to International Online Journal of Primary Education (IOJPE). For any suggestions and comments on IOJPE, please do not hesitate to send me e-mail. The countries of the authors contributed to this issue (in alphabetical order): Australia, Greece, Nigeria, Turkey, and United States.

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DISTANCE LEARNING IN PRIMARY EDUCATION IN GREECE IN THE MIDST OF COVID-19

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Abstract

The present study aims at probing the views of primary school educators on the use of distance learning during the COVID-19 pandemic crisis in Greece. The survey registers the problems encountered by the educators due to their insufficient training in online teaching, the lack of equipment that they and their pupils faced, and technical problems when connecting to the distance-learning platform. The paper also describes the educators' observations regarding the effectiveness of the learning process in terms of the degree of pupil participation, the percentage of material covered, and homework assignments. Furthermore, they present their experience in connection to the role that parents played in online teaching and their communication with them. Finally, they express their views on whether and how it might be possible to implement the learning process differently during the period of mandatory school shut-down because of the pandemic.

Keywords: Education, primary education, distance learning, teaching.

INTRODUCTION

The universal application of distance learning to all levels of education due to COVID-19 has been a worldwide fact and a worldwide necessity during the 2020-2021 school year. The learning process in education had to be transformed as educators, students and parents had to learn to cooperate on a new basis, different from the traditional one (Ng & Renshaw, 2020, p.645; Anderson, 2020; Hargreaves, 2020; Harris, 2020; Mineo, 2020). Naturally, Greece could not escape from this necessity. In many countries, including Greece, the level of educator training on how to practice distance learning and how to use new teaching technologies was low (OECD, 2020). For this reason, educators went looking for resources, training, and cooperation with the children's families (Yang, 2020; Huang, Liu, Tlili, Yang, Wang, et al., 2020) in order to ensure the effectiveness of the learning process.

Online teaching exposed more or less the same problems in all the countries where it was practiced. One of the more important ones that emerged concerned the equipment that students needed in order to be in a position to attend online courses (Robert & Danechi, 2020, p. 10; Powers, Brawn & Wyatt, 2020, p. 307) and to successfully cope with their demands. Many families had but one digital device which had to be shared by all siblings and/or parents working from home (Garcia, Weiss & Engdahl, 2020). Student access to the internet has also been a problem. On a global level, children from lower-income families lagged in terms of equipment as well as internet access (Andrew Cattan, Costa Dias, Farquharson, Craftman, Krutikova, Phimister & Sevilla, 2020, p. 668-670). There were also problems in the way teaching was conducted, the main one being teaching duration, which was not long enough to cover the material specified in the curriculum (Sharp et al., 2020, p. 4). Furthermore, the exercise material often had to be completed by the students after the end of class, then photographed or scanned, and sent to the educator (Addimando, Leder & Zudini, 2021, p. 65).

In addition, educators encountered great difficulties with the degree of student participation in distance learning. This effect was stronger in the first classes of primary school, where it was noted that the degree of participation was smaller and the quality of turned-in assignments lower compared with the impression given by the same students in times of in-person teaching (Figg, Lu, Lu & Crawford, 2020,



p. 25). Many authors maintain that, in most cases of distance learning, the teacher-student interaction seems to be only virtual so that it becomes a responsibility of the parents to stand in for the educator in terms of in-person teaching (Donohue Johnson, Lucas, Lynd, Mukerjee, & Thouvenelle, 2020). The role of parents in online teaching was decisive both in terms of the number of hours that they would devote to help their children, and in terms of their own level of education so that they may be in a position to help them (Bansak & Starr, 2021, p. 79; Jaeger & Hoppe, 2020).

In Greece, distance learning in primary schools began in April 2020, and continued from November 2020 until May 2021 with short breaks. The aim of this research is to analyse the views of primary education teachers concerning the way in which remote learning has been applied to primary school pupils, so as to provide a clear picture, to the extent possible, of the problems, difficulties and the effectiveness of this form of education.

This was accomplished by means of a survey which was carried out in order to investigate (a) the level of preparedness of the educators in applying distance learning techniques (knowledge and equipment), (b) the adequacy and the appropriateness of educator training for online teaching, (c) the problems that emerged from the application of online teaching and the way in which they were overcome, (d) the degree of student participation, and (e) the extent of parental involvement in online education.

The survey results could become a useful tool for managing similar situations where an exclusively online teaching approach is deemed necessary. Identifying the problems encountered can enable the design of solutions (in similar conditions in the future) that would enable a more effective online teaching.

METHOD

Research Model

The present survey was conducted among primary school educators using the questionnaire method. The questionnaire was designed and distributed electronically to avoid in-person contact due to the deteriorated epidemiological situation in the country.

Sample of the Research

The questionnaire was sent to 45 educators, 20 of which accepted to participate in the survey. The selection was made via the method of random sampling (Creswell, 2011:179-180). The selected educators teach in the two biggest cities of Greece, namely Athens and Thessaloniki, where classes are big, so that more data could be collected for the research parameters of interest.

There were 13 females (65%) and 7 males (35%) participating in the survey. Their professional experience varied between 2 and 36 years of service. The classes they teach can be broken down as follows: Three teachers in first grade, three in second grade, three in third grade, three in fifth grade, and seven in sixth grade. Thirteen of the participants teach classes of 20-25 children, five teach classes of 15-19 pupils, and two teach smaller classes.

Data Collection Tool

The data collection took place in May 2021 (more than a year after the start of the COVID-19 pandemic crisis in Greece) via electronic mail. Να το σβήσουμε από εδώ? Το αναφέρουμε παραπάνω. It contained 34 questions and 11 sub questions. Of these, four concerned the participant's background, eight were graded-answer questions, three were multiple-choice questions with multi-select answer options, 11 were open-ended questions, and the remaining were closed-ended. The questionnaire took approximately 25 minutes to complete.

For closed-ended and multiple-choice questions, the results are reported in order of decreasing frequency of the answer. For open-ended questions, a "content analysis" was performed, and categories were set up.



Analysis of the Survey Data and Results

Analysis of the Survey Data

Regarding the extent to which the educators were prepared to cope with this kind of teaching, half of the sampled educators replied that they were “not at all” prepared, and more than one in four (six) replied that they were “a little” prepared. Two of the participants stated that they were “quite” prepared, and two “very” prepared. The lack of preparedness for online teaching does not originate from a shortage of technical equipment on the part of the respondents, since 15 out of 20 replies that they possessed the necessary means. Two of those who did not possess technical equipment used material provided by the school, while three obtained what was necessary at their own expense. All respondents carried out online teaching from their home and not from school. The reasons for which they opted to teach from home are the following:

- Availability of appropriate hardware at home and familiarity with it (4 teachers)
- Family and practical reasons (presence of small children, comfort and better suitability of spaces, avoiding commuting, etc.) (6 teachers)
- Health reasons (2 teachers)
- Fear of network overload at school (2 teachers)
- Lack of network connectivity at school (1 teacher)
- “I did what every other teacher in the school unit did” (1 teacher)

In what concerns the question of educator training on distance learning, the majority stated that they were not prepared for remote teaching. Only one of the participants replied that they had previously attended some kind of training on online teaching. Since the introduction of distance learning (April 2020) and to this day, more than half of the educators have not received relevant training (12 teachers). The remaining eight of the sampled educators attended some training offered by one or more entities: (a) At the university (five teachers), (b) at a seminar organised by the coordinator of teaching activities (two teachers), (c) at a seminar organised by a trainer colleague (two teachers), (d) at seminars at Regional Training Centers (one teacher), (e) at a seminar organised by a school training counsellor (one teacher), and (f) at a seminar organised by the director of primary education (one teacher).

An investigation of possible problems that arose from the use of distance learning showed that 17 out of the 20 sampled educators respond in the positive as to the existence of problems during online teaching. These problems were (a) technical (some applications of the teaching software platform would not work), (b) related to platform usability (new tools for them as well as for the students) and (c) health-related (many hours in front of the computer, stress, psychological pressure).

The most important problems, as mentioned in more detail in their replies, involved the connection to either the Internet or specifically to the remote education platform (nine teachers), and the lack of necessary equipment on the part of the students (three teachers). Furthermore, the participants found that during remote teaching, communication with their students suffered (two teachers). As one of them characteristically stated, there was “*lack of participation, weak interest, loss of communication with children and parents*”. Other educators (two) mentioned that the difficulty they faced concerned the fact that they were unfamiliar with the process of online teaching (“*I knew nothing and I had to learn everything by myself*”), and that there was “*stress and difficulties in applying [the remote learning process] for both the parents and for myself*”. Another educator brought up the issue of parental cooperation: “*Parents were not always cooperative. For all intents and purposes, asynchronous education did not work for first-grade pupils, while synchronous education required plenty of time, effort and patience before we could get up to speed*”. A mother educator who participated in the survey noted that she had a hard time preparing for her class because her children were attending class at the same time as she.

In what concerns the ways in which they addressed these problems and difficulties, four of the sampled educators responded that they coped with the problems with “*persistence and patience*”.



Three educators dealt with the problems by modifying their method of communication with parents and pupils (sending educational material by email, communicating via Facebook, discussing over the telephone). Three of the participants asked for help from colleagues, friends and their own children in connection to the use of the online education platform, whereas other educators (two) experimented with the platform by themselves so that they would be able to use it more effectively.

Regarding the question of whether the problems experienced in the beginning of distance learning continued to persist until the end, eight educators responded in the affirmative. These were problems concerning difficulties or inability to establish an Internet connection, problems with the sound, and the lack of equipment for families with two or more children. Six educators responded that the problems (mainly those of a technical nature) decreased, and four mentioned that there were no longer any issues. Two educators also mentioned that *“student interest diminishes with time. Those who did not use to submit homework assignments before continue not doing so. Those who did not work autonomously before, do not do so now either”*.

Concerning the problems that the students potentially faced during the period of remote teaching, it would appear that their main problem in the first implementation of online teaching was the lack of technical equipment, since 13 out of 20 teachers mention that their pupils had no technical means at their disposal to attend online courses (49 out of a total of 394 pupils taught by the teachers who participated in the survey, or 12.44%). Among the children who did not possess any technical means to attend online courses, nine of them obtained the necessary equipment at their family’s expense, eight obtained it from school, three children were able to find equipment from friends and relatives, and one of them from the Ministry of Education.

Furthermore, thirteen of the participating teachers identified similar problems among their students to the ones they had to face themselves, both during the first year that online teaching was introduced (April 2020) and during the current school year (November 2020 – May 2021). Nine of those cited the difficulties that children experienced in connecting to the online teaching platform, and the lack of adequate technical equipment. Another teacher had difficulties with the teaching hours and the process of interacting with his students. An educator teaching a lower-grade class opined that the children were too young and immature for this kind of education, while yet another educator teaching a more senior class emphasises that *“The pupils are not used to an independent and autonomous way of working. They need very specific instructions, and distance learning requires personal effort and proper time management”*. Finally, another educator notes that *“some (children) have lost their spontaneity. Others turn off the cameras and leave; some are having a hard time with maths”*.

In the current school year, in which distance learning has been applied over a 6 month period, there was a major problem for pupils attending online classes simultaneously with their siblings and/or while their parents worked from home. The participating educators mention that 16 pupils were attending class simultaneously with their siblings of the same (primary) level of education, 11 pupils were attending class simultaneously with siblings of a different level of education (i.e., secondary or higher), 9 pupils had parents working from home, and 8 children were attending class while having siblings who were also attending class plus parents working from home.

Despite the problems that pupils might have had, most sampled educators report that their pupils attended online classes regularly.

Of great importance were deemed the educators’ responses regarding the course effectiveness and the teaching method. A series of questions were asked to this end. The first question concerned the pace at which the online course material was being taught relative to in-person teaching. For six educators the online course was advancing at 21%-40% of the classroom teaching pace, for five educators at 41%-60%, for six educators at 61%-80%, while for one educator the pace was at 0-20% and for another two educators at 81%-100%. The educators who responded that their teaching advances very slowly online compared with in-person teaching were the ones who teach first grade, while those reporting that online teaching advances almost as fast as in person teach sixth grade.



The next question, concerning the number of exercises taught by the surveyed educators, was crucial for the level of the provided education. Sixteen out of 20 did not teach as many exercises as in a physical classroom setting. Of those, six educators taught half of them, three educators taught one-third of the exercises, and four educators taught 60%. One educator responded that *“I have them do little games, we do other exercises orally by sharing screens, so in theory it could be that we actually do even more exercises”*. Although it follows from the above replies that most educators could not teach online as many exercises as they used to teach in the physical classroom, almost all respondents assigned homework (19 out of 20 educators). Of those, six educators assigned to their pupils the same number of exercises that they used to assign in a classroom setting; ten educators assigned fewer exercises, and three educators much fewer.

The sampled educators had some interesting responses in connection to parent behaviour during online teaching. Nine educators mention that only “a few” parents were attending class alongside their children, eight educators respond that they were “quite a few”, and three educators say that “most” parents were attending class.

However, even though parents may have been attending class to a significant extent, fourteen out of 20 participants state that there was no intervention on the parents’ side, while five educators report that there were “few” interventions.

Furthermore, with regard to parent involvement during online evaluation in the form of a test or a monthly examination, the surveyed educators respond that “few” are the parents who help their children. On the basis of this, it is not surprising that in their answer to the question of whether they believe it is possible to properly evaluate student performance in online courses, approximately half of the participating educators (nine of them) say that the evaluation cannot be accurate, while the remaining 11 reply that it can be accurate to some degree. For this reason, when responding to a question regarding the difficulty that they had in evaluating student performance in a way that reflects reality, nine out of 20 educators responded that they found it “quite” difficult, six that they found it “very” difficult, three “a little” difficult, and two “not at all” difficult. In any case, almost all educators (19 out of 20) agree that they would rather not turn in grades during the time that online teaching is in effect.

Another question was whether the participants believe that there are ways to replace remote teaching, to which seven out of the 20 responded that there is no other way, while three respond that they are not aware of an alternative. According to half of the educators, the system that was applied in May 2020 should have also been applied during the current school year, namely in-person attendance at school on a rotating basis or in small groups, and reduction of the course material.

Finally, the respondents were asked to mention any thought or difficulty they had with remote teaching. The responses are quoted verbatim:

- “We were unprepared for it. There should have been teacher training on new technologies even before [the pandemic]. Distance learning is not for the first grades of primary school, especially for the first grade.”
- “... to what extent we know how to teach remotely, as this is a different type of teaching.”
- “Pupils spend quite a few hours in front of a computer.”
- “The mental and physical effect of teaching during the lockdown.”
- “It is more tiring for both teachers and pupils.”
- “I am quite concerned about issues of personal data protection and the use or not of the camera.”
- “It is a very wrenching experience in front of a screen with cameras turned off so as to not lose the connection. No comparison with in-person [teaching].”
- “I hope this is not a trial experiment [sic] for future use, because nothing [can be] more definitive than the temporary. We want in-person learning.”



FINDINGS

There are two important issues that emerge from the responses of the sampled educators of this survey. The first issue is the extent to which they were knowledgeable enough to practice online teaching, while the second issue concerns the various technical problems that both they and their pupils had to face.

In what concerns the implementation of distance learning, it could be said that primary school teachers in Greece went through a violent transition. Considering that a number of them are of a more senior age with major shortcomings in digital literacy, the problem was quite acute. Making things worse, most of them had no training for this form of teaching either during their studies or during their professional career (König, Jäger-Biela & Glutsch, 2020; Wahyuni, Aziz, Wargadinata & Efiyanti, 2021). They were completely unprepared when remote teaching came along, so that they started seeking various ways to educate themselves (Song et al., 2020, p. 751-754; Yang et al., 2020, p.740-742). Equally problematic is the fact that, to this day, there has been no training offered by the Greek Ministry of Education. In fact, teachers serving in primary education did their remote teaching using, in most cases, a “utilitarian” approach. At the same time, it is not surprising that in primary education, and especially in the first grades of elementary school, pupils are not very familiar with the use of a computer or the Internet. This objective shortcoming of the pupils was compensated by parental assistance. However, as parents often remained present for the entire duration of a class, they added stress to the teachers who felt that they were being constantly “judged” and “evaluated” by the parents, thus taking spontaneity out of their teaching.

The second issue pertains to the technical equipment (computers, tablets, cameras, etc.) and concerns both educators and students. The problem became more severe when two or more children were attending an online class while parents were also working from home (Addimando et al., 2021, p.66; Andrew et al., 2020, p. 679). As far as the technical equipment is concerned, several educators did not possess the necessary means to accomplish their teaching. It seems, however, that the lack of technological devices was more frequent on the part of the students (Cakin, & Kulekci Akyavuz, (2021). Furthermore, educators and students often found it difficult to connect to the digital classroom due to a low data-connection signal or network overload (Korkmaz & Toraman, 2020, p. 304). The problems with sound continued to persist until the end of the use of remote teaching, thus causing irritation and stress to both teachers and pupils.

From the above one can understand that the teaching pace could not be as it should; it was slow and often problematic (Sharp et al., 2020). The educators did not manage to teach the material and the exercises that they would have taught in the case of in-person teaching, nor to communicate with their students, support them in their problems, etc. (Ballová Mikušková & Verešová, 2020). For this reason, half the sampled educators believe that it would be possible to have a better learning outcome if the teaching took place on a rotating basis or in small groups, as it happened during the first period that distance learning was applied (Mauras, Cohen-Addad, Duboc, Dupré la Tour, Frasca, Mathieu, et al., 2021). In that way, teaching would be done under “normal” conditions, as opposed to the “unnatural” and protracted reality of a mandatory lockdown, thus offering a better learning and psychological outcome for the students.

DISCUSSION, CONCLUSION and RECOMMENDATIONS

The COVID-19 pandemic crisis has already lasted for more than a year, and according to global epidemiological data it may well continue for a long time. It is therefore possible, according to the opinions of the experts that similar emergency conditions may arise again in the near future. Obviously, the choice of distance learning has been imposed by the circumstances but it is not the only available choice. Its use over extended periods of time cannot yield the same learning outcomes as in-person teaching. In order to safeguard not only the children’s cognitive development but also their social-emotional learning and well-being, it would be preferable to create classes with a lower teacher-



to-student ratio or at least to adopt teaching on a rotating basis. At the same time, it would be good if the curriculum were adapted to the new conditions which do not only concern COVID-19 but also other, analogous changes in the future. Furthermore, it is necessary to provide educators with periodic training on the use of new educational technologies, thus enabling them to use them comfortably for the benefit of the learning process. New technologies could be incorporated in everyday in-person teaching to ensure that students and teachers are sufficiently familiar with them when live teaching must be interrupted. In that way, the teaching pace will be maintained while ensuring the active participation of all students. Moreover, when it comes to student evaluation, educators will no longer have concerns with its validity and objectivity if students become accustomed to being examined by electronic means even during in-person teaching. Finally, educators must seek out teaching methods and techniques that would make distance learning more appealing, thus offsetting the loss of personal contact with their students but also among students themselves. In any event, it cannot be denied that the global pandemic crisis caused by COVID-19 has significantly changed the daily lives of all of us, and especially our work and educational environment.

This research attempted to show the weakest, most “problematic” points of online teaching, such as it was implemented during the pandemic in Greece. However, the sample of primary education teachers that was used was relatively small, and can only indicate “trends” in the total teacher population. This work is a pilot survey, the findings of which can constitute the basis of future, wide-ranging research for an in-depth investigation of the learning, social-emotional and psychological implications of distance learning during periods of health or other crises that necessitate its exclusive use.

Limitations

The present survey was carried out via the questionnaire method over electronic mail to maintain the anonymity of the participants. Three teacher interviews were held before the questionnaire was finalised, in order to pinpoint ambiguities in the initial version of the questionnaire, and to identify points where the surveyed needed further clarification. It was decided that data collection should take place towards the end of the school year so that, on the one hand, the coursework would be almost completed, while, on the other hand, the overall experience of distance learning would still be recent for the teachers.

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CULTURALLY-BASED INSTRUCTIONAL STRATEGY AND PRE-PRIMARY SCHOOL CHILDREN'S SOCIAL COMPETENCE IN NIGERIA

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Abstract

Pre-primary education lays a foundation for the formation of competence in every domain of a child's development including social competence. Social competence is culturally linked and might not be achieved when a culturally-based strategy is neglected in the classroom. Most of the strategies adopted in the Nigerian classrooms have less touch on relevant culture. This study, therefore, determined the impact of a Culturally-Based Instructional Strategy (CBIS) on pre-primary school children's social competence. Two pre-primary schools (public and private) from two Local Government Areas (LGAs) with a large number of pre-primary schools in the Ibadan metropolis were purposively selected. An intact class of Nursery III was selected per school and randomized into CIBS and conventional groups. 74 pre-primary school children participated. Children's Social Competence Rating Scale ($r=.80$) and CIBS Instructional Guide were used to collect data. Data were analyzed using both descriptive and inferential statistics. There was a significant main effect of treatment on pre-primary school children's social competence ($F_{(1,65)}=24.57$; partial $\eta^2=.27$). The children exposed to CBIS had a higher social competence mean score (107.14) than their counterparts in the control group (80.41). Pre-primary school teachers should adopt this strategy to facilitate pre-primary school children's social competence.

Keywords: Culturally-based instructional strategy, social competence, pre-primary school children.

INTRODUCTION

Producing a complete child that will be highly knowledgeable and culturally relevant remains part of the goals of early childhood education globally and Nigeria in particular (Federal Republic of Nigeria, (FRN) 2013; Allen & Kelly 2015; Gordon & Ionescu 2018). According to Oduolowu (2011), children developed holistically hence their education should follow the same pattern. None of the domain of child development ought to be neglected or given less attention. Education generally is considered as a way of equipping an individual recipient with relevant knowledge, attitudes and skills necessary for survival within the cultural environment, to make a meaningful contribution and live peacefully with people in the immediate environment and the global world (Majebi, 2017; Olowe, 2019). This is to say that education is culture-oriented.

Education tailored alongside the real culture of the Africans focuses on the all-around development of the child. Conscious efforts are made towards developing a holistic child, no aspect of child development



lacks attention. Children were engaged in culturally-related activities that promote mental and physical development, well-mannerism, and a high level of social interaction via communalism. Among all these, special attention is giving to the development of a socially competent individual who will not display behaviour that will tarnish the image of the family and community. Inability to exhibit social competence makes nonsense of other forms of knowledge a child might have acquired in the African setting. According to Fafunwa (1995), functionality and character building were the hallmarks of the education of Africa. Omordu and Amaele (2014) proclaimed that the absence of any other aspect of education could be managed as long as a good character (ability to relate with others in a socially acceptable manner) was prevalent, but the absence of this on the part of an individual is the most shameful thing that could happen to the child's own immediate and extended families. As Fafunwa (1995) placed it, in the traditional Nigerian society all parents want their children to be upright, honest, kind and helpful to others, and will spare no pain to instill the qualities ...all Nigerian parents irrespective of ethnic group, prefer to remain childless than to have children who will bring shame and dishonour to the family. What Fafunwa meant is that developing a socially competent child was not negotiable, either was it handle with laxity. Special attention was committed to producing children that were able to relate with others around him/her in a socially acceptable manner. Conscious efforts were made to inculcate values, attitude, and character to equip the individual with what is needed to be functional and relevant in the immediate environment and the society at large (Majebi & Oduolowu, 2020).

Moreover, the recent negative happenings in the world have increased the world's interest in building human capacity that is not only intellectually sound but also socially competent. The world is becoming unsafe among the human race as people are becoming a threat to one another. This has changed the global perspective on learning to include learning to live as one of the essential parts of learning. The global agenda for the child encapsulates all-around learning, which includes learning to know, learning to do, learning to be and learning to live (Delors et al. (1996) cited in UNESCO 1996). Living successfully in an environment whether immediate or global demands that an individual must be socially competent.

The study of social competence focused primarily on behavioural skills displayed during interaction with others either peer, family or group of people. It is a broader term used to describe social relationship effectiveness. Estes (2004) described social competence as the ability of an individual to effectively engage in appropriate social behaviours and maintain an interpersonal relationship. Manz and Mcwayne (2004) viewed it as the capacities children possess for developing positive relationships with adults and other children. It could be described as the children's ability to act wisely in a culturally acceptable and appropriate human relationship. Social competence begins as early as a child is born into a family system and a particular cultural setting. Howes and Matheson (1992) ascertained that social competence develops initially during early childhood as this is a developmental period. It thus means that adequate attention is required during this sensitive stage to mould the child into an acceptable member of society by employing a strategy that is culturally based.

The development of social competency is culture-tied because culture dictates specific behaviour and manners that are socially acceptable in human relationship in communities. It plays important roles in helping children to be able to relate in culturally appropriate manners in society. According to Aydin, Thorns and Kozleski (2012), part of the process of becoming educated is becoming socialized to the cultural way in which knowledge and skills are pursued, understood and performed in and outside the school. Education plays a pivotal role in the socialization of a people and also in the moral or ethical life of the people. A person who lacks good character, though filled with all knowledge, cannot be said to be well cultured. He is in no wise an educated fellow (Egbunu, 2013). This means, therefore, that being educated is linked to the ability to relate effectively in a culturally acceptable manner. Education is not expected to make its recipient an alien to his or her immediate society.



Social competence encompasses many skills that someone can display appropriately or deficiently before it can be determined. Among these components of social competence are the skills of relationship, tolerance and respect which can help children to relate well with peers and adult around them, and also be acceptable in society. These skills are given prominent attention in this study because the early years are known for tremendous growth in interactions and building a relationship with peers and adults.

A relationship is one of the skills of social competence considered in this study. This skill was selected because it might be difficult to ascertain how socially competent a child is if he or she is not relating to others. It has to do with the way two people or groups of people feel or behave towards each other. Amosun (2011) views relationship to mean behaviour or feelings towards somebody else; the connection between two or more people or groups and their involvement with one another, especially as regards the way they behave towards and feels about one another. Social competence refers to getting along well with others, being able to form and maintain a close bond, and responding in adaptive ways in social settings (online library). So, a relationship holds a sensitive position in social competence. Evans, Myers and Ifield (2000) identify the relationship, especially peer, adult and child relationships as one of the key elements of social competence. Abatan and Otufale (2010) say that relationship is socially and culturally constructed. A relationship is crucial and unique in an African setting. The individual is viewed as an integral part of society, and can only exist corporately (Mbiti, 1969). In this way, an African child is born into a world consisting of people who are connected, not necessarily by blood. This makes her/him a brother, sister, niece, nephew, and/or a grandchild of many people in his/her village.

Respect in the same vein helps to promote a cordial relationship. It connotes a mark of a well-behaved individual. Africans have a great and high sense of respect for ages. Any act of disrespect is frowned upon and attract punishment (Nwanaju, 2010). Putnam (2003) says respect is the good starting point for ethics. According to him, respect equals good behaviour and good behaviour equals respect. Invariably, a lack of respect equals bad behaviour. Among the various ways of showing respect, greeting plays a significant role. Ntagu (2010) avers that the uniqueness of every culture is probably centred on the mode of greeting. Respect for elders is one of the practices that African cultural values.

Tolerance is a fundamental component of social competence. It is a way of learning to accommodate others regardless of the difference between behaviour, belief and opinion. Reardon (1997) describes it as a way of according others the right to have their persons and identities respected. Benenson, Markorits and Fitzgerald (1990) describe tolerance as acceptance of the stresses and strains within a relationship. It is the willingness to accept feelings, habits, or beliefs that are different from one's own. The ability to endure minor frustrations, such as delayed gratification, interruption of activity, broken or misplaced playing materials is one indicator of a child's social competence. It takes tolerance to be socially competent, there is a need to get used to varieties in terms of opinion, lifestyle and background. When a child is among peers relating, there is bound to be a crisis in a relationship in the form of argument, and dislike. The key to bringing these under control is tolerance.

These skills have been identified to be badly affected by the interaction with foreign culture. An average African man was known to be his brother's keeper (Oroka, 1990). African societies believe that the individual cannot successfully live in isolation. They believe in corporate existence characterized by a web of closely-knit, kinship well as social and religious relationship. They are known for communalism but the celebration of Western culture above African's harmless values has tremendously displaced this. The advent of Western education, which tended to emphasize individualism has also caused communal life to be thrown overboard. Individualism and social isolation have become the style of social relationship in African communities (Nyerere, 1968; Bilesanmi-Awoderu, 2008; Johansson, 2009). This might likely be one of the factors that opened the door for intolerance in the African community. Employing western-based strategy solely in the African classroom is also believed to have badly affected the ways and



manners by which African children are now exhibiting social competence because it has been reported that values such as greetings, communal relationship, respect for elders, and the hosts of others are going down the drain. Ocitti (1994), Gwanfogbe (2001), Okeke (2007) Akinsola (2006), and Akinwale (2013) decry the rate at which an act of respect is disappearing from society. It is not uncommon to see youths not respecting the elders, in the spheres of greetings, courtesy, respectful communication (Bilesanmi-Awoderu 2008). Children now demand remuneration before carrying out a domestic chore (Okpilike, 2013). Considering all the inadequacies identified, it can be deduced that children of the present generation are socially incompetent. These could be the reflections of the fact that the conventional instructional strategy does not consciously focus on developing this area. This was confirmed by Gay (2002), who asserts that conventional instructional strategy only emphasizes factual information while minimizing values, attitudes and ethics. This is a pointer to the fact that there is a need to engage children at the early stage in classroom practices that promote and respect values and virtues of the immediate environment through culturally based strategy

Culturally-based instructional strategy (CBIS) is described as the instructional strategy that is grounded in an understanding of the role of culture in the teaching and learning process (Underwood, 2009). Alaska Native Knowledge Network (1998) views the strategy as a way of shifting the focus in the curriculum from teaching/learning about cultural values as another subject to teaching/learning through the local culture as a foundation for all educational activities. This strategy emphasises the use of indigenous stories, rhymes, songs and games during teaching and learning activities. It uses the language of the immediate environment and culturally relevant instructional materials as well as a community resource to support children's learning. King (2012) note that CBIS recognises that pupils learn in many different ways and that these practices maintain that varied instructional techniques are a critical part of teaching responsively. This strategy encourages children to recite local stories, rhymes and engage in play and game songs. All these are effective in producing a total child in an African setting. Pence and Schafer (2006) confirm that local stories convey strong morals, helping children to distinguish between good and bad. They also help in shaping character and promoting children's education in specific social values, such as encouraging resilience, bravery, cleverness and intelligence, care for others, family life, obedience to elders, and hard work, while criticizing greed and corruption. Essa (2011) avers that play continues to be an important vehicle for school-age children's social development. Salami and Oyaremi (2012) also stress that plays develop in the children acceptable habits, attitudes and values that could produce a fundamental and deeper inculcation of societal norms. Play especially the indigenous –based, immensely accelerates the process of socialization.

Manganye (2011) also claims that African indigenous game-songs do not have any trace of Western influence; they are purely in the language of the immediate particular environment. They are carried out mostly in an outdoor environment and involve a lot of activities that could lead to the holistic development of children. Ogundijo (2005) had earlier identify some of these activities to include running, jumping and other physical, energy-sapping activities. The activities support the development of the children's fine and gross motor skills. They also provide an opportunity for children to interact maximally, the majority of them cannot be done as an individual. Most of the 'so-called games' children engage in now is done while seated, and alone which might have social and health implications. These indigenous games provide physical exercises that give children the opportunity to vigorously and joyfully use their bodies, they simultaneously refine and develop skills that enable them to feel confident, secure, and self-assured. And most especially provide an opportunity for optimal interaction among peers.

Though National policy on education (FRN, 2004) recommends some of the elements of a culturally-based instructional strategy for teaching and learning, they also reflected in the school curriculum, but most at times, the strategies employed to pass instruction in the classroom betray them. This is supported



by many authors who concluded that the contemporary strategy in our classroom is believed to be western-culture based especially in the area of methodology, the medium of instruction and instructional materials (Okeke, 2007; Roy-Omoni, 2010; Salami & Oyaremi, 2012; Okpilike, 2013). These are believed to have eroded so many of the values that have been used to prepare people to be conscious of their background.

Omordu and Amaele (2014) confirmed that the contemporary Nigerian system of education has been functioning with Western concepts of values without emphasis on the aims of African education. The authors explain that because we do not function with the aims and objectives of our education, we cannot but experience some cultural and moral disorientation. Functioning with the European frame of reference is not only extremely damaging to our sense of identity but could be the root cause of our present moral decadence. One way by which the elements of culture that have been found effective in training children in culturally acceptable ways can find their way back to the classroom is to make the instructional strategy culturally-based. This implies that if the role of culture cannot be ignored in the proper upbringing of children and also that children learn in many different ways, then the indigenous ways of teaching and learning could be effectively integrated into the conventional strategy.

The extents of the moral decadence perhaps could be what responded to Obanya (2007) that calls for education that reflects African values and practices. This can best be introduced at the early childhood education level most especially at the pre-primary school level. Pre-primary education, according to United Nation Education Scientific and Cultural Organisation (1997), is the initial stage of organized instruction, designed primarily to introduce very young children to a school-type environment that is to provide a bridge between home and a school-based atmosphere. Federal Government of Nigerian (2013) in the National Policy on Education describes it as the one-year education given to children aged 5 before their entering primary school. The essence of this one-year compulsory education according to Haque, Nasir, Yesmin, and Biswas (2013) are to ensure a smooth transmission to primary education and lay the foundation for lifelong learning. Pre-primary education can then be described as an educational level designed to expose and prepare children for primary school activities to ensure readiness for the task ahead. The period lays the foundation for the formation of competence in every domain of a child's development. One of such competence is social competence.

Integration of culturally appropriate strategy into the teaching and learning process is gaining global attention because it is believed that it can produce a culturally responsive child. Nevertheless, in Nigerian classroom, the culture of the immediate environment has been relegated to the background as the use of foreign stories, songs, rhymes, language, and materials during the teaching and learning processes especially at the pre-school level are becoming the prevailing practices in our classroom setting. This is believed to be the reason why this generation is experiencing the fast disappearance of cultural values and practices. Studies have shown that CBIS is effective to promote children's social competence but most of these studies were carried outside the shores of Nigeria. Some related studies carried out in Nigeria only considered some of the elements of CBIS but the effect of all elements of CBIS on pupils in Oyo State has not been given adequate attention. This study, therefore, determined the impact of the strategy on pre-primary school children's social competence in Oyo State, Nigeria.

Research Questions

This research question was posed to guide the study

Is there any difference before and after the treatment in children's development of social competence in

1. relationship,
2. respect, and
3. tolerance?



Theoretical Framework

The study is hinged on the theory of Ujamaa or African Socialism. This theory was propounded by Julius Kambarage Nyerere in 1967. His theory states that it is through socialism that Africans can get the vision of what is life. This theory was an attempt to decolonise African minds to accept themselves as Africans. Nyerere made a critique of inadequacies and appropriateness of colonial education. He believed that the educational system introduced by the British was to defraud Africans of their values and traditions, so did not address the needs of the African people. He identified this fault especially in the area of the relevance of the education to the recipient's immediate environment. More so, he wanted a change in the education system because of the beliefs that education is an instrument of society to reinforce its value and tradition. The theory believes that for the African educational system to be relevant and benefit the recipient's in his/her immediate environment, the education should not de-culture the African child. Thus the theory of African socialism (Ujamaa) is considered relevant to this study because it was conceived by an African philosopher and the theory believes that the spirit of communalism should define a relationship. It also advocates for an instructional strategy that accommodates stories, songs, games and rhymes that were part of the people before the advent of western education.

METHOD

The Model of Research

The study used the pretest-posttest control group quasi-experimental research design to determine the impact of the treatment (culturally-based instructional strategy) on pupils' social competence (skills of relationship, respect and tolerance). This study observed how well the pre-primary school children exhibited the skills of relationship, respect and tolerance before as well as post-treatment.

A Sample of the Research

Two pre-primary schools (one public and one private) were randomly selected from two local government areas (LGAs) (Ibadan North and Ibadan North-East) based on their willingness to participate in the study. A total of 74 pre-primary school children (44 males and 30 females) with a mean age of 5.61 from the two local governments participated in the study. An intact class of Nursery III was selected per school, and randomized into CIBS and conventional groups respectively.

Scope of the Study

The study covers two local government areas in Ibadan. Two pre-primary schools (one public and one private) were selected from each of the local government areas. The social competence considered were skills of relationship, respect and tolerance. The elements of CBIS covered were methodology (Indigenous stories, games, songs and rhymes), the language of the immediate environment (Yorùbá) and indigenous instructional materials (shells, stones, mats, dry seeds and big colourful beads).

Data Collection Tools

Instruments used to collect data for this study were instructional guides (for both experimental and control groups), children's social competence scale ($r = 0.80$) (This scale was adapted from Ages and Stages Questionnaire (ASQ-3) designed by Squires, Bricker, Twombly (2003) ASQ-3 is the blueprint for measuring social competence in preschool children.), Compiled Relevant Indigenous Rhymes, Songs and Games, Children's Indigenous Picture Storybook, Pictorial Charts on Indigenous Numbers and Alphabets.

Procedure for Data Collection

The study was carried out in three stages which include; the training of research assistants/administration of pretest, implementation of the treatment and administration of posttest. The procedure lasted for ten weeks in the selected schools. Four schools (two public and two private schools) selected were randomizing mixed as one public and one private into experimental and conventional groups respectively.



The pre-primary school children in both groups were rated before the experiment to ascertain their level of social competence. Children in the experimental group were exposed to culturally-based instructional strategy (CBIS) which comprises methodology (indigenous songs, rhymes, games and stories), the medium of instruction (the language of the immediate environment -Yoruba) and indigenous materials (such as beads of different colours, dry seeds, cowries to develop the skills. All these were used to expose children to hands-on activities that enhance social interaction, individual work was reduced to the nearest minimum. Group work was encouraged during the teaching and learning activities through indigenous games, songs, rhymes and stories. Relevant indigenous stories, rhymes and game songs were used to facilitate the acquisition of the skill of relationship, respect and tolerance. The pre-primary school children in the control group were exposed to the conventional instructional strategy (CIS). Each child focused on the class activities given to him/her. This strategy has been established by researchers to be dominated by Western-oriented activities, such as foreign songs, rhymes and games language. English was the medium of instruction adopted for the conventional group. Afterwards, a posttest was administered to the two groups by the tenth week of the study.

Four research assistants that have M.Ed. in Early Childhood Education served as raters in the four schools why the study was conducted. These raters received training on how to use children’s social competence scale to rate individual child’s exhibition of the skills that were the focus of the study (relationship, respect and tolerance). The training involved lecture and practical demonstration to ascertain the mastery of the usage. The video was also recorded throughout the experiment to further observe each child’s social competence during each of the activities to provide more information on these skills. Pictures were taken during the activities.

Data Analysis

Both descriptive and inferential statistics were used to analyse the data collected in this study. Descriptive statistics of frequency count, percentage and graph were used to analyse the demographic data; these, in conjunction with mean and standard deviation, were used to answer the research questions as appropriate. Paired t-test was used to show the difference between the pretest and posttest scores of children. Estimated Marginal Means was used to show the magnitude of performance across the two groups.

FINDINGS

Section A: Answers to Research Questions

Research Question: Is there any difference before and after the treatment in children’s social competence in

1. relationship,
2. respect, and
3. tolerance?

Table 1. Summary of paired t-test analysis showing the difference between pretest and posttest scores of the children in social competence

Paired Variable	N	Mean	Std.Dev.	Mean Gain	t-value	Df	Sig.	Remark
Pre-relationship	37	24.405	5.246	13.892	12.537	36	.000	Significant
Post-relationship	37	38.297	5.695					
Pre-tolerance	37	22.108	4.624	12.135	11.752	36	.000	Significant
Post-tolerance	37	34.243	5.372					
Pre-respect	37	22.351	4.480	12.595	14.247	36	.000	Significant
Post-respect	37	34.946	4.955					



Table 1 reveals that there was a difference between the mean scores of relationship skill at the pretest (24.41) and the posttest (38.30) of the children exposed to the treatment. This difference was significant ($t=12.54$; $df=36$). Also, there was a difference between the mean score of tolerance skill at the pretest (22.11) and the posttest (34.24) of the children exposed to the treatment. This difference was significant ($t=11.75$; $df=36$). There was a difference between the mean score of speaking skill at the pretest (22.35) and the posttest (34.95) of the children exposed to the treatment. The difference between the pretest and the posttest mean scores was 12.60. This difference was significant ($t=14.25$; $df=36$).

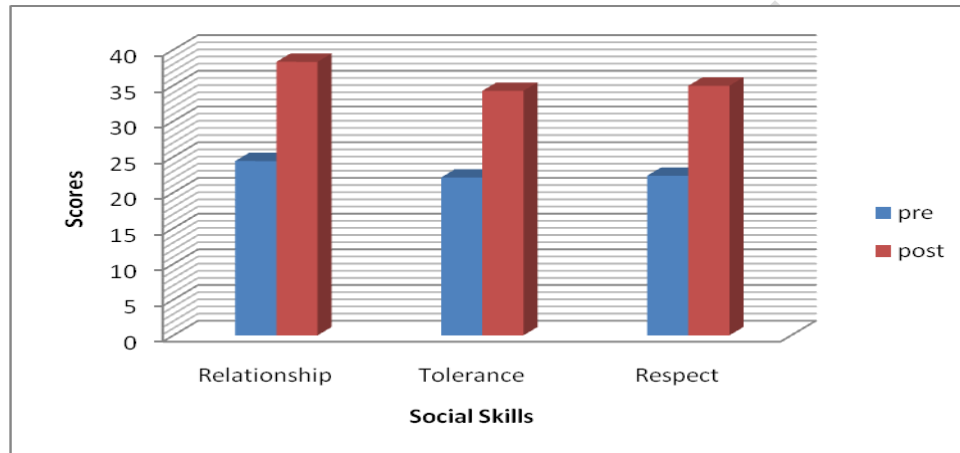


Figure 1. Social competence before and after treatment

Table 2 presents the magnitude of performance across the groups.

Table 2. Estimated marginal means on social competence of the children

Variable	N	Mean	Std.E.
INTERCEPT			
Pre score	74	58.405	-
Post Score	74	93.776	2.117
TREATMENT			
Control Group	37	80.413	2.711
Experimental Group	37	107.139	4.019

Table 2 reveals the social competence scores of the two groups of children. Out of a maximum mark of 136, the mean score of children in the control group is 80.41 (59.13%) while that of children in the experimental group is 107.14 (78.79%). This implies that those exposed to cultural-based instructional strategy had better social development than those exposed to conventional strategy.

DISCUSSION and CONCLUSION

The Main Effect of Treatment on the Acquisition of Social Competence

The major concern of this study was to determine the impact of the treatment (a culturally-based instructional strategy which comprises of the indigenous method, medium of instruction and learning materials) on pre-primary school children’s social competence. The research question raised is; is there any difference before and after the treatment in children’s social competence in

- a. relationship,
- b. respect, and
- c. tolerance?



The finding of the treatment revealed that there was a significant main effect of treatment on children's social competence. Those exposed to culturally-based instructional strategy gained more in social competence than those exposed to conventional strategy.

The effect size of the treatment was 27%. This might be as a result of several culturally-based activities that children were exposed to in the experimental group. They were engaged in culture-related activities, such as singing and demonstration of indigenous songs, rhymes and games. They were also exposed to some of the practices that were socially acceptable in their immediate environment, such as ways of showing respect, including culturally appropriate verbal greetings with physical gestures. Also, the contents of social development (peace education, rights and responsibility, conflict transformation), as stated in the early childhood curriculum, were taught with relevant indigenous stories, songs, rhymes and the language of the immediate environment (Yorùbá) was the medium of instruction. The treatment provided opportunities for children to relate better and closer than the conventional classroom practices. Children were engaged in group work as individual classwork was reduced to the barest minimum, and this gave room for close interaction among them in the classroom.

All these were found to have facilitated the acquisition of social competence of those in the experimental group more than those of the conventional group. This finding is in line with the finding of the study carried out by Nyota and Mapara (2008) on children's traditional games and songs, which revealed that traditional games and songs played a significant role in the development of socialisation of the young. The CBIS is not only effective in acquiring social competence but also possesses the ability to correct problems associated with the behaviour. Garza (2004) found CBIS to be effective in handling children with behavioural problems. The result of the findings of Thoms (2014) also revealed that adopting CBIS tends to lead to behavioural success in learners. Engaging children in indigenous play and game-songs activities, according to Serpell and Nsameng (2014) enhances social enculturation because it exposes them to practising their cultural values.

The pre-primary school children in the control group were exposed to conventional instructional strategy. Conventional strategy in this context means the classroom situation where teaching and learning activities were carried out through the use of Western rhymes, songs and games. The medium of instruction was the Western language although teachers at the public schools use the mixed (bilingual) method of instruction. This has been earlier identified by Oduolowu (2007) and the situation persists. Also, teachers relied on the use of imported materials as instructional materials. They were taught the same content but the teaching was carried out without any element of culturally-based strategy. This was confirmed by Nyota and Mapara (2008), Salami and Oyaremi (2010), Obanya (2010), Roy-Omoni (2010) and Fakeye (2010). No activity gives room for group work. Each of the pupils concentrated on his/her work. There was little opportunity to relate with peers in the classroom. Social interaction was restricted to break time. This might have prevented children from demonstrating some of the skills of social competence considered in this study. The language of instruction (English) also affected the expression of respect, especially to adult. As reported by Akinmusire (2013) that English could be described as not as an honorific when compared with Yorùbá. This might hinder the demonstration of courtesy and respect that is culturally acceptable in the immediate environment.

The findings also revealed the social competence scores of the two groups of children. Out of a maximum mark of 136, the mean score of children in the control group was 80.41 (59.13%) while that of the children in the experimental group was 107.14 (78.79%). This implies that those exposed to culturally-based instructional strategy had significantly better social competence than those exposed to the conventional strategy. This is in line with the submission of the National Policy on Education (FRN, 2007; 2013), that culturally appropriate content, method, medium and materials should be employed to engage



pre-primary school children in teaching and learning activities, to develop in children societal acceptable values and harmless practices.

The significant effect of culturally-based strategy on the social competence of children is in support of the findings of Underwood (2009), Thompson (2010), and Mayfield (2011). The study conducted by Underwood (2009) did not have social competence as one of its dependent variables but it was discovered during the study that the strategy was capable of enhancing other students' outcomes such as social skills and behaviour which was beyond the scope of the study. Mayfield (2011) reported that any school that engages this strategy to teach provides a 'nest' where children are nurtured in a socially acceptable way. The strategy, according to him, is known for the culture of caring for each other. Greeting automatically becomes part of the school culture in CBIS. Also, the result of the findings of the study carried out by Thompson (2010) indicated that students in the CBIS classroom were more inclusive in their mutual friendship than students in the conventional classroom. He argues that CBIS makes learners relate as one community.

Each of the components of social competence (relationship, tolerance and respect) was examined separately before and after the treatment. The findings revealed that the pre-primary school children that were exposed to a culturally-based instructional strategy concerning the series of culturally-based activities, such as indigenous stories, songs, rhymes, games and language of the immediate environment, demonstrated a higher level of competence in a relationship, tolerance and respect after treatment than before the commencement of the treatment.

The findings revealed that there was a significant difference between the mean scores of the skill of relationship before and after exposure to treatment. This difference in mean scores was 13.89. This finding is similar to the report of Kovacevic and Ovic (2013) from a study carried out on examining the contribution of traditional games on the quality of relations and frequency of socialization in primary education. The findings also showed that there was an improvement in human relations among the pupils in class after they had been engaged in traditional games and songs. The treatment also had a significant effect on the acquisition of the skill of tolerance. There was a difference between the mean score of the skill of tolerance of children before and after exposure to treatment. The difference between the mean scores was 12.14. This difference was significant. This finding was in correlation with that of Mangany (2011) who found that engaging children in indigenous game-songs play a significant role in the social development of children; it encourages them to control themselves and most specially to tolerate other children.

In the same vein, the treatment had a significant effect on the skill of respect. The findings revealed that there was a difference between the mean scores of the skill of respect before and after the children were exposed to the treatment. The difference between the mean scores was shown to be 12.60. This implies that indigenous stories, songs, rhymes, games and language of the immediate environment had a significant effect on the social competence of pre-primary school children after the treatment. Muratovna (2013) advocates the need to create a special game environment where a child can not only communicate with other children and relatives but acquire knowledge, norms, and social rules. Precious (2010) stresses the need to expose the child to his or her cultural values. There is no better way to let them know without teaching them. One truth about cultural values is that they are learned.

Based on the findings of this study, it can be concluded that culturally-based instructional strategy is better than the conventional instructional strategy that has dominated pre-primary school classrooms in Nigeria especially in the area of development of social competence. Adopting CBIS will effectively inculcate in children social competence skill that is culturally acceptable. Therefore, CBIS possesses the ability to develop a socially competent learner. It teaches children how to relate with others in a group, respect



others opinion and tolerate others different opinion. It also builds the spirit of cooperation in children during learning and reduces individualism.

Suggestions for Researchers and Practitioners

Further studies on culturally-based instructional strategy should cover all the developmental domains. The strategy is holistic, indigenous education focused on producing a holistic child

1. There should be an increase in the number of preschool children and as well as public and private schools to be included to participate in the further study. More states could be included to compare performances across states.
2. Positive findings of culturally-based instructional strategies should be made available to stakeholders in education such as parents, school owners to encourage the adoption of this strategy in the classroom
3. Seminar and conferences should be organized for pre-school teachers on the proper implementation of the strategy.
4. The indices of culturally-based instructional strategy (indigenous methodology, medium of instruction and learning materials) should be employed in a pre-primary school classroom to produce children that will be culturally responsive.
5. Classroom activities should cover the holistic development of children, none of the domains should be neglected or given more attention than the other.
6. Teachers of young children in both public and private schools should engage children in culturally-based instructional strategy activities by employing indigenous method such as stories, songs, proverbs and rhymes among others to teach to young children.

Limitations of the Study

The major limitation of this study was the preference of parents of preschool children especially those in the private school for the use of the English language more than the language of the immediate environment. This affected the response got from some of the private schools contacted for the study. The fear of losing children if they were made to participate in a study that employs the use of the language of the immediate environment which is the Yoruba language made some private school turned down the researcher's request. Some of the consent forms sent home were not returned, so the children concerned could not participate. This affected the number of a participant in the study. Financial constraint restricted the study to just two local government areas. A study of this nature needs to be sponsored for wider coverage.

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FACTORS AND MULTIPLES: IMPORTANT AND MISUNDERSTOOD

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Abstract

Factors and multiples are important aspects of mathematical structure that support the understanding of a range of other ideas including multiplication and division, and later on, factorization. At primary school level, it is important that factors and multiples are taught as a connected enterprise and as vital parts of the multiplicative situation; that is multiplication and division. The primary objective of the study on which this paper is based was to determine the extent of children's understanding of factors and multiples. A written quiz containing questions about factors and multiples and asking for children to explain their responses, was administered. Results suggest that the language involved with factors and multiples may play a role in the extent to which children develop a conceptual understanding of them. Also, most children know some things about factors and multiples but struggled to connect and articulate ideas when factors and multiples were presented in a different context. In conclusion, the inconsistency of participant responses suggests that teaching about factors and multiples needs to emanate from a more conceptual and connected standpoint.

Keywords: Factors, multiples, language, divisibility, connections.

INTRODUCTION

Factors and multiples are important elements of mathematics and underpin an understanding of number, the consolidation of multiplication and division facts, expansion and factorization, and powers, roots, and exponents (Bana, Marshall, & Swan, 2014; Turton, 2007). A factor can be defined as being a whole number that can be multiplied a certain number of times to create a given number, and a multiple is the result of multiplying a number by a natural number (Turton, 2007). Although expressed as being important (Bana, Marshall, & Swan, 2014; Feldman, 2014; Gunes, 2021; Turton, 2007) there is a paucity of extant literature which deals directly with factors and multiples. A search of literature from 2015 to 2022 through a University library database was undertaken. Search parameters for peer reviewed journal articles were entered with the filters of "multiplication & teaching & factors & multiples not higher education and not multiplication facts". A total of 3 426 articles were presented by the database. Through reviewing the abstracts of the first 300 articles, only 17 indicated that the topics of factors and multiples were addressed and of these only 3 were considered proved to be germane. This paucity of research on these two fundamental ideas is concerning.

The importance of factors has been documented in research (Feldman, 2014; Gunes, 2021). Feldman (2014, p. 231), noted that factors are part of number theory, "which includes topics such as prime



numbers, composite numbers, divisibility, prime factorization, greatest common factors, and least common multiples.” Feldman points to the Common Core State Standards for Mathematics (CCSSM) as indicating that children from kindergarten begin learning aspects of number theory. Specifically, he notes that, “in fourth grade, students find factor pairs of whole numbers less than 100 and recognize that a whole number is a multiple *of its factors*” (Feldman, 2014, p. 231). Two important points arise there – first that factors are in pairs (except for square numbers) and second, that a whole number is a multiple of its factors. These points will be discussed later. Feldman (2014) notes that an understanding of factors underpins many other important ideas, including links with multiples, properties of multiplication, adding and subtracting fractions using the lowest common denominator, and later, simplification of algebraic expressions.

Explicitly making connections between factors, multiples, and divisibility, is central to understanding them. In linking multiples to the division process, Thompson (2012) described the process of ‘chunking’ to divide larger numbers. He gave an example of generating multiples of 36, initially using ‘ten times’ (360), then halving to find ‘five times’ (180), before doubling and doubling again to generate ‘two times’ (72), ‘four times’ (144), and ‘eight times’ (288). The degree of success enjoyed by children with the process “depends on how much work children have done on multiples” (Thompson, 2012, p. 46). In his discussion of the vital development of multiplicative thinking, Drake (2012) noted that ‘truly’ multiplicative thinkers “understand about factors, multiples, primes, and divisibility and use these ideas in their thinking (p. 49)”. McEachran (2008, p. 24), in describing an investigation of prime numbers, noted that it is important for children “to understand what these numbers *are*, not what they are *called*.” We suggest that the same applies to factors and multiples. It is important that children know what they are, and the language used in helping children learn about them is of critical importance. The regular use of appropriate mathematical language and terminology is likely to enhance the development of conceptual understanding of ideas like factors and multiples, as opposed to children knowing them in a procedural way. Conceptual understanding should better place children for learning concepts related to algebra and proportional reasoning (Hurrell & Day, 2015; Siemon et al., 2021)

McKenna (2019, p. 38) described a teaching activity based on exploring factors, noting that the ‘traditional’ approach would have likely been referred to as “doing factors” and “which would have relied heavily on direct instruction followed by . . . repetitive exercise with not much thinking involved”. Consequently, McKenna challenged students to explore their understanding of factors by getting them to prove or disprove the conjecture that bigger numbers have more factors. The end result was that the students disproved the conjecture and importantly, arrived at the realisation that “they all had an even number of factors apart from 36” (McKenna, 2019, p. 39). Further investigation led to children realising that 36 was a square number, and as a square number, would have an odd number of factors. This thoughtful development of understanding about factors echoes an earlier article by Richards (2007) describing how, in response to a challenging question, ‘How can we be sure that we have all of the factors [of 36]?’ one student responded with, “The factors come in pairs: 1 and 36, 2 and 18, 3 and 12, 4 and 9, and 6” (Richards, 2007, p. 39). The notion of ‘factor pairs’ is important because, if there is one factor, there must be a ‘partner factor’ (except for square numbers where a factor is multiplied by itself). The development of the idea of factor pairs is within the scope of children. Rickard and Earle (2019) worked with children between the ages of eight and ten years and found that students were not only able to describe the connections between factor pairs, but could extrapolate these connections to reason how 6×7 will give the same result as 3×14 .

Further to these ideas, it is necessary to explicitly teach children about the inverse relationship between multiplication and division and the notion of the factor-factor-product relationship. Strategies such as ‘thinking of multiplication’ to derive division facts are important (Siemon et al., 2021). Similarly, Lemonidis (2016) discussed the complementary nature of multiplication and division and how knowledge of products can inform the derivation of factors.



Karp, Bush, and Dougherty (2015) discuss the ‘rainbow’ representation for factors (see Figure 1) which they describe as having shortcomings.

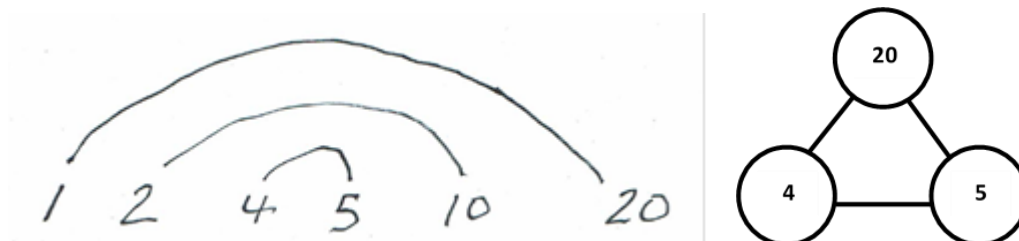


Figure 1. ‘Rainbow’ and ‘triad’ representation for factors of 20

They illustrate this, using 20 as the multiple, “The rule is taught so that once you identify factors that are consecutive numbers (e.g., 4 and 5), you have identified all factors” (Karp et al., 2015, p. 211). They note that the rule does not hold for numbers like 40 where the closest factors are five and eight, nor for square numbers which have an odd number of factors. Also, Parker (2019) described an activity using ‘a triad’, a triangle with three circles at its vertices, the multiple at the apex, and the pair of factors in each of the base circles. Parker (2019) asserts that this is not only a powerful representation of factor pairs but also of the link between factors and multiples.

Rickard and Earle (2019) also described a task using a Venn diagram to show multiples of three and six. A good example of connected knowledge was demonstrated by one child’s comment that, “there won’t be any numbers in there [pointing to the circle for multiples of 6] . . . [because] . . . there are two threes in every six” (Rickard & Earle, 2019, p. 17). However, while Rickard and Earle (2019, p. 15) describe another useful task to explore how the four times table is ‘hidden’ within the eight times table, using number grids, there is no mention made of the use of the term ‘multiples’ to describe that eight is a multiple of four and therefore shares the same factors as four. In a similar way, they describe how children showed an awareness of the commutative law but talked about it in terms of ‘swapping the numbers around’ rather than in terms of the factors being the same and that the order is irrelevant. The paucity of the use of the terms factors, multiples and divisibility embedded and highlighted in the context of teaching and learning of multiples is of concern. Day and Hurrell (2015, p. 20) note that the naming of factors and multiples is “an important and often undervalued piece of mathematical understanding”, and that the idea of ‘number families’ needs to be developed through the use of arrays. They continue to say that “students are told that if you know 3×4 you know the associated facts of 4×3 , $12 \div 3$ and $12 \div 4$, and many accept this as being the case without ever seeing why it is so” (Day & Hurrell, 2015, p. 20).

The explicit use of the terms factors, multiples and divisibility can be found in the task ‘Thinking of Two Numbers’ (Mathematics Assessment Resource Service – MARS, 2015). MARS (2015, p. 4) provided focus questions and prompts for teachers including, ‘What can you tell me about a factor?’, ‘What do we mean by a multiple?’, and ‘Show what you have written to your neighbour. Do you agree on what a factor is? Have you described it in a similar way? If not, what are the differences?’ In contrast, ‘Demystifying multiplication’ (National Council for Teachers of Mathematics – NCTM, 2013) discussed some important ideas such as using the multiplicative array to demonstrate the distributive property, and then linking that to factorization. However, there was no specific mention of the terms ‘factor’ or ‘multiple’ in this document. The point here is that some sources explicitly mention the terms while other sources do not.

There appears to be a lack of consistency in a number of articles that discuss issues related to factors and multiples. Indeed, it is interesting to note how many times the word ‘factor’ was mentioned as opposed to the term ‘multiple’. In discussing perfect numbers, Griffiths (2017), mentioned ‘factor/factors’ 17 times and ‘factorization/s’ twice. ‘Multiple’ was not mentioned at all. In the article by Ollerton and Cooper (2017) about sequences and patterns of number facts, ‘multiple’ was mentioned five times, but ‘factor’ was not mentioned at all. Again, in Richards’ (2014) article on



division, 'multiple/s' had eight references but 'factor/s' were not mentioned, and McEachran (2008) discussed prime numbers but mentioned neither 'factor' nor 'multiple'. It is difficult to understand how a discussion of prime numbers can be achieved without talking about factors and multiples. Thompson (2012) did something similar in an article on 'chunking' in division – 'multiples' was mentioned eight times, but there was no mention made of 'factor/s'. It is suggested here that factors and multiples need to be taught simultaneously and that the terms should be used in tandem wherever possible in order for children to develop a connected understanding of the mathematical structure and be able to articulate that understanding.

The proposition on which this article was based was that children need to hold a strong understanding of factors and multiples and concepts associated with them if they are to grasp the mathematical structures that are underpinned by factors and multiples. Given that, the researchers were keen to determine the extent to which children hold a connected understanding of factors and multiples, and how they relate to multiplication, division, and divisibility. However, as is evident above, while there is material written about factors and multiples, there appears to be inconsistent use of the key terms 'factor' and 'multiple' and this may impinge on students' capacity to develop a conceptual understanding of factors and multiples.

METHOD

Research Model

According to the research theorists (Cresswell & Cresswell, 2018), pragmatism "...arises out of actions, situations and consequences rather than antecedent conditions" (p. 10) and is about what is practical and works (Cresswell & Plano-Clark, 2011). Further, because pragmatism as an epistemology welcomes the plurality of methods (Kaushik & Walsh, 2019) and is often related with mixed-methods (Cresswell & Plano-Clark, 2011; Teddlie & Tashakkori 2009), it was deemed suitable for this qualitative study which was supported by descriptive statistics. The data collected for this study came from only one source, namely a questionnaire, but was subjected to some descriptive statistical analysis to look at trends, and then a more qualitative approach was adopted to further refine the decisions made about the meaning of the answers. This dual interrogation of the data satisfied the parameters of a mixed-method study.

In consideration of the established form of symbolic interactionism as articulated by theorists (e.g. Denzin, 2004), people act towards things (and events) on the basis of the self-reflections and meaning these things have for them. From the collected data we formulated and offered narratives of how the respondents' communicated their level of understanding regarding the role of factors and multiples as indicators of their level of multiplicative thinking. For the methodology, survey research was adopted for this study. Survey method is the act of questioning individuals on one or multiple topics, and then reflecting upon their responses (Check & Schutt, 2012). A questionnaire was considered the most efficient and least obtrusive way in which to collect the data from the students.

Study Group and Data Collection Tools

The research on which this article is based is part of a larger study on Multiplicative Thinking. Data for the study were generated through the use of a Multiplicative Thinking Quiz (MTQ-A). The instrument was developed and refined over three years with multiple age groups and was deemed to be valid as results were consistent across different samples. This quiz (questionnaire) was constituted with eight questions, most of which had multiple parts. The three questions which are examined in this article had a particular focus on factors and multiples:

- In the number sentence $7 \times 5 = 35$, which number/s are factors and which number/s are multiples? Please explain how you know.
- Write as many factors of 30 as you can. Please explain how you know they are factors of 30.
- Write at least four multiples of six. Please explain how you know they are multiples of six



The MTQ was administered by the researchers to whole class groups in primary schools in Perth (Western Australia) and Plymouth (United Kingdom). Each student had her/his own paper and was encouraged to seek guidance if s/he could not read and understand the question. No help was given in helping the students formulate or write their responses. No time limit was set, and students were asked to hand in their quiz at their discretion.

Post the quiz, student responses to questions were recorded on spreadsheets and analysed by the researchers to determine trends and themes. The participant sample on which this article is based consisted of 108 children from four classes, two Year Five classes, with children aged between 10 and 11, and two Year Six classes, with children aged between 11 and 12. One Year Five and one Year Six class came from one primary school in Western Australia, and one Year Five and one Year Six class from one primary school in the United Kingdom.

Data Analysis

A recording tool was constructed by the researchers and the data were transcribed to that tool. Transcription revolved around reading the children’s responses and determining if the question was suitably answered in relation to the stated intent for the question. For example, question 3a asked “In the number sentence $7 \times 5 = 35$, which number/s are factors and which number/s are multiples?” For this to be classified as suitably answered the student had to identify both 7 and 5 as factors and 35 as the multiple. The idea that 35 is a factor of itself was not considered germane in this situation. Each of the researchers was then given the questionnaires and asked to determine if a zero or a one should be ascribed each answer in accordance with the key. One would be an indicator that a reasonable response had been given and zero, that the response was inadequate. No partial credit was given. The researchers coded their data individually, and this coding was then scrutinised to ensure consistency of the application of this coding system, to measure interrater reliability.

The extent to which two or more coders agree is interrelated reliability, and is usually measured as a percentage agreement between the coders. To measure the percentage agreement, the researchers created a template in which the rows represented variables and the columns the coders’ response to the collected data. The cells in the matrix contained the zero or one entered by each coder for each of the variables. The interrater reliability proved to be 92%.

RESULTS

Data from three interview questions listed above are now discussed in turn.

- Question 1. In the number sentence $7 \times 5 = 35$, which number/s are factors and which number/s are multiples? Please explain how you know.

Students used a range of approaches to provide answers to this question. These are summarized in Table 1. Samples of student responses showing their various methods and reasoning are included after Table 1.

Table 1. Student responses to identifying factors and multiples in $7 \times 5 = 35$

Student response	%
	n = 108
Recognized the number sentence as containing both factors and a multiple	9
Identified 7 and 5 as factors of 35	50
Identified 35 as a multiple (of 5 and/or 7)	43

It is significant that whilst half of the cohort could identify the factors as being 7 and 5, and just less than half the cohort identified 35 as the multiple, a small percentage recognised that the number sentence contained both factors and a multiple (these students were all in the Year 5 class from the UK). Where students gave correct responses, their explanations suggested they were secure in



understanding the language of factors and multiples and could link this to their knowledge of multiplication and division. For example, student CRE explained that ‘A factor is a pair or one number that are multiplied to make a multiple’ and student CNE explained that ‘7 x 5 are factors and 35 is a multiple because the word multiple means the one that is answer to the numbers being multiplied’. Student WBL succinctly said ‘Because 2 factors make a multiple. You x 2 factors together to make a multiple’. However, where students gave incorrect responses, they appeared to be confusing the notion of multiplying and the term multiple, suggesting that as the 7 and 5 are being multiplied together, they must be multiples. For example, student MAN said ‘The 7 x 5 is the multiple and the 35 is the factor’. The explanation was ‘The 7 x 5 is multiplying and 35 is the answer’. This confusion in the link between multiply and multiple was also demonstrated by student ESC who said ‘35 are factors and 7 and 5 are multiples, because it says times, so I picked them’. This student seemed to understand that multiply and times are equivalent, so thought that the numbers used in the ‘times’ must be multiples. The confusion with the language is exemplified by the sample from Student TLI (Figure 2).

3. In the number sentence $7 \times 5 = 35 \dots$

a) Which number/s are factors and which numbers are multiples?

Factors | 1, 5, 7, 35 | Multiples, 35, 70, 105, eg

b) Explain how you know.

a factor is the numbers
what go into the number
and multiples are the numbers which can
be multiplied by that number

Dr Derek Hurrell (University of Notre Dame Australia) & Dr Chris Hurst (Curtin University) May 1 2017

Figure 2. Sample from Student TLI

- Question 2. Write as many factors of 30 as you can. Please explain how you know they are factors of 30.

Students’ responses to this question were varied. These are summarized in Table 2. Samples of student responses showing their various methods and reasoning are included after Table 2.

Table 2. Student responses to writing factors of 30

Student response	%
	n = 108
Identified some factors of 30	84
Identified factors of 30 in pairs	44
Explained factors in terms of divisibility or multiplication	54

The majority of students across the 4 classes were able to identify some factors of 30, although not necessarily all of the factors. This suggested that students understood what factors are, however their explanations showed misunderstanding with the language of factors and multiples, as in the previous question. For example, student CBR when describing why the numbers given are factors of 30 said, ‘Because they all multiply into 30’. Student RWO also said, ‘They can all times into 30’. These students appeared to understand that 30 can be divided exactly by its factors, and were perhaps thinking that each factor has a multiple which is 30 in their use of the words ‘multiply into’ and ‘times into’. Student SSI gave a comprehensive response to the questions (see Figure 3).

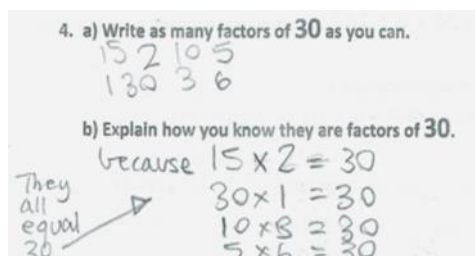


Figure 3. Samples by Student SSI

Other students used the language of division incorrectly but the factors they gave were correct, suggesting they understood there is a link between the factors of a number and divisibility. For example, student JMA’s response was ‘1, 3, 5, 6, 10, 15, 30, because if you divide them, they would equal 30’. Student OST explained that ‘Also, 5, 6, 10, 2, 3, 15 are all factors of 30 because they are divisible by 30’, which suggested some awareness of the idea of divisibility. Student CBO offered an explanation based on the ‘rainbow’ representation (see Figure 4), explaining that the factors are multiplied.

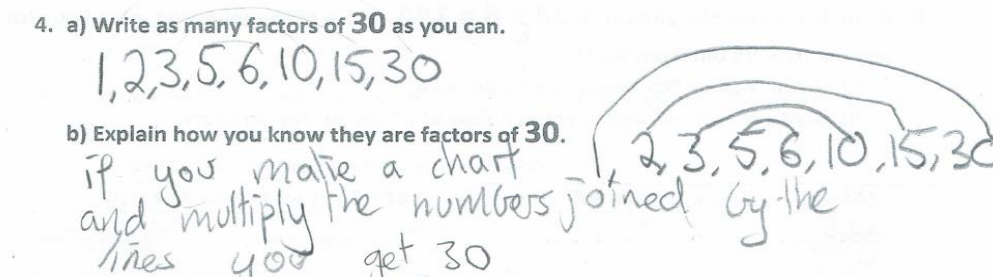


Figure 4. Sample from Student CBO

There was great variation from class to class and school to school in terms of students being able to write factors in pairs. The vast majority of the children wrote some factors of 30 but less than half wrote them in pairs. There was also great variation between the two school sites as to the number of students who wrote all of the factors of 30, even though the question didn’t specifically ask for that. A question for further analysis is ‘To what extent do these children understand that to have one factor means that there must be another factor (or partner factor)?’

- Question 3. Write at least four multiples of six. Please explain how you know they are multiples of six.

Students offered a range of responses to this question. These are summarized in Table 3. Samples of student responses showing their various methods and reasoning are included after Table 3.

Table 3. Student responses to writing factors of 30

Student response	%
Identified four multiples of 6	34
Explained multiples in terms of divisibility or multiplication	28

Whilst the percentage of students who could write four multiples of six was low across the sample, where students answered correctly, they had good explanations for their response. For example, student PHO gave examples of 12, 18, 24, 30, 36 and said, ‘Because 6 x ? equals those numbers’. Student LNG gave 12, 18, 24, 30 and said, ‘They can be divided by 6 to form a whole number’. Student LME wrote them as 6 x 4, 6 x 6, 6 x 9, 6 x 12 and said, ‘Because it is six times another number’. These students seemed to understand why the numbers are multiples of six and their explanations suggest that they might have understood that it had to be a multiple of something.



One student, CRE, knew to multiply numbers by six to get the multiples, saying ‘I multiplied random numbers by 6 to make multiples’, whilst student ELA had a more organised approach, saying ‘Because they are different numbers in order multiplied by six, making the six times table’, and showed an understanding that the answers in a multiplication table are multiples. A particularly interesting response came from student JDA who had nothing correct in the quiz to this point and then wrote all the multiples of 6 to 114. He said, ‘They are multiples of six because they can all be divided by six’, which suggested he knew there was a link between multiplying numbers by six to get the multiples, and being able to divide the multiples of six by six. Student IHA made explicit the link between multiples and division (see Figure 5).

c) Write at least four multiples of 6. Explain how you know they are multiples of 6.

12
24
36
54

I know they are multiples of 6 because if you divide them by 6 you get a whole number.

Figure 5. Samples from Student IHA

More widely across the sample for this question was evidence of misconceptions and poor explanations. One of the more common incorrect responses was to confuse multiples with factors, and instead of giving four multiples of six, the students gave four factors of six. Here are a selection of responses that highlighted this error.

Student JDU said, ‘1, 2, 3, 6, and you have to see if it can go into 6’. Student SSI said, ‘They all equal six’ and showed some examples of $2 \times 3 = 6$ and $6 \times 1 = 6$. Student IIS said, ‘You can’t do four’ . . . because she had identified 1, 2, 3 as multiples of six. These students seemed to be looking for factors of six instead of multiples, but there were other interesting responses, such as student RCO who said ‘1 and 6, and 2 and 3, because as pairs in columns and rows make 6’, which perhaps invoked the notion of arrays using six counters, and student SBL who said, ‘3, 2, 1, because there [sic] factors of 6 and they add up to six’, identifying factors of six rather than multiples, but then noticed that these factors total six – it would be good to think that an inspiring teacher might have pointed out that this makes 6 a ‘perfect’ number.

The quiz items on factors and multiples showed up some interesting features individually, but a comparison between the items showed that some students had insecure understanding on some aspects, which would seem unlikely given their response to other questions. For example, consider questions 1 and 3 from above. Table 4 shows the percentage of students who responded correctly or incorrectly to both the identification of factors and multiples in $7 \times 5 = 35$ and the identification of four multiples of six.

Table 4. Student responses to identifying factors and multiples in $7 \times 5 = 35$ and writing four multiples of six

Student response	% n = 108
(a) Correctly identified 35 as a multiple	20
(b) Correctly identified 35 as a multiple Did not identify four multiples of 6	30
(c) Did not identify 35 as a multiple Correctly identified four multiples of 6	16
(d) Did not identify 35 as a multiple Did not identify four multiples of 6	27
(e) No response to identifying 35 as a multiple No response to identifying four multiples of 6	7



Criterion (a) (both correct) and criterion (d) (both incorrect) were reasonably expected. That is, it was expected that children could recognize or identify and write a multiple in both examples, or in neither example. However, only 47% of students did one or the other. Also, it was reasonably expected that some students would not respond to either and 7% did that (criterion (e)). This leaves some 46% of the students who gave different combinations of responses. It begs the question, ‘Why would 30% of the cohort correctly identify 35 as a multiple, yet not be able to write some multiples of six (criterion (b))?’ Similarly, the other question is, ‘Why would 16% of the cohort correctly identify multiples of six, yet not be able to identify 35 as a multiple (criterion (c))?’

Student JLO seemed to have no idea about the factors and multiples in $7 \times 5 = 35$, but provided all the factors of 30 and showed them in the form of $15 \times 2 = 30$, as justification. Student ZWH did exactly the same thing but also provided correct multiples of six and said that they can be divided by six. These instances were puzzling but far from uncommon across the sample. It suggested that students’ understanding was not sufficiently robust to recognise that the two questions were asking the same things. Some answered correctly when the multiple was in the context of a number sentence but could not do so when simply asked to write some multiples, and vice-versa.

Students TCL and JOA were interesting cases. For the $7 \times 5 = 35$ question, when asked which were factors and multiples, TCL wrote, 5, 10, 15, 20, 25, 30, 35, with the explanation of, ‘5 x tables’. While he didn’t actually answer the question, his answer suggested that he might know what multiples are. However, why would he then write 6, 1, 3, and 2 for multiples of six? Student JOA showed she had little or no idea of the rest of the questions but then where others have not done so, she showed the multiples of 6 as $6 \times 10 = 60$, $6 \times 2 = 12$, $6 \times 8 = 48$, $6 \times 3 = 18$, $6 \times 4 = 24$, with the comment, ‘I know my 6’s’. The apparent confusion in the students’ understanding is typified by Student EMA who was partially correct regarding 35 being a multiple, but could not provide four multiples of 6 (see Figure 6).

4. a) In the number sentence $7 \times 5 = 35$, which number/s are factors and which numbers are multiples? Explain how you know.

Handwritten student response:
~~35 is a multiple.~~ 35 and 7 is a multiple.
 7 and 5 are both factors.
 21, 28, 35 are all multiples.

c) Write at least four multiples of 6. Explain how you know they are multiples of 6.

Handwritten student response:
 1, 2, 3, 6
 $1 \times 6 = 6$ $3 \times 2 = 6$
 $2 \times 3 = 6$ $6 \times 1 = 6$

Figure 6. Samples from Student EMA

These comparative results from those two questions raise interesting questions - What is the issue here? Was it to do with the fact that they could or could not recognize the multiple unless it was in a number sentence? However, some ($n = 4$) did not identify the 35 but did identify multiples of six, and vice-versa ($n = 5$). Was that something to do with the words ‘multiple’ and ‘multiplied’? Was it linked to the phrasing ‘5 multiplied by 7’ and did that prompt them to say that the 7 is the multiple?

In a similar way to above, consider the link between questions 1 and 2. Table 5 shows the percentage of students who responded correctly or incorrectly to both the identification of factors and multiples in



$7 \times 5 = 35$ and the identification of factors of 30.

Table 5. Student responses to identifying factors in $7 \times 5 = 35$ and writing factors of 30

Student response	% n = 108
(a) Correctly identified 7 and 5 as factors Correctly identified factors of 30	50
(b) Correctly identified 7 and 5 as factors Did not identify factors of 30	4
(c) Did not identify 7 and 5 as factors Correctly identified factors of 30	37
(d) Did not identify 7 and 5 as factors Did not identify factors of 30	5
(e) No response to identifying 7 and 5 as factors No response to identifying factors of 30	4

Criterion (a) (both correct) and criterion (d) (both incorrect) were reasonably expected. That is, one would have expected that children could recognise or identify and write a factor in both examples, or in neither example. Some 55% of students did one or the other. Also, it might be reasonably expected that some students would not respond to either and 4% did that (criterion (e)). This left some 41% of the students who gave different combinations of responses. This raised the question, ‘Why would 37% of the cohort be unable to correctly identify 7 and 5 as factors, yet could correctly identify some factors of 30 (criterion (c))?’

Looking at individual responses, student BPE for $7 \times 5 = 35$ said, ‘5 is a factor and 7 is a multiple because the first number you multiply it then you look at the second number and that’s a factor’. As with the results from Table 4, there appeared to be confusion between ‘multiply’ and ‘multiple’. Also, when explaining factors of 30, she said that, ‘they all add up to 30 equally’, and for multiples of 6, she said, ‘Because they all add up to 6’. Student LED identified the 7 and 5 as factors and identified some factors of 35, though her explanation that ‘factors make the product’ is not entirely convincing (see Figure 7).

4. a) In the number sentence $7 \times 5 = 35$, which number/s are factors and which numbers are multiples? Explain how you know. *The 7 and the five are factors because factors make the product (35). I think that the multiple is 35 because it is the only other number.*
- b) Write as many factors of 30 as you can. Explain how you know they are factors of 30. *5 x 6 10 x 3 because factors make the product.*

Figure 7. Samples from Student LED

The language around factors, multiples, multiply and divide seemed to be causing many issues for students, highlighted in this example from student OST who said ‘7 and 5 are factors because they are both divisible by 35’. Also, ‘5, 6, 10, 2, 3, 15 are all factors of 30 because they are divisible by 30’. The student appeared to have been taught the term ‘divisible’ but confused the meaning in the quiz.

Finally in this section, a consideration of the extent to which students could explain factors and multiples in terms of multiplication and division. Table 6 shows the percentage of students who could explain why factors are factors and multiples are multiples, in terms of multiplication and/or division.

**Table 6.** Student responses to explaining factors and multiples in terms of multiplication or division

Student response		% n = 108
(a)	Explained factors and/or multiples in terms of multiplication and division on all three occasions.	15
(b)	Explained factors and/or multiples in terms of multiplication and division on two of three occasions.	18
(c)	Explained factors and/or multiples in terms of multiplication and division on one of three occasions.	30
(d)	Did not explain factor and/or multiples in terms of multiplication and division on any occasion	37

The questions in the three quiz items discussed here essentially ask the same thing.

- Which number/s are factors and which numbers are multiples? Explain how you know.
- Write as many factors of 30 as you can. Explain how you know they are factors of 30.
- Write at least four multiples of 6. Explain how you know they are multiples of 6.

It is not unreasonable to think that, if a student answered one of the questions correctly, s/he would be able to answer all three correctly. However, only 15% of the whole cohort did so. The same applies to students who did not explain it appropriately in any question – 37% of students did that. This more reflects the reasonable assumption that, if a student cannot explain the situation for one question, s/he would not do it for the other two questions. It is puzzling as to why 48% of the children answered either one or two questions correctly but not the others.

There is also a clear difference between the two Australian classes and the two UK classes, with a much higher proportion of the latter being unable to explain it for any question, which could be due to the curriculum content in the two countries, or the way in which the students' knowledge and understanding are tested at a national level, leading to teachers in one country adopting a different teaching approach.

Some students gave very succinct explanations about factors and multiples, for example, student BRO explained that '7 and 5 are the factors and 35 is a multiple because factors are what 35 can be divided by and the multiple is the answer', and the same student said '1, 2, 3, 5, 6, 10, 15, 30 because 30 can be divided by all those numbers'. Student WBL described the relationship between factors and multiples as '2 factors make a multiple. You x 2 factors together to make a multiple'.

However, explanations from the majority of students showed a lack of understanding about factors and multiples, and the language they used suggested that language itself may be a very significant issue in acting as a barrier to their learning. Student CBO offered '7 is a factor because it being timed by 5 so 5 is a number', while student JCA said 'A factor is something that can be into (sic), and a multiple is 2 numbers x together, and then makes an answer'. Student JMA observed that numbers can be both factors and multiples in the same number sentence when saying '7 and 5 are factors and they are multiples because they equal 35'. Finally, student MGI admitted to not understanding but was happy to suggest '7 and 5 are multiples and 35 is a factor because 7 and 5, you have to multiply and 35 is just a factor. Don't know why but that's what I think'. The confusion between 'multiple' and 'multiply' repeatedly appeared as a possible factor (sic) in students' lack of ability to explain factors and multiples. This has raised questions that require further analysis.

- To what extent does the context of the question affect their reasoning?
- Do they have a sufficiently robust understanding of the concept?

DISCUSSION and CONCLUSION

It is suggested that the sample size (n=108) is sufficiently large to be able to make some generalizations, and a number of observations can be made from the data presented in Tables 1, 2, and 3, and the ensuing discussion. First, with regard to identifying factors (McKenna, 2019; Richards,



2007; Rickard & Earle, 2019) in the context of a multiplication sentence, approximately half of the participants were able to do so. However, when asked to identify factors without such a context, more than three quarters were able to do so. Furthermore, less than half of the participants wrote the factors in pairs (Feldman, 2014; Rickard & Earle, 2019; Parker, 2019), suggesting an incomplete understanding of what factors are. Second, when asked to identify a multiple in the context of a multiplication sentence, less than half of the participants did so, and even less could identify multiples when no context was provided. Third, with regard to explaining why they identified particular numbers as factors or multiples, slightly more than half of the participants offered an explanation for factors in terms of multiplication or division, yet slightly more than a quarter were able to do so for multiples. The variation in these results is surprising as it would be reasonable to expect that, because factors and multiples are inextricably linked, responses for each would be similar.

Tables 4 and 5 contain comparisons between pairs of questions related to the same idea – factors or multiples. Each of the first two questions from the MTQ essentially asked participants the same things that is to identify factors or multiples. It could reasonably be expected that participants would successfully do so for both questions or neither question. In the case of multiples, less than half responded correctly or incorrectly to both questions yet the same proportion responded correctly to one question but not for the other. In the case of factors, the pattern was similar. Slightly more than half of the participants responded either correctly or incorrectly to both questions yet more than 40% responded correctly to one question but not to the other.

Table 6 considered the participants' explanation of what constituted factors and multiples in terms of multiplication or division. There were three opportunities for this to occur. Again, it would be reasonable to expect that participants would offer a correct explanation in all three instances or in none, yet slightly more than half did so. Indeed, slightly less than half provided an appropriate explanation on one or two occasions but not the others.

In seeking an explanation for the inconsistency of participant responses, the following observations and comments are made. First, many participants appear to confuse the terms 'multiple', 'multiply', and 'multiplied', along with the '×' sign. Evidence has been presented to support that. Second, it appears that a large number of participants fail to recognize that factors and multiples do not exist without one another, and that they must be 'a factor of something' and 'a multiple of something'. This is manifest in the fact that many participants did not show factors in pairs and/or did not show all possible factors, further suggesting that they did not realize that to identify one factor means that there must be a 'partner factor'. Third, the inconsistent results might be explained by students failing to see that the questions posed essentially asked the same things, which suggests that their knowledge of factors and multiples is not sufficiently robust to enable them to make connections between ideas, a situation which is concerning if we are trying to develop students who are multiplicative thinkers (Day & Hurrell, 2015; Drake, 2012; Siemon, et al., 2021).

Perhaps these results are hardly surprising given that the review of the pertinent literature (for example Griffiths, 2017; McEachran, 2008; Ollerton & Cooper, 2017; Richards, 2014; Thompson, 2012) pointed out inconsistencies in the use of terminology on the part of contributors to teacher journals. In any case, there are some clear implications for teaching about factors and multiples. First, factors and multiples need to be taught together as part of the multiplicative situation about equal groups. The base for doing this is provided by the multiplicative array, in which the factors are represented by the number of rows and the number in each row. The multiple, product, or total is represented by the whole array. It is of critical importance that the language of factors and multiples is used as part of the daily discourse of the mathematics classroom and that children are given ample opportunities to discuss and explain their thinking. Second, it is suggested that the language used is carefully considered. It appears that there is confusion based on the terms 'multiply' and 'multiplied' so it might be prudent to refer to multiplication and division sentences in terms of 'six groups of five' as opposed to 'six multiplied by five' or 'six times five'. Third, in keeping with the use of the array, it is likely to help if multiplication and division are taught as being different ways of considering the



same situation – that is, the multiplicative situation (Downton & Sullivan, 2017; Hurst, 2015; Siemon et al., 2021). This links with the inverse relationship between multiplication and division and the language of factors and multiples. If we know both factors, they are multiplied to find the product or multiple. If we know one of the factors – number of groups or the number in each group, and the total, product or multiple – we divide to find the other factor.

As noted at the end of the literature review, the proposition on which this article was based was that children need to hold a strong understanding of factors and multiples and concepts associated with them if they are to grasp the mathematical structures that are underpinned by factors and multiples. It would appear from the results of this study such an understanding may be held by some children but not by all. Indeed, the proportion of children who did not demonstrate a deep or broad conceptual understanding is of great concern.

Limitations of this study

Although we suggest that the sample size ($n = 108$) is sufficiently large to be able to make some generalizations, we recognise that this is not an exhaustive sample. It is large enough to be indicative without being conclusive. Secondly, although a questionnaire is an efficient manner in which to collect data, for some students the act of writing may limit their capacity to show the depth of their understanding. A one-to-one interview might be employed to alleviate this issue, but is an intrusive and time consuming exercise.

Ethical Collection of Data

All data was collected following standard protocols as dictated by the University of the lead-researcher. Requirements for ethical research was met for the necessary sector/systems and permission to work in particular schools, was granted by the schools themselves.

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EXAMINING THE PRESCHOOL AND PRIMARY SCHOOL TEACHERS' PERCEPTION OF SELF-CONFIDENCE ABOUT THEIR TPACK IN TURKEY

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Abstract

The aim of this research is to examine the preschool and primary school teachers' perception of self-confidence about their Technological Pedagogical Content Knowledge (TPACK) and analyze the differences in this perception depending on some variables (gender, type of high school, university, undergraduate program, and grade). Survey model was employed in the research. The research was carried out with the participation of 630 preservice teachers studying at the 2nd, 3rd, and 4th grades of the Preschool and Primary School Education Program of Anadolu University and Eskişehir Osmangazi University in the spring term of the 2019-2020 academic year. The data of the research were collected using "Technological Pedagogical Content Knowledge (TPACK) Self-Confidence Scale" developed by Graham, Burgoyne, Cantrell, Smith, and Harris (2009) and adapted to Turkish by Timur and Taşar (2011), and "Personal Information Form" developed by the researchers. As a result of the research, it was found that the preschool and primary school teachers' perception of self-confidence about their TPACK was high. Moreover, their perception of self-confidence about TPACK was found to differ significantly depending on gender, university, and grade, but not depending on undergraduate program and type of high school.

Keywords: TPACK, Self-confidence, preschool teacher, classroom teacher, pre-service teachers.

INTRODUCTION

Today, as technology permeates the human life increasingly day by day, new educational practices are developed in Turkey and other countries. The use and dissemination of technology in educational practices, as in many other fields, are put on the agenda. One of the most important initiatives is the project FATİH carried out by the Ministry of National Education. The objective of this project is to complete the technological infrastructure through smart boards, fiber internet line, and tablet for each student and to ensure active participation of students in education practices from kindergarten to high school (Ministry of Education, 2016). Another important practice is the use of the Education Information Network (EBA), a distance education portal for providing e-learning. Preservice teachers, who will implement technology applications in educational settings, should receive training on technological



knowledge (Choe & Lee, 2015). Getting insights into the preservice teachers' perception of self-confidence about their technological Pedagogical Content Knowledge (TPACK) in Turkey will contribute to the training of preservice teachers who know and apply the technology.

Teachers' qualifications, competencies, and experiences play an important role in the planning and implementation of teaching activities in the classroom (Demir & Bozkurt, 2011). Moreover, it should be kept in mind that the developments that come with technology are one of the main factors that affect teacher roles (Kabakçı Yurdakul, 2011). Teachers must get sufficient technology knowledge from the very beginning of their education lives (Güder, 2018). Teachers can effectively integrate technology into classroom applications using their technological knowledge and skills (Niess, 2011). Moreover, it is necessary for today's teachers to know how to keep up with the rapid changes in science and technology and integrate the reflections of these changes into the teaching-learning environments (Gedik, Sönmez, & Yeşiltaş, 2019). Today, technology is developing rapidly, children are introduced to technology at a very early age starting from preschool period. It is extremely important for preschool and classroom teachers to perceive and direct the children's interests. The present research examined the perception of self-confidence about TPACK in 630 preschool and primary school teachers from two universities in Turkey. To the best of our knowledge, there is a limited number of studies in this cultural context (Tokmak, Konokman, & Yelken, 2013).

Significance of the Research

There are some important reasons why this research was carried out. One of them is the need for improving teachers' TPACK in order to integrate technology into education, considering that new technologies have started to shape education systems more and more and the use of these technologies in educational settings increases every day (Roblyer, 2006). Developing digital technologies are more accessible in terms of applicability in educational programs. However, teachers experience difficulties in how and when to use these technologies in the curriculum (Niess, 2011). Thus, there is a need for conducting researches on what can be done to provide the knowledge and skills required for the use technology in teacher education programs (Canbazoğlu Bilici, 2012; Niess, 2006; Sultan & Aslan, 2017; Uğurlu, 2009) and how preservice teachers understand the relationship between technology and education (Hechter, Phyfe, & Vermette, 2012).

The second important reason is the integration of technology into education and its contribution to students' learning. The use of technology in education allows students to better understand and recall the knowledge (Akgün, Yılmaz, & Seferoğlu, 2011). With the advent of digital technology, students actively participate in the learning process and develop their knowledge generation, thinking, and problem-solving skills (Guzey & Roehring, 2009). In addition, the learning environment created with technology is very important for children to develop their ability of using technology (Uğurlu, 2009). TPACK, which is the subject of the research, explains the realization of permanent learning in children as a result of the combination of teachers' technology knowledge and expertise of technology transfer (Güder, 2018).

In addition, TPACK is one of the important research topics of recent years. In previous studies on teachers' self-confidence level in using technology in the teaching process, it has been reported that teachers' technological and pedagogical beliefs are effective in integrating technology into education (see, e.g., Abbitt 2011; Graham, 2011; Manfra & Hammond, 2006; Moore-Adams, Jones, & Cohen, 2016; Özgün-Koca, 2009; So & Kim 2009). Some studies showed that both teachers and preservice teachers were not sufficiently equipped to use technology (see, e.g., Agyei & Voogt, 2012; Erdoğan & Şahin, 2010; So & Kim 2009; Tondeur, Braak, Sang, Voogt, Fisser, & Ottenbreit-Leftwich, 2012; Yelken, Tokmak, Özgelen, & İncikabı, 2013) and that technology and education could not be integrated successfully (see, e.g., Çiftçi, Taşkaya, & Alemdar, 2013; Judson, 2006; Usta & Korkmaz, 2010).



Therefore, technology knowledge of teachers is seen as an important predictor of their self-efficacy perceptions about technology (Abbitt, 2011). In this context, the theoretical framework of TPACK provides a guideline for eliminating shortcomings and problems as well as evaluating preservice teachers' beliefs (Koh, Chai, & Lim, 2017). However, there is not enough information about preschool and primary school preservice teachers' perception of their self-confidence about TPACK. Therefore, in this research, preschool and primary school teachers' perceptions of self-confidence about their TPACK and the differences in these perceptions depending on some variables were examined using "TPACK Self-Confidence Survey" developed by Graham, Burgoyne, Cantrell, Smith, Clair, & Harris (2009). Current research results are thought to be an important source for teacher training institutions and educators to train more qualified teachers. Moreover, the evaluation of preschool and primary school teachers' perceptions of their self-confidence about TPACK in a different cultural context will broaden the scope of researches in Turkey.

TPACK Framework

TPACK is a framework that allows teachers to think about the knowledge they need in the process of integrating digital technologies into education as learning tools (Niess, 2011). Shulman (1986) was the first to suggest that pedagogy and content knowledge (PCK) should be integrated and used together in teacher training programs. With the development of technology, the necessity of adding technology to the content and pedagogy components has emerged (Koehler & Mishra, 2005; Koehler & Mishra, 2009; Mishra & Koehler, 2006; Niess, 2006; Shin, Koehler, Mishra, Schmidt, Baran, & Thompson, 2009). Mishra and Koehler (2006) added the dimension "technology" to the pedagogical content knowledge (PCK) model, which was created by Shulman (1986), and created TPACK model as a framework that includes the concepts that teachers need to know to integrate technology into education. TPACK, which is the integration of technology knowledge into pedagogy knowledge (Bağdıken & Akgündüz, 2018; Güder, 2018; Günbatar, Boz, & Damar, 2017; Koehler & Mishra, 2005; Saltan & Aslan, 2017), is structured as an innovative and contextual knowledge in which pedagogy, content, and technology are clustered within the same framework (Angeli & Valanides, 2009; Hofer, Blanchard, Grandgenett, Schmidt, van Olphen, & Young, 2010; Koehler & Mishra, 2009). In addition, as a guide for students to think and learn using digital technologies, it is a highly dynamic framework that provides the information that teachers need in planning the educational process (Niess, 2011). In this context, the framework consists of three main sources of knowledge [pedagogical knowledge (PK), content knowledge (CK), technological knowledge (TK)] and four structures resulting from their intersections [pedagogical content knowledge (PCK), technological pedagogic knowledge (TPK), technological content knowledge (TCK), technological pedagogical content knowledge (TPACK)] (Koehler & Mishra, 2009; Mishra & Koehler, 2006). The definitions of these three sources of knowledge and four structures are as follows:

- (1) Content knowledge (CK): It is the knowledge that the teachers or preservice teachers possess about their field of teaching (Koehler, Mishra, & Yahya 2007). It is the organization of knowledge in teacher's mind, such as theories, ideas and practices (Shulman, 1986).
- (2) Pedagogical knowledge (PK): It is the knowledge of teacher or preservice teacher about the use of teaching methods and strategies for structuring the child's knowledge in the teaching process (Koehler & Mishra, 2009).
- (3) Technological knowledge (TK): It is the knowledge of the teacher or preservice teacher about the use of both standard technologies (white board, book, etc.) and advanced technologies (digital video, internet, smart board, educational software, etc.) as teaching tools (Koehler, Mishra, & Yahya, 2007).



- (4) Technological content knowledge (TCK): It is the knowledge of the teachers or preservice teachers to decide about the technology that best suits the subject that they will teach (Koehler & Mishra, 2008).
- (5) Pedagogical content knowledge (PCK): It is the knowledge of the teacher or preservice teacher to make a subject understandable for children by using the most appropriate illustrations (Shulman, 1986).
- (6) Technological pedagogical knowledge (TPK): It is the knowledge of the teacher or preservice teacher about the use of technology tools in the teaching process and the effect of the use of technology on the teaching process (Mishra & Koehler, 2006).
- (7) Technological pedagogical content knowledge (TPACK): It is the knowledge of how the teacher or preservice teacher takes into account the three sources of knowledge, that is, technology, pedagogy, and content knowledge together and how learning is realized through the relations between these sources of knowledge (Koehler & Mishra, 2009).

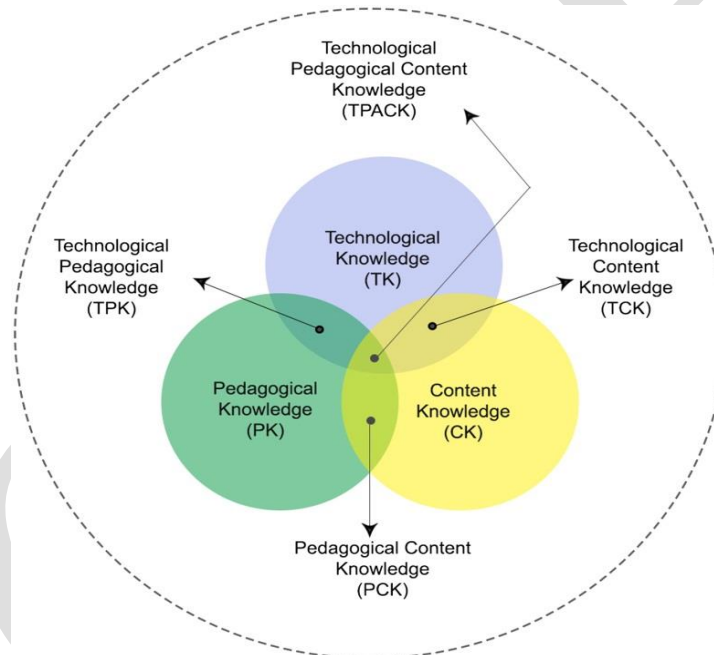


Figure 1. TPACK Framework (Koehler & Mishra, 2008).

As seen in Figure 1, Mishra and Koehler (2008) positioned multi-knowledge fields in the context of teachers' use of theory and practice together in their classrooms. The knowledge of teacher affects the application level in the classroom, while the application affects the degree of using knowledge in the classroom (Doering, Veletsianos, & Scharbe, & Miller, 2009). This framework, which allows teachers to think about the difficulties and subtleties of the context on how to teach the knowledge to children, also facilitates for children to learn (Angeli & Valanides, 2009). It is also an efficient framework for designing teacher education programs and guiding teachers' educators in order to help preservice teachers integrate technology into education (Günbatır, Boz, & Damar, 2017).

Purpose of the Study

In order to clarify what TPACK means and to develop a more robust and mature understanding about it, attention should be paid to what is being questioned in TPACK-related studies (Niess, 2011). The main objective of the current study is to investigate the preschool and primary school teachers' self-confidence



about their TPACK in Turkey. Preservice teachers were from two different universities and two different undergraduate programs. Their self-confidence about TPACK was analyzed through the questionnaires they filled in without any time limit.

The research question and five sub-questions of the research were specified as below:

What are the preschool and primary school teachers' perception of self-confidence about their TPACK?

Regarding preschool and primary school teachers;

- What is the role of gender in the perception of self-confidence about TPACK?
- What is the role of the type of high school they graduated from in the perception of self-confidence about TPACK?
- What is the role of the university they attend in the perception of self-confidence about TPACK?
- What is the role of the undergraduate program they study in the perception of self-confidence about TPACK?
- What is the role of grade in the perception of self-confidence about TPACK?

METHOD

This section includes the design of the research, participants, data collection, and data analysis.

Research Design

Survey model was used to determine the preschool and classroom teacher candidates' perception of self-confidence about their technological pedagogical content knowledge (TPACK) and to examine the differentiation of these self-confidence depending on some variables. Survey model is a research model that aims to describe a situation that existed in the past or still exists as it is without any intervention (Karasar, 2008). In addition, in survey model (cross-sectional survey technique), variables are measured once to determine whether there is a difference between them (Fraenkle, Wallen, & Hyun, 2006).

Sample

The sample of the study consisted of 630 preservice teachers studying at the 2nd, 3rd, and 4th grades of Preschool and Primary School Education Program of Anadolu University and Eskisehir Osmangazi University (ESOGU). In the selection of the preservice teachers, having taken educational courses was considered as a criterion and, therefore, those studying at the 2nd and higher grades were included in the sample. Some demographic characteristics of the preservice teachers are given in the table below.

Table 1. Demographic characteristics of the pre-service teachers who participated in the research

Variable	Category	f	%
Gender	Female	512	81.3
	Male	118	18.7
University	Anadolu University	315	50
	Eskişehir Osmangazi University	315	50
Undergraduate Program	Preschool Teaching	306	48.6
	Primary School Education Program	324	51.4
High school Type	Science High School	8	1.3
	Anadolu High School	420	66.7
	Anadolu Teacher Training High School	65	10.3
	Social Science High School	11	1.7
	Vocational High School	94	14.9
	Normal High School	32	5.1
	Grade	2 nd Grade	281	44.6
	3 rd Grade	209	33.2
	4 th Grade	140	22.2



512 (81.3%) of the preservice teachers were female and 118 (18.7%) of them were male. 315 (50%) preservice teachers were from Anadolu University and 315 (50%) from Eskişehir Osmangazi University (ESOGU). 306 (48.6%) of them were studying at the preschool teaching education program, 324 (51.4%) at the classroom teaching education program. 291 (44.6%) of them were from the 2nd grade, 209 (33.2%) from the 3rd grade, and 140 (22.2%) from the 4th grade. As for the type of high school, 420 (66.7%) of them graduated from Anatolian High School, 94 (14.9%) from Vocational High School, 65 (10.3%) from Anatolian Teacher Training High School, 32 (5.1%) from Normal High School, 11 (1.7%) from Social Sciences High School, and 8 (1.3%) from Science High School.

Data Collection Tools

The data of the research were collected using “Personal Information Form” developed by the researchers and “Technological Pedagogical Content Knowledge Self-Confidence Scale” developed by Graham, Burgoyne, Cantrell, Smith, and Harris (2009) and adapted to Turkish by Timur and Taşar (2011).

TPACK Self-Confidence Scale: TPACK Self-Confidence Scale was developed by Graham, Burgoyne, Cantrell, Smith, and Harris (2009) and adapted to Turkish by Timur and Taşar (2011). The survey was created as a 5-point Likert scale with five options [(1) Not confident, (2) Somehow confident, (3) Moderately confident, (4) Very Confident, and (5) Completely confident] and an additional option [(0) I don’t know this type of technologies] for the items 16, 17, 18, 19, and 20. The scale consists of 31 items and has a 4-factor structure. TPACK was specified as the first factor (items 1-8), TPK as the second factor (items 9-15), TCK as the third factor (items 16-20), and TK as the fourth factor (items 21-31). The lowest score possible for TPACK Self-Confidence Scale is 26 and the highest score possible is 155. The first factor of the scale has a score range of 8-40, the second factor 7-35, the third factor 0-25, and the fourth factor 11-55. Cronbach Alpha values of the original scale for the factors 1, 2, 3, and 4 were found to be .95, .91, .97, and .92, respectively. Cronbach Alpha reliability coefficient of the scale adapted to Turkish was found to be .92 for overall scale, and .89, .87, .89, and .86, for the factors 1, 2, 3, and 4, respectively (Timur and Taşar, 2011). These values show that the Turkish version of the scale is both valid and reliable.

Personal Information Form: Personal Information Form was created by the researchers to collect information such as gender, university, and undergraduate program, type of high school, and grade that may cause a difference in the preschool and primary school teachers’ perceptions of self-confidence about their TPACK.

Data Analysis

Prior to the data analysis, the data set was controlled. The data of 630 preschool and primary school teachers were transferred to SPSS 23.0 program and checked for missing/incorrect data entries. Then, the compatibility of the factor structures of the scale with the data was evaluated by Confirmatory Factor Analysis (CFA). Skewness and kurtosis coefficients were calculated to determine the distribution of the data. The results are shown in Table 2.

Table 2. Skewness and Kurtosis coefficients calculated for the answers given to the TPACK scale items

Dimension	n	Skewness	Kurtosis
TPACK	630	-.276	-.076
TPK	630	-.583	.171
TCK	630	-.799	-.119
TK	630	-.475	-.198
TPACK Self-Confidence (Overall)	630	-.262	-.056

TPACK: Technological Pedagogical Content Knowledge, **TPK:** Technological Pedagogic Knowledge, **TCK:** Technological Content Knowledge, and **TK:** Technological Knowledge.



As seen in Table 2, the skewness and kurtosis coefficients of the overall scores of the preservice teachers who participated in the research were calculated as -.262 and -.056, respectively. The skewness and kurtosis coefficients calculated for the score distribution of the sub-dimensions and the whole scale were within the range of ± 1 . Skewness and kurtosis values within the range of ± 1 indicate that the data is normally distributed (Büyüköztürk, 2018). Accordingly, it can be said that the preservice teachers' TPACK self-confidence scores have a normal distribution without excessive deviation.

After analyzing the data set, descriptive statistics including minimum, maximum, average, and standard deviation values were calculated in order to determine the preschool and primary school teachers' perceptions of self-confidence about their TPACK. Then, the difference tests were carried out to reveal the differences between the preschool and primary school teachers' perceptions of self-confidence about their TPACK in terms of demographic characteristics. In the interpretation of the tests, the statistical significance was set at $p < .05$.

RESULTS

Confirmatory Factor Analysis (CFA)

The compliance of the factor structures of "TPACK Self-Confidence Scale" with the data obtained after the adaptation was evaluated by CFA.

CFA is carried out to examine the extent that a previously created structure is verified with the obtained data. In other words, CFA tests the hypothesis that the predetermined factor structures will not change in the new application (Sümer, 2000). Figure 3 shows the path diagram of the CFA carried out for the four-factor structure specified in the original TPACK Self-Confidence Scale.

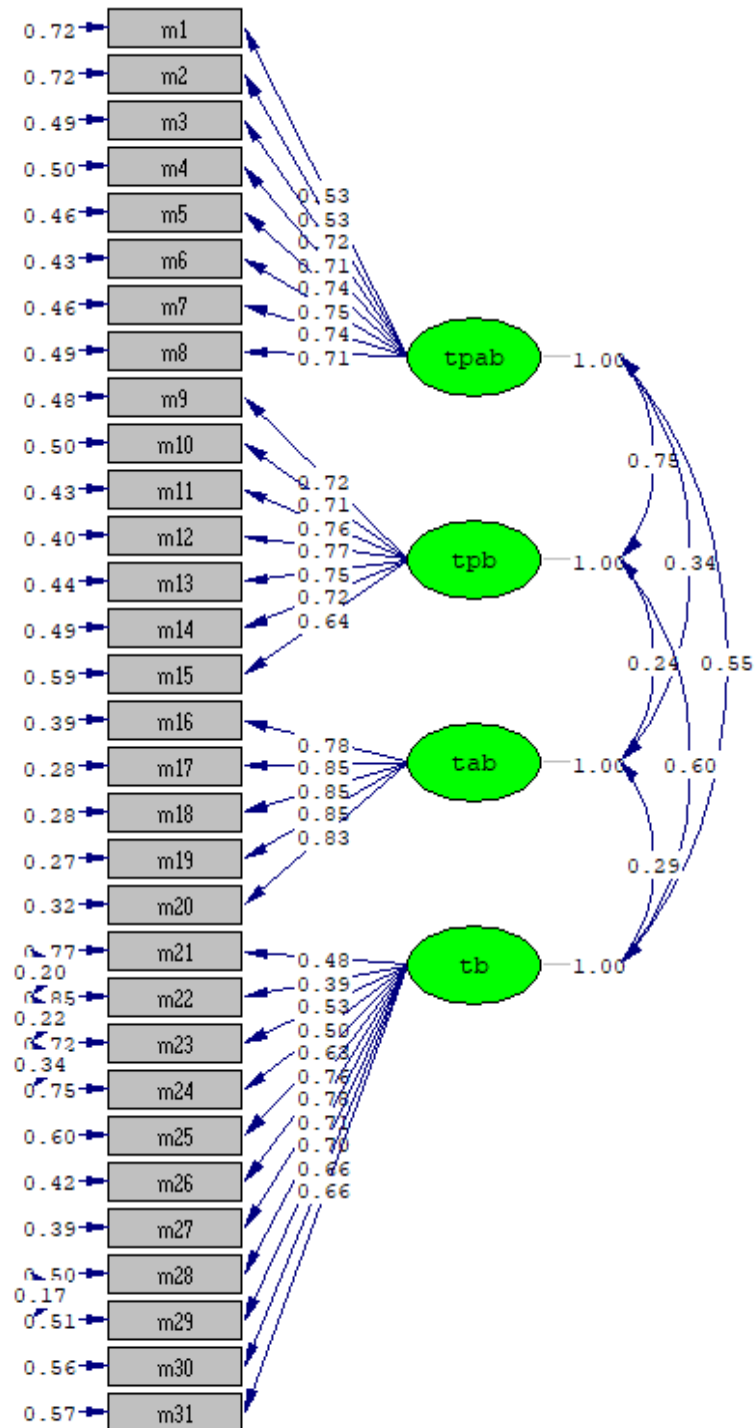
Table 3. Goodness of fit results of the preservice teachers' perception of self-confidence about TPACK by CFA

Fit Parameter	Fit Parameter Statistics	Acceptable Fit Values	Good Fit Values
RMSEA	.069	$.05 \leq \text{RMSEA} \leq .08$	$0 \leq \text{RMSEA} \leq .05$
$\chi^2/\text{s.d.}$	3.97	$0 \leq \chi^2 \leq 2$	$2 \leq \chi^2 \leq 3$
SRMR	.065	$.05 \leq \text{SRMR} \leq .10$	$0 \leq \text{SRMR} \leq .05$
NFI	.95	$.90 \leq \text{GFI} \leq .95$	$.95 \leq \text{GFI} \leq 1.00$
GFI	.85	$.90 \leq \text{GFI} \leq .95$	$.95 \leq \text{GFI} \leq 1.00$
AGFI	.83	$.85 \leq \text{AGFI} \leq .90$	$.90 \leq \text{AGFI} \leq 1.00$
CFI	.97	$.90 \leq \text{CFI} \leq .95$	$.95 \leq \text{CFI} \leq 1.00$

RMSEA: Root Mean Square Error of Approximation, **NFI:** Normed Fit Index, **GFI:** Goodness of Fit Index,

AGFI: Adjusted Goodness of Fit Index, **CFI:** Comparative Fit Index

The following criteria were taken into account when evaluating the indices: $2 \text{ DF} \leq \chi^2 \leq 3 \text{ DF}$ (degree of freedom) acceptable fit, $0 \leq \chi^2 \leq 2 \text{ DF}$ good fit; $.90 \leq \text{CFI} \leq .95$ acceptable fit, $.95 \leq \text{CFI} \leq 1.00$ good fit; $.05 \leq \text{SRMR} \leq .10$ acceptable fit, $0 \leq \text{SRMR} \leq .05$ good fit; $.05 \leq \text{RMSEA} \leq .08$ acceptable fit, $0 \leq \text{RMSEA} \leq .05$ good fit; $.90 \leq \text{GFI} \leq .95$ acceptable fit, $.95 \leq \text{GFI} \leq 1.00$ good fit; $.85 \leq \text{AGFI} \leq .90$ acceptance fit, $.90 \leq \text{AGFI} \leq 1.00$ good fit. The criterion taken into consideration in the evaluation of the standardized factor loads was being equal or higher than .30. The factor loads and goodness of fit values given in the figures showed that the factor loads were fully compatible, and goodness of fit values indicated a good fit. Model-data fit values calculated in the Confirmatory Factor Analysis ($\chi^2/\text{DF} = 3.97$, $\text{RMSEA} = .069$, $\text{CFI} = .97$, $\text{NFI} = .95$, $\text{AGFI} = .83$, $\text{GFI} = .85$) showed that the four-dimension, 31-item structure was verified in the Turkish sample (Timur & Taşar, 2011).



Chi-Square=1683.49, df=424, P-value=0.00000, RMSEA=0.069

Figure 2. The path diagram of the CFA carried out on the four-factor structure specified in the original "TPACK Self-Confidence Scale"



Within the scope of this research, 630 preservice teachers answered the questions in the TPACK Self-Confidence Scale. Cronbach alpha reliability coefficients were calculated to determine the reliability of the answers given to the scale items.

Table 4. Reliability analysis results of the preservice teachers' perception of self-confidence about TPACK

Dimension	Cronbach Alfa	Number of Items
TPACK	.872	8
TPK	.883	7
TCK	.918	5
TK	.879	11
TPACK Self-confidence	.921	31

TPACK: Technological Pedagogical Content Knowledge, **TPK:** Technological Pedagogic Knowledge, **TCK:** Technological Content Knowledge, and **TK:** Technological Knowledge.

As can be seen in Table 4, the reliability coefficients of the sub-dimensions and the whole scale were as follows: TPACK, .872; TPK, .883; TCK, .918; TK, .879; and the whole Scale, .921. These values show that the answers given to the scale items by the preservice teachers participating in the research were highly reliable (Kalaycı, 2010).

Descriptive Statistics

The descriptive statistics were calculated to determine the preschool and primary school teachers' perceptions of self-confidence about their TPACK. The results are shown in Table 5.

Table 5. Descriptive statistics result of the preservice preschool and primary school teachers' perceptions of self-confidence about TPACK

Scale	Number of Items	n	Min.	Max.	Mean	Std.Dev.
TPACK	8	630	12.00	40.00	30.36	5.29
TPK	7	630	9.00	35.00	28.08	4.94
TCK	5	630	.00	25.00	15.41	6.92
TK	11	630	14.00	55.00	42.26	8.13
TPACK Self-confidence (Overall)	31	630	46.00	155.00	116.11	18.85

TPACK: Technological Pedagogical Content Knowledge, **TPK:** Technological Pedagogic Knowledge, **TCK:** Technological Content Knowledge, and **TK:** Technological Knowledge.

As can be seen in Table 5, the preschool and classroom teacher preservice teachers' scores for the dimension "TPACK" ranged between 12.00 and 40.00, and the mean score was calculated as 30.36 (± 5.29). Their scores for the dimension "TPK" ranged from 9.00 to 35.00 with an average of 28.08 (± 4.94). Their scores for the dimension "TCK" varied between .00 and 25.00, and their average was calculated as 15.41 (± 6.92). TK scores of the preservice teachers varied between 14.00 and 55.00, and the average was calculated as 42.26 (± 8.13). Finally, their scores for the overall scale (31-item TPACK Self-Confidence scale) varied between 46.00 and 155.00, and the average was calculated as 116.11 (± 18.85). The average score obtained from the whole scale was 93. The fact that the average score for the whole scale was above 93 ($\bar{X}=116.11$) indicates that the preschool and primary school teachers' perception of self-confidence about their TPACK was high. Since the number of items in each dimensions of the scale is different, the average score for each sub-dimension was divided by the number of items in that sub-dimension to make comparison between the dimensions. Accordingly, preservice teachers were observed to have the highest score in TPK ($\bar{X}=4.0$), whereas they were found to have the lowest score in TCK ($\bar{X}=3.08$).



Difference Statistics

Difference statistics were calculated to reveal the significant differences, if any, between the preschool and primary school teachers' perceptions of self-confidence about TPACK in terms of demographic variables (gender, type of high school, university, undergraduate program, and grade). Before the calculations, the assumptions of normality and homogeneity of variances were tested using non-parametric statistics.

Mann Whitney-U test was used to test the significance of the differentiation between the preschool and primary school teachers' perceptions of self-confidence about TPACK depending on gender. The results are given in Table 6.

Table 6. Mann Whitney-U test results of the preservice teachers' perceptions of self-confidence about TPACK by gender

Dimensions	Gender	n	Mean	Std.Dev.	Z _{calc}	p
TPACK	Female	512	30.29	5.27	-.79	.429
	Male	118	30.67	5.40		
TPK	Female	512	28.03	4.95	-.48	.630
	Male	118	28.30	4.92		
TCK	Female	512	15.03	6.95	-3.18	.001*
	Male	118	17.02	6.58		
TK	Female	512	41.90	8.17	-2.39	.017*
	Male	118	43.82	7.80		
TPACK Self-confidence (Overall)	Female	512	115.26	18.64	-2.65	.008*
	Male	118	119.81	19.40		

* $p \leq .05$ $H_0: \mu_1 = \mu_2$ (The difference between the self-confidence of the female and male preservice teachers is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

As can be seen in Table 6, the zero hypothesis, which claims that the differences between the female and male preservice teachers in terms of TPACK self-confidence, TCK, and TK average scores are statistically insignificant, can be rejected with a confidence of 95% ($p = .008 \leq .05$). Statistically significant differences were observed between the self-confidence perceptions of female and male preservice teachers in terms of the sub-dimensions TCK and TK ($p = .001 \leq .05$ and $p = .017 \leq .05$, respectively). As for the average scores, the male preservice teachers' TCK and TK perception levels (17.02 ± 6.58 and 43.82 ± 7.80 , respectively) were significantly higher than those of the female preservice teachers (15.03 ± 6.95 and 41.90 ± 8.17 , respectively). Moreover, the preservice teachers' TPACK self-confidence perception also showed a significant difference depending on gender ($p = .008 \leq .05$). The perception level of the male preservice teachers (119.81 ± 19.40) was significantly higher than that of the females (115.26 ± 18.64). Therefore, it can be asserted that gender has a statistically significant effect on the perception levels of self-confidence about TCK, TK, and TPACK. No significant difference was observed between the preservice teachers' TPK levels depending on gender ($p > .05$). In other words, the female and male preservice teachers were found to be similar in terms of TPK.

Mann Whitney-U test was used to test the significance of the differentiation of the preservice teachers' perceptions of self-confidence about TPACK in terms of the university they attend. The results are given in Table 7.

As can be seen in Table 7, the zero hypothesis, which claims that the differences between the preservice teachers' average scores for TPACK self-confidence, TPACK and TCK depending on whether they attend Anadolu University or Eskisehir Osmangazi University (ESOGU) are statistically insignificant, can be rejected with a confidence of 95% ($p = .031 \leq .05$). It was observed that there was a significant difference between the self-confidence perceptions of the pre-service teachers studying at Anadolu University and



Eskişehir Osmangazi University in terms of the sub-dimensions of technological pedagogical content knowledge (TPACK) and technological content knowledge (TCK) ($p=.000\leq.05$ and $p=.038\leq.05$, respectively).

Table 7. Mann Whitney-U test results of the preservice teachers’ perceptions of self-confidence about TPACK by the university they attend

Dimension	University	n	Mean	Std.Dev.	Z _{calc}	p
TPACK	Anadolu	315	31.15	5.17	-3.783	.000*
	ESOGU	315	29.57	5.31		
TPK	Anadolu	315	28.19	5.24	-.974	.330
	ESOGU	315	27.97	4.64		
TCK	Anadolu	315	15.94	6.93	-2.072	.038*
	ESOGU	315	14.87	6.88		
TK	Anadolu	315	42.52	8.31	-.703	.482
	ESOGU	315	42.00	7.94		
TPACK Self-confidence (Overall)	Anadolu	315	117.81	19.46	-2.163	.031*
	ESOGU	315	114.41	18.09		

* $p\leq.05$ $H_0: \mu_1 = \mu_2$ (The difference between the self-confidence of the preservice teachers who attend different universities is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

The preservice teachers from Anadolu University were found to have significantly higher average scores for TPACK and TCK (31.15 ± 5.17 and 15.94 ± 6.93 , respectively) than those from ESOGU (29.57 ± 5.31 and 14.87 ± 6.88 , respectively). The preservice teachers’ perceptions of self-confidence about TPACK also showed a significant difference depending on the university they attend ($p=.031\leq.05$). The preservice teachers from Anadolu University were found to have a significantly higher score for TPACK self-confidence perception (117.81 ± 19.46) than those from ESOGU (114.41 ± 18.09). Therefore, it can be asserted that the university they attend had a statistically significant effect on their TPACK, TCK, and TPACK self-confidence perception levels. No significant difference was observed between their TPK and TK levels depending on the university they attend ($p>.05$). In other words, the preservice teachers from Anadolu University and Eskişehir Osmangazi University were found to have similar TPK and TK.

Mann Whitney-U test was used to test the significance of the differentiation of the preservice teachers’ perceptions of self-confidence about TPACK depending on the undergraduate program they study. The results are given in Table 8.

Table 8. Mann Whitney-U test results of the preservice teachers’ perceptions of self-confidence about TPACK by the undergraduate program they study.

Dimension	Undergraduate Program	n	Mean	Std.Dev.	Z _{calc}	p
TPACK	Preschool Teaching	306	30.07	5.35	-1.173	.241
	Classroom Teaching	324	30.64	5.23		
TPK	Preschool Teaching	306	27.69	4.98	-2.028	.043*
	Classroom Teaching	324	28.45	4.89		
TCK	Preschool Teaching	306	14.90	7.03	-1.922	.055
	Classroom Teaching	324	15.88	6.80		
TK	Preschool Teaching	306	41.87	8.24	-1.008	.313
	Classroom Teaching	324	42.63	8.02		
TPACK Self-confidence (Overall)	Preschool Teaching	306	114.52	19.13	-1.867	.062
	Classroom Teaching	324	117.61	18.49		

* $p\leq.05$ $H_0: \mu_1 = \mu_2$ (The difference between the self-confidence of the preservice teachers who study different undergraduate programs is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.



As can be seen in Table 8, the zero hypothesis, which claims that the difference between the preservice teachers' average scores for the perception of self-confidence about TPK depending on the undergraduate program is statistically insignificant, can be rejected with a confidence of 95% ($p=.043 \leq .05$). A statistically significant difference was observed between the preservice teachers studying at the undergraduate programs of preschool and classroom teaching in terms of perception of self-confidence about TPK ($p=.043 \leq .05$). The preservice teachers studying at the undergraduate program of classroom teaching were found to have a significantly higher average score for TPK (28.45 ± 4.89) than those studying at the undergraduate program of preschool teaching (27.69 ± 4.98). In other words, it can be asserted that the undergraduate program they study had a statistically significant effect on their perception of self-confidence about TPK. No significant difference was observed between their scores for TPACK, TCK, and TK depending on the undergraduate program they study ($p > .05$). In other words, the preservice teachers studying at the undergraduate programs of preschool teaching and classroom teaching were found to have similar TPACK, TCK and TK. Moreover, the preservice teachers' scores for the overall scale of TPACK self-confidence did not differ significantly depending on the undergraduate program they study ($p=.062 > .05$).

Kruskal Wallis test was used to test the significance of the differentiation of the preservice teachers' perceptions of self-confidence about their TPACK depending on the type of the high school they graduated from. The results are given in Table 9.

Table 9. Kruskal Wallis test results of the preservice teachers' perceptions of self-confidence about TPACK by the type of the high school they graduated from.

Dimension	High school Type	n	Mean	Std.Dev.	p
TPACK	Anatolian High School	420	30.28	5.34	.722
	Anatolian Teacher Training High School	65	31.08	4.99	
	Vocational High School	94	30.33	5.00	
	Other High School	51	30.20	5.86	
	Overall	630	30.36	5.29	
TPK	Anatolian High School	420	28.10	4.86	.809
	Anatolian Teacher Training High School	65	28.52	4.99	
	Vocational High School	94	28.00	4.72	
	Other High School	51	27.51	5.93	
	Overall	630	28.08	4.94	
TCK	Anatolian High School	420	15.30	6.98	.094
	Anatolian Teacher Training High School	65	17.09	6.71	
	Vocational High School	94	15.37	6.22	
	Other High School	51	14.22	7.77	
TK	Overall	630	15.41	6.92	.804
	Anatolian High School	420	42.03	8.31	
	Anatolian Teacher Training High School	65	42.71	8.12	
	Vocational High School	94	42.71	6.99	
	Other High School	51	42.80	8.72	
TPACK Self-confidence (Overall)	Overall	630	42.26	8.13	.464
	Anatolian High School	420	115.70	19.12	
	Anatolian Teacher Training High School	65	119.40	18.12	
	Vocational High School	94	116.42	16.85	
	Other High School	51	114.73	21.08	
Overall	630	116.11	18.85		

* $p \leq .05$ $H_0: \mu_1 = \mu_2 \dots \mu_n$ (The difference between the self-confidence levels of the preservice teachers who graduated from different types of high school is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.



As can be seen in Table 9, the zero hypothesis, which claims that the difference between the groups in terms of the type of the high school they graduated from is statistically insignificant, cannot be rejected with a confidence of 95% ($p=.464 \geq .05$). Therefore, it can be asserted with a reliability of 95% that the type of the high school from which the preservice teachers graduated did not have a statistically significant effect on their perceptions of self-confidence about their TPACK. In other words, the preservice teachers who graduated from different types of high school were found to have similar perceptions of self-confidence about TPACK.

Kruskal Wallis test was used to test the significance of the differentiation of the preservice teachers' perceptions of self-confidence about TPACK in terms of grade. The results are given in Table 10.

Table 10. Kruskal Wallis test results of the preservice teachers' perception of self-confidence about TPACK by grade

Dimension	Grade	n	Mean	Std.Dev.	p
TPACK	2 nd Grade	281	30.27	5.30	.003*
	3 rd Grade	209	29.70	5.03	
	4 th Grade	140	31.53	5.50	
	Overall	630	30.36	5.29	
TPK	2 nd Grade	281	27.83	5.08	.001*
	3 rd Grade	209	27.57	4.67	
	4 th Grade	140	29.36	4.86	
	Overall	630	28.08	4.94	
TCK	2 nd Grade	281	14.08	7.29	.000*
	3 rd Grade	209	16.14	6.24	
	4 th Grade	140	16.96	6.68	
	Overall	630	15.41	6.92	
TK	2 nd Grade	281	41.41	8.27	.021*
	3 rd Grade	209	42.43	7.87	
	4 th Grade	140	43.73	8.05	
	Overall	630	42.26	8.13	
TPACK Self-confidence (Overall)	2 nd Grade	281	113.59	19.05	.000*
	3 rd Grade	209	115.85	17.77	
	4 th Grade	140	121.57	19.00	
	Overall	630	116.11	18.85	

* $p \leq .05$ $H_0: \mu_1 = \mu_2 \dots \mu_n$ (The difference between the self-confidence of the preservice teachers who were at different grades is statistically insignificant), **TPACK**: Technological Pedagogical Content Knowledge, **TPK**: Technological Pedagogic Knowledge, **TCK**: Technological Content Knowledge, and **TK**: Technological Knowledge.

As can be seen in Table 10, the zero hypothesis, which claims that the difference between the groups depending on the grade is statistically insignificant, can be rejected ($p=.001 \leq .05$). Therefore, it can be asserted with a reliability of 95% that the grade of the preservice teachers creates a statistically significant effect on their perceptions of self-confidence about their TPACK. Post-hoc test results showing the source of the difference in terms of grade are given below.

Table 11 shows that the senior (4th grade) students were the source of the difference in the overall scale of TPACK self-confidence and in the sub-dimensions of TPACK, TPK, TCK, and TK ($p \leq .05$). In other words, it can be asserted that the variation in the preservice teachers' scores for TPACK self-confidence dimensions depending on grade was caused by the seniors, and the self-confidence perceptions of the seniors were significantly higher than those at other grades.



Table 11. Least significant differences (LSD) test results of the preservice teachers' perception of self-confidence about TPACK

Dependent Variable	(I) Grade	(J) Grade	Mean Difference (I-J)	Standard Error	p
TPACK	2 nd Grade	3 rd Grade	.58	.48	.231
		4 th Grade	-1.25*	.54	.021
	3 rd Grade	2 nd Grade	-.58	.48	.231
		4 th Grade	-1.83*	.57	.002
	4 th Grade	2 nd Grade	1.25*	.54	.021
		3 rd Grade	1.83*	.57	.002
TPK	2 nd Grade	3 rd Grade	.25	.45	.575
		4 th Grade	-1.53*	.51	.003
	3 rd Grade	2 nd Grade	-.25	.45	.575
		4 th Grade	-1.78*	.54	.001
	4 th Grade	2 nd Grade	1.53*	.51	.003
		3 rd Grade	1.78*	.54	.001
TCK	2 nd Grade	3 rd Grade	-2.06*	.62	.001
		4 th Grade	-2.88*	.71	.000
	3 rd Grade	2 nd Grade	2.06*	.62	.001
		4 th Grade	-.81	.75	.275
	4 th Grade	2 nd Grade	2.88*	.71	.000
		3 rd Grade	.81	.75	.275
TK	2 nd Grade	3 rd Grade	-1.03	.73897	.166
		4 th Grade	-2.32*	.83691	.006
	3 rd Grade	2 nd Grade	1.0	.74	.166
		4 th Grade	-1.30	.88	.142
	4 th Grade	2 nd Grade	2.32*	.84	.006
		3 rd Grade	1.30	.88	.142
TPACK Self-confidence (Overall)	2 nd Grade	3 rd Grade	-2.26	1.70	.185
		4 th Grade	-7.98*	1.93	.000
	3 rd Grade	2 nd Grade	2.26	1.70	.185
		4 th Grade	-5.72*	2.03	.005
	4 th Grade	2 nd Grade	7.98*	1.93	.000
		3 rd Grade	5.72*	2.03	.005

TPACK: Technological Pedagogical Content Knowledge, **TPK:** Technological Pedagogic Knowledge, **TCK:** Technological Content Knowledge, and **TK:** Technological Knowledge.

DISCUSSION and CONCLUSION

In this study, the preschool and primary school teacher candidates' level of self-confidence about their TPACK was analyzed according to some demographic characteristics. Overall TPACK self-confidence of the preservice teachers was found to be high. As for the sub-dimensions of TPACK self-confidence scale, the preservice teachers were found to have the highest mean score in TPK and the lowest mean score in TCK. In their study examining the preservice teachers' perceptions of self-confidence about TPACK, Tokmak, Konakman and Yelken (2013) also reported that the preservice teachers had a high self-confidence perception. They also reported that the preservice teachers had the highest average score in TPK and the lowest in TK. In their study examining the TPACK self-confidence perceptions of the preservice and in-service teachers from four different teaching fields (science, math, ICT, classroom), Saltan and Arslan (2017) reported that the preservice teachers had the highest average score in TPK and the lowest in TPACK. As for the previous studies carried out with the participation of teachers, Güder (2018) and Bağdiken and Akgündüz (2018) focused on classroom teachers' and science teachers' TPACK



self-confidence, respectively. In both studies, the teachers' self-confidence was found to be high, and the highest average score was observed in the sub-dimension TPK, while the lowest average scores differed. The results of these studies support the finding of our study that the preservice teachers' self-confidence perception was high, the sub-dimension with the highest average score was TPK, even though they reported a different result in terms of the sub-dimension with the lowest average score. In the research conducted by Emre, Atıcı and Ayaz (2020) to determine the classroom teachers' levels of technological pedagogical content knowledge in the context of learning outcomes, it was asserted that the usage levels were not sufficient. In this context, it can be thought that preschool and primary school teachers should be supported more in all the sub-dimensions except TPK. On the other hand, in their research carried out with the participation of preservice teachers from 13 different undergraduate programs, Tatlı, Akbulut ve Altınışik (2016) examined the effects of the use of Web 2.0 tools for educational purposes on the preservice teachers' self-confidence. They reported that the preservice teachers achieved the highest average score in TCK, and the lowest in TPK. This study, which was carried out with a broad sample in terms of undergraduate programs, shows that the results may change due to the differences between undergraduate programs. In the research, it was reported that an increase was observed in the preservice teachers' scores for TPACK self-confidence and its sub-dimensions after web 2.0 tools were used for educational purposes. This result is important in that it shows the effects of the applications that teacher educators provided in the teaching process on the preservice teachers' TPACK self-confidence.

In order to examine the preservice teachers' TPACK self-confidence in more detail, the scores were analyzed according to gender, university, undergraduate program, high school type, and grade. Among these variables, the type of the high school from which the preservice teachers graduated was observed to have no effect on their scores for TPACK self-confidence and its sub-dimensions. The male preservice teachers were found to have significantly higher scores for overall TPACK self-confidence, TCK, and TK than the females. This result might be due to the fact that men are more interested in learning digital games and using technical knowledge (Hsu, Tsai, Chang, & Lia, 2017). In the research carried out by Koh, Chai and Tsai (2010), the technology knowledge of the male preservice teachers was found to be higher than that of the females, which also supports this interpretation. Similarly, the studies conducted with the participation of teachers also reported that TK level of the male teachers was higher (see, e.g., Bal & Kandemir, 2013; Karadeniz & Vatanartleyen, 2015). Cheng (2017) investigated the TPK level of mother-tongue teachers and concluded that the male teachers had more self-confidence about their TK than the female teachers. Creating settings such as workshops where male teachers can share their technology knowledge with female teachers may positively contribute to females' TK level. Çetin (2019) examined the technological pedagogical field knowledge of teacher candidates and reported results similar to those of Cheng. Çetin (2019) reported that TPACK of the male pre-service teachers was higher than that of the females, except for the sub-dimensions PC and PCK. Based on the current research results, it is thought that educational settings where male teachers can share their TCK and TK with females can be beneficial. However, some studies concluded that preservice teachers' TPACK self-confidence did not differ depending on gender (see, e.g., Bozkurt, 2016; Doğan, 2019; Koh & Sing, 2011; Tokmak, Konokman, & Yelken, 2013). Therefore, there is a need for conducting in-depth analysis on gender with further researches on TPACK self-confidence.

As for the effect of university on TPACK self-confidence of the preservice teachers from two universities in the same province, the preservice teachers from Anadolu University were found to have a significantly higher average score in overall TPACK self-confidence and the sub-dimensions TPK and TK. Teacher training institutions are expected to provide preservice teachers with competence in technology integration and improve their self-confidence perception (Mishra & Koehler, 2006). In Turkey, the competences that preservice teachers should possess are specified by the Council of Higher Education (CoHE), which is



affiliated to the Ministry of Education. In the report on teacher qualifications, it was stated that teachers should have all the necessary knowledge and skills for the integration of education and technology (Ministry of Education, 2006). Universities and educators who train teachers are responsible for providing these qualifications to preservice teachers. In the process of adapting students to the integration of technology into the educational process, it is very important to make more planning starting from technical support (Baxter & Lederman, 1999). However, the relevant researches in the literature did not include the variable “university”. The current research shows that the educational setting offered by the university has an effect on the TPACK self-confidence of preservice teachers.

Both preschool and primary school teacher candidates participated in the study, and their undergraduate program was included in the study as a variable. As a result of the research, TPACK self-confidence of the preservice teachers studying in both programs was found to be high; however, the primary school teacher candidates were found to have significantly higher average scores in the sub-dimension TPK. It was concluded that the technological pedagogical content knowledge (TPACK) levels of the pre-service teachers differed significantly depending on their department (Doğan, 2019). The knowledge and competencies of teachers are very important in using technology in preschool education. However, it is a very sensitive issue how to use technology in preschool education. If education and technology cannot be fully integrated, they may have some negative effects on children's creativity (Haughland, 1999). Therefore, preschool teachers need training for using and applying technology tools (NAEYC, 2012).

Finally, it was found that the senior (4th grade) preservice teachers had higher scores in TPACK self-confidence and all sub-dimensions than those at other grades. Similarly, in the studies examining TPACK self-confidence of preservice teachers, it was reported that senior preservice teachers' self-confidence was higher than those of the other grades (Bozkurt, 2016; Kartal & Afacan, 2017). The review of the studies on teachers' TPACK self-confidence revealed that self-confidence decreases as the professional seniority increases (Avcı & Ateş, 2018; Bal & Kandemir, 2013; Bilici & Güler, 2016; Doğru & Aydın, 2017; Güder, 2018). This can be explained by the fact that teachers are introduced to the development of technology early in their faculty life, and in later periods, they use technology more intensively in their daily lives (Bal & Kandemir, 2013). In the study examining teachers' TPACK levels, Chuang and Ho (2011) reported that the teachers in the lowest age group (20-30 years old) had a significantly higher knowledge level than other age groups. Considering the results reported in these studies, it can be thought that TPACK self-confidence is higher in the senior students who increased their knowledge level during their education in the undergraduate program and the new teachers who are in the similar age group.

Conclusion

This study examining the preschool and primary school teacher candidates' TPACK self-confidence provides important information to educators. As preservice teachers' levels of technology usage increase, they develop a positive attitude towards the use of technology when they become a teacher (Usta & Korkmaz, 2010). The data obtained in this study will also help preservice teachers develop their TPACK self-confidence. Although the preservice teachers' TPACK self-confidence was high, they had a low score in TCK. This indicates that they should be supported in this dimension. In addition, there is a need to support the female preservice teachers and the preservice teachers at the 2nd and 3rd grades in terms of TPACK self-confidence. In addition, another result of the study was the significance of technology-integrated education opportunities provided to preservice teachers in education faculties, which explained the difference between universities. Finally, the preschool teacher candidates were observed to need more support in undergraduate education regarding TPK. More empirical research can be carried out to improve the TPACK levels of prospective teachers. More measurement tools can produce more qualified and comprehensive results in future studies. More applications associated with TPACK can be included in the lessons in the undergraduate program of Preschool Education and Classroom Teaching.



Limitations and Directions for Future Research

This research, which was conducted with the participation of preschool and primary school teachers in Turkey, expanded the scope of the studies on TPACK self-confidence. However, the research has some limitations. The data of the study were collected from 630 preservice teachers from two universities in the same province in Turkey. It should be noted that preservice teachers' TPACK self-confidence may change depending on the participant's demographic characteristics or their cultural differences. Considering that the preservice teachers were trained by similar education programs in the same province, it can be thought that the research results may not fully reflect the TPACK self-confidence of preservice teachers.

In addition, this is the first research examining preschool and primary school teachers' TPACK self-confidence in Turkey. Therefore, the results of the research should be supported and verified by other studies.

Future research should include different samples that allow the evaluation of different provinces and regions of Turkey. In addition to the quantitative analysis, qualitative methods can be used in future studies to examine other variables that may affect preservice teachers' TPACK self-confidence. Comparison of quantitative and qualitative research results may be helpful in understanding preschool and primary school teachers' attitudes towards TPACK. Moreover, since different results were obtained depending on the gender of the preservice teachers in Turkey, it is recommended to monitor their TPACK self-confidence by longitudinal studies in future. In addition, the impact of the educational settings offered by universities on preservice teachers' TPACK self-confidence should be examined.

Future researches may investigate the impact of the technologically improved instruction provided by teacher educators on preservice teachers, and this may provide insights about more effective applications in undergraduate programs. In this way, education programs focusing on the use of developing technologies such as web technology, augmented reality, and virtual reality for educational purposes can be designed to increase the preservice teachers' TPACK self-confidence in the future (Cheng, 2017).

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INTEGRATING PEACE EDUCATION INTO ENGLISH LANGUAGE TEACHING IN PRIMARY SCHOOLS

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Abstract

Peace education is a significant aspect of education as it aims to teach individuals to deal with violence and conflicts in a peaceful way. A literature review indicated that peace education can be integrated into English language teaching (ELT) and learned by students while they study English in middle and high schools and at universities, but how peace education can be integrated into ELT in primary schools has not been studied. Therefore, the present study aimed to find out whether peace education is integrated into the new English language teaching program (ELTP) for primary schools in Turkey and, if it is, how it is integrated into the ELTP. This work was designed as a qualitative study. The new ELTP for primary schools in Turkey was used as the data collection tool and data were subjected to content analysis. The findings of the study indicated that peace education is integrated into the new ELTP through the themes and/or language functions of the units in the 2nd, 3rd, and 4th grades. Findings also showed that the units related to peace education can help students study three aspects of peace education, which are inner peace, social peace, and peace with nature. The findings were discussed and suggestions for further studies were made.

Keywords: Peace education, new English language teaching program in Turkey, primary schools, English language teaching.

INTRODUCTION

People in any part of the world may be exposed or may have been exposed to violence and conflicts (Billings Chilcoat, 2017; Borg & Grech, 2014; Buck, 2016; Costa & Ivenicki, 2016; Manojlovic, 2018; Snauwaert, 2019; Verma, 2017). Violence and conflicts result from human-related factors such as gender, religion, and ethnicity (Borg & Grech, 2014; Manojlovic, 2018). People's inner peace, social peace, and peace with nature may deteriorate due to violence and conflicts as Agnihotri (2017), Gebregeorgis (2017), and Renner (1991) emphasized. According to Agnihotri (2017), Bajaj (2015), Borg and Grech (2014), and Verma (2017), such deterioration may create serious physical, political, psychological, economic, and ecological effects in people's lives such as homicide, suicide, oppression, and inequalities. Therefore, the exposure to violence and conflicts and their deteriorating effects on people's lives have made peace a significant part of people's lives. Peace education has accordingly become an important aspect of education, which makes it essential to understand what peace education means.

Theoretical Background of the Study

Peace education is defined as an instructional process in which students learn values, skills, knowledge, and attitudes related to peace to deal with conflicts and violence peacefully (Manojlovic, 2018; Ubogu, 2016; Yusuf, 2011). Due to their effects on individuals, societies, and the environment, learning values, skills, knowledge, and attitudes to handle conflicts and violence peacefully can affect students' inner and social peace as well as their peace with nature (Agnihotri, 2017; Bajaj, 2015; Borg & Grech, 2014; Verma, 2017). Therefore, students should learn and practice the three aspects of peace education: inner peace, social peace, and peace with nature (Agnihotri, 2017; Renner, 1991). According to Agnihotri (2017) and Renner (1991), inner peace teaches students to have peace with themselves regarding their bodies, hearts, and minds, while social peace helps them to promote human rights, justice, and peaceful conflict resolution as well as other people's well-being. Peace with nature



assists students in consciously protecting and sustaining the environment (Agnihotri, 2017; Renner, 1991). According to UNESCO (2001), peace education consequently aims to help people grow up as peaceful individuals who are:

1. critical and positive thinkers,
2. respectful of human dignity,
3. peace builders in their communities,
4. non-violent conflict resolvers,
5. their true selves,
6. in peace with their inner selves,
7. knowledgeable enough to live together,
8. caregivers of the planet, and
9. compassionate, not harmful.

Peace Education and English Language Teaching

Peace education can be given as a separate curriculum subject or can be integrated into other subjects. According to Fountain (1999), it can be integrated into language teaching. English language teaching (ELT) can also contribute to peace education since both conceptual papers (Abid, 2016; Kruger, 2012; Natarajan, 2018; Sun, 2017; Şahin, 2011; Takkaç Tulgar, 2017; Yusuf, 2011) and research papers (Arikan, 2009; Carmel & Yochanna, 2018; Chowdbury, 2013; Gebregeorgis, 2017; Gutiérrez, Guerrero, & Bohórquez, 2020) in the literature related to peace education and ELT have indicated that students can learn and practice peace education while they learn English. On the one hand, the conceptual papers in the literature have discussed how peace education can be integrated into ELT by English language teachers in general English language courses (Abid, 2016; Kruger, 2012; Natarajan, 2018; Şahin, 2011; Takkaç Tulgar, 2017). Regarding the promotion of peace education, Sun (2017) also wrote about how to use graphic novels in a middle school English class, and Yusuf (2011) suggested the use of reading in English in primary schools. On the other hand, research papers have considered the following topics:

1. teaching English grammar to high school students through peace education (Arikan, 2009),
2. using English as a peacemaker with pre-service English language teachers (Carmel & Yochanna, 2018; Chowdbury, 2013),
3. peace values in a high school English language coursebook (Gebregeorgis, 2017), and
4. using artifacts as peacemakers with middle school students (Gutiérrez et al., 2020).

However, none of these papers focused on peace education in English language classes in primary schools except for that by Yusuf (2011). He discussed the promotion of peace education through English reading classes in primary schools, but not how peace education can be integrated into an English language teaching program (ELTP) and promoted through the ELTP in primary schools.

Aim of the Study and Research Questions

Due to the gap in the literature, this study aimed to find out whether peace education is integrated into the new ELTP for primary schools in Turkey (the 2nd, 3rd, and 4th grades) and, if it is integrated, how it is integrated into the new ELTP by answering the following research questions:

Is peace education integrated into the new ELTP for primary schools in Turkey?

If it is, how is it integrated into the new ELTP for primary schools in Turkey?

METHOD

Research Design

The aim of this study requires a complex and detailed understanding of an issue under investigation to explore it. Therefore, it was designed as a qualitative study because, according to Creswell (2007, 2014), qualitative research enables researchers to understand an issue by providing a detailed and full understanding so that they can explore it thoroughly.



Data Collection Tool

The data were collected through part of the English language teaching program (primary and lower secondary school 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th grades) of the Ministry of National Education (2018) for primary schools.

Data Analysis

The new ELTP of Turkey for primary schools was content-analyzed by following the approach suggested by Yıldırım and Şimşek (2013) for content analysis. First, the document was read many times by the researcher to derive codes. The data were categorized into meaningful units, which were conceptualized through the derived codes. Second, the data were organized according to the derived codes and were presented by the researcher without adding any comments to the analysis. Third, the data were interpreted by the researcher without any conflict with the description of the data.

Trustworthiness

To make the present study trustworthy (i.e., reliable and valid), the new ELTP of Turkey for primary schools was also content-analyzed by a colleague of the researcher who has a PhD. degree in ELT and has conducted qualitative research using content analysis. The researcher and his colleague compared their content analyses, talked about the similarities and differences in their analyses, and made changes related to the differences by reaching a consensus.

RESULTS

The results of the present study including the themes, language functions, and learning outcomes are given separately below for the 2nd, 3rd, and 4th grades.

2nd Grade

Inner Peace

The results related to inner peace in the 2nd grade are given in Table 1 below.

Table 1. Units related to inner peace and what relates them to inner peace

Units	What relates units to inner peace	Theme	Language function
5	Language function		Expressing likes and dislikes
7	Theme and language function	Body parts	Talking about one's possessions Making inquiries about them
9	Language function		Expressing likes and dislikes
10	Language function		Expressing likes and dislikes

According to Table 1, the language functions of units 5, 9, and 10 connect with inner peace. They express likes and dislikes. Students can talk about the colors, fruits, and animals they like and dislike in units 5, 9, and 10, respectively. Unit 10 also trains students on how to express abilities as one of its language functions. Respecting this function, students can understand vocabulary related to abilities in oral texts. They can also talk to other people about their abilities.

The theme and language functions of unit 7 link to inner peace. "Body parts" are its theme, and they are used to teach students how to talk about one's possessions and make inquiries as language functions. Students can recognize the names of their body parts in an oral text and tell other people the names of their body parts at the end of the unit.

Social peace

Table 2 presents the units related to social peace and what relates them to social peace in the 2nd grade.

According to Table 2, the themes and language functions of units 2, 3, and 6 relate to social peace. The theme of unit 2 is based on "friends," and its language functions are greeting and meeting people and asking a person's name. Students are expected to recognize greeting and meeting expressions in oral texts and when people introduce themselves. They are also expected to introduce themselves, greet and meet other people, and ask other people questions to learn their names and feelings.

**Table 2.** Units related to social peace and what relates them to social peace

Units	What relates units to social peace	Theme	Language function
2	Theme and language function	Friends	Greeting and meeting people Asking a person's name
3	Theme and language function	In the classroom	Giving directions, explaining and responding to thanks Asking for clarification Giving and responding to instructions
6	Theme and language function	At the playground	Making inquiries and suggestions

The theme of unit 3 is “in the classroom.” It aims to teach students how to (a) give directions, (b) explain and respond to thanks, (c) ask for clarification, and (d) give instructions and respond to them as language functions. Students are supposed to comprehend instructions and follow directions in oral texts. They are also supposed to express and respond to thanks, ask other people for clarification, and tell other people how to do things in the classroom.

The theme of unit 6 is “at the playground,” through which students study and learn how to make inquiries and suggestions as language functions. Students can understand suggestions in oral texts. They can also join a conversation by asking questions, answering them, and making suggestions.

Peace with Nature

Table 3 indicates the units related to peace with nature and what relates them to peace with nature in the 2nd grade

Table 3. Units related to peace with nature and what relates them to peace with nature

Units	What relates units to social peace	Theme	Language function
8	Theme and language function	Pets	Making inquiries about pets Talking about the location of animals
9	Theme and language function	Fruit	Telling other people what to do Giving and responding to instructions Explaining likes and dislikes
10	Theme and language function	Animals	Making inquiries about animals Explaining likes and dislikes

Units 8, 9, and 10 are related to peace with nature in terms of their themes and language functions as shown in Table 3. “Pets” are the theme of unit 8 and are used to teach the language functions of making inquiries and talking about the location of animals. Students can recognize certain pets and follow instructions about the locations and names of pets in oral texts. They can also tell other people the names and locations of pets.

The theme of unit 9 is based on “fruit.” Telling other people what to do, giving and responding to instructions, and explaining likes and dislikes are taught as language functions. Students are expected to identify the names of fruits in an oral text. They are also expected to talk to other people about the fruits they like and dislike and to tell other people what to do with fruit.

“Animals” are the theme of unit 10 and are used to train students on how to make inquiries and express abilities, likes, and dislikes as language functions. Students can identify the names of certain animals and understand the vocabulary related to abilities in oral texts. They can speak to other people about their and animals' abilities as well as the animals that they like and dislike.

3rd Grade

Inner Peace

The units related to inner peace and what relates them to inner peace in the 3rd grade are presented in Table 4 below.

**Table 4.** Units related to inner peace and what relates them to inner peace

Units	What relates units to social peace	Theme	Language function
4	Theme and language function	Feelings	Expressing feelings Making suggestions
10	Language function		Explaining likes and dislikes

As Table 4 shows, unit 4 can help students learn inner peace in terms of its theme and language functions. Its theme is “feelings.” How to express feelings and how to make suggestions are studied as the language functions. Concerning the theme and language functions, students can listen to and recognize suggestions and the names of feelings. They can express their feelings and make suggestions to other people.

Unit 10 can assist students in learning inner peace because of its language function. Students learn how to express their likes and dislikes as a language function in this unit. Concerning this function, they are expected to talk about the animals they like and dislike.

Social Peace

Table 5 indicates the units related to social peace and what relates them to social peace in the 3rd grade.

Table 5. Units related to social peace and what relates them to social peace

Units	What relates units to social peace	Theme	Language function
1	Theme and language function	Greeting	Introducing oneself Greeting and saluting people
2	Theme and language function	My family	Asking about family members Introducing family members
3	Theme and language function	People I love	Describing people and characters Expressing abilities and inabilities
7	Language function		Apologizing Talking about the locations of people and things
8	Language function		Expressing locations of things Asking and giving information about transportation

According to Table 5, units 1, 2, and 3 can help students learn social peace because of their themes and language functions. “Greeting” is the theme of unit 1, and its target language functions are how to introduce oneself, greet people, and address them. At the end of the unit, students can recognize expressions of greeting and address, the alphabet, and numbers in oral texts. They can also introduce themselves to other people, greet other people, and spell their names.

The theme of unit 2 is based on “my family,” through which students learn the language function of how to ask about and introduce family members. Concerning this theme and language function, students can recognize the names of family members in oral texts. They can also ask and talk about the relationships of family members while introducing them.

The theme of unit 3 is “people I love.” It aims to teach students how to describe people and characters and express their abilities and inabilities. Accordingly, students can identify the physical qualities of people in oral texts. They can also talk about the physical qualities, abilities, and inabilities of people.

Units 7 and 8 can help students learn social peace due to their language functions. Unit 7 aims to educate students on language functions such as how to apologize and talk about the locations of people and things. Concerning these functions, students can understand the types of buildings and parts of a city and follow instructions about them in oral texts. They can talk to other people about the locations of different places on a city map. They can also express their apologies.



Students study and learn how to express the locations of things and ask for and give information about transportation as the language functions in unit 8. Regarding these functions, they are expected to comprehend the types of vehicles and instructions about transportation in oral texts. They are also expected to talk to other people about the locations and use of vehicles.

Peace with Nature

Table 6 below presents the units related to peace with nature and what relates them to it in the 3rd grade.

Table 6. Units related to peace with nature and what relates them to peace with nature

Units	What relates units to social peace	Theme	Language function
9	Theme and language function	Weather	Describing the weather
10	Theme and language function	Nature	Expressing likes and dislikes Making inquiries Talking about animals and nature

The themes and language functions of units 9 and 10 link to peace with nature as shown in Table 6. In unit 9, “weather” is the theme and students study how to describe the weather as the language function. Students can recognize weather conditions in oral texts and describe weather conditions at the end of the unit.

In unit 10, the theme is based on “nature,” through which students learn how to express their likes and dislikes, make inquiries, and talk about animals and nature as language functions. Students are expected to identify nature and animals and follow the instructions about nature and animals in oral texts. They are also expected to talk about nature, animals, and the animals they like and dislike.

4th Grade

Inner Peace

The units related to inner peace and what relates them to it in the 4th grade are indicated in Table 7 below.

Table 7. Units related to inner peace and what relates them to inner peace

Units	What relates units to social peace	Theme	Language function
3	Language function		Expressing abilities and inabilities Talking about possessions
4	Language function		Expressing likes and dislikes
8	Language function		Expressing different weather conditions and basic needs Making requests
10	Language function		Talking about basic needs and feelings

Table 7 shows that the language functions in units 3, 4, 8, and 10 can help students learn inner peace. Students learn how to express their abilities and inabilities and to talk about their possessions as language functions in unit 3. At the end of the unit, they are expected to talk about their abilities, inabilities, and possessions.

In unit 4, students study how to express their likes and dislikes as a language function. With this function, they can talk about their likes and dislikes at the end of the unit.

Unit 8 teaches students how to describe different weather conditions and their basic needs and make requests as language functions. They are supposed to make requests and talk about their basic needs in terms of clothing in different weather conditions by asking and answering questions at the end of the unit.



Unit 10 aims to train students to talk about their basic needs and feelings as a language function. Accordingly, students can listen to and recognize offers about their basic needs and other people's feelings and needs. They can also express their needs and feelings.

Social Peace

The units related to social peace and what relates them to it in the 4th grade are given in Table 8 below.

Table 8. Units related to social peace and what relates them to social peace

Units	What relates units to social peace	Theme	Language function
1	Theme and language function	Classroom rules	Making request Asking for permission Telling other people what to do
2	Theme and language function	Nationality	Identifying countries and nationalities Talking about the locations of cities
3	Language function		Expressing their own and other people's abilities and inabilities Talking about their own and other people's possessions
4	Language function		Expressing likes and dislikes Making inquiries
7	Language function		Asking for clarification Describing people's jobs, Explaining likes Making inquiries
9	Theme and language function	My friends	Describing people Talking about possessions

According to Table 8, units 1, 2, and 9 can help students learn social peace in terms of their themes and language functions. The theme of unit 1 is "classroom rules," in which students learn how to make requests, ask for permission, and tell other people what to do as language functions. Students can comprehend utterances about requests and permission and notice classroom rules in oral texts. They can ask for and give permission and make requests. They can also give and respond to instructions.

"Nationality" is the theme of unit 2, through which identifying countries and nationalities and talking about the locations of cities are covered as language functions. Students can listen to and identify information about other people and their nationalities. They can also talk to other people about nations, nationalities, and the locations of cities.

In unit 9, the theme is "my friends," and its language functions are describing people and talking about possessions. Students are expected to comprehend oral texts about possessions and the descriptions and features of people. They are also expected to describe other people and talk about their possessions and physical appearances by asking and answering questions.

The language functions of units 3, 4, and 7 connect with social peace. Students learn to express other people's abilities and inabilities and to talk about their abilities, inabilities, and possessions as language functions in unit 3. They can also understand the main idea of an oral text about abilities and notice possessions in an oral text.

Unit 4 aims to train students on how to express their likes and dislikes, make inquiries, and ask for clarification as its language functions. Accordingly, students can comprehend an oral text about likes and dislikes. They can participate in a conversation about likes and dislikes and ask other people for clarification.

Unit 7 aims to teach how to describe people's jobs, to explain what they like, and to make inquiries as language functions. Concerning these functions, students can recognize other people's jobs and likes in oral texts and talk to other people about these issues.



Peace with Nature

Table 9 indicates units related to peace with nature and what relates them to it in the 4th grade.

Table 9. Units related to peace with nature and what relates them to peace with nature

Units	What relates units to social peace	Theme	Language function
8	Language function		Expressing different weather conditions and basic needs Making requests Naming seasons
10	Theme and language function	Food and drinks	Making offers Talking about basic needs and feelings

As understood from Table 9, students can learn peace with nature in unit 8 because of its language functions. Students learn how to discuss different weather conditions and their basic needs, make requests, and name seasons. Utilizing these language functions, students can comprehend oral texts about different weather conditions and clothing and notice seasons and clothes in oral texts. They can describe weather conditions and make requests. They can also name the seasons and participate in conversations about weather conditions and clothing by asking and answering questions.

Unit 10 is the other unit related to peace with nature owing to its themes and language functions. “Food and drinks” are its themes, and students learn how to make offers and talk about their basic needs and feelings as language functions in this unit. Accordingly, students can understand vocabulary about food and drinks, offers about their basic needs, and other people’s feelings and needs in oral texts. They can also talk about their and other people’s needs and feelings.

DISCUSSION and CONCLUSION

Peace education is integrated into the new ELTP in Turkey in the 2nd, 3rd, and 4th grades through the themes and/or language functions of the units. The themes of the units are directly connected with peace education in terms of inner peace, social peace, and peace with nature. Inner peace is an aspect of peace education that helps a person to have peace in his/her heart, mind, and body (Agnihotri, 2017; Renner, 1991). For example, “feelings” is the theme of unit 4 in the 3rd grade, and this contributes to the establishment of inner peace because if a person can express his/her feelings, he/she can express himself/herself better. This can contribute to his/her inner peace. Another aspect of peace education is social peace, which helps students consider other people in their actions and relations by promoting human rights, justice, and the well-being of other people (Agnihotri, 2017; Renner, 1991). Social peace also deals with “friendship,” which is the theme of unit 2 in the 2nd grade, and it requires considering other people. The last aspect of peace education is peace with nature, which contributes to the conscious protection and sustainment of the environment (Agnihotri, 2017; Renner, 1991). Thus, everything related to nature and the environment is a part of peace with nature. For instance, in the 3rd grade, unit 10 is related to peace with nature as its theme is “nature.” In sum, choosing themes related to the three aspects of peace education can create a connection between peace education and ELT to be used for their integration.

In addition to themes, language functions link the new ELTP to peace education. Language functions are closely aligned with themes in several units related to peace education. Thus, language functions can help students learn inner peace, social peace, and peace with nature. To clarify, unit 7 in the 2nd grade contributes to peace education through its theme and language functions. Its theme is “body parts,” through which it aims to teach students how to talk about and make inquiries about possessions (i.e., their body parts), and so unit 7 can assist students in learning inner peace as Agnihotri (2017) and Renner (1991) stated. Language functions can also connect units with peace education on their own though the themes of units are not based on any aspect of peace education. For instance, unit 7 in the 3rd grade relates the new ELTP to social peace because apologizing is one of its language functions



and that can be considered as an important aspect of social relations that help to promote social peace among people.

The present study has indicated that the new ELTP for primary schools can help students learn peace education while they learn English by means of the themes and/or language functions of the units in the 2nd, 3rd, and 4th grades as discussed in the relevant literature (Abid, 2016; Kruger, 2012; Natarajan, 2018; Sun, 2017; Şahin, 2011; Takkaç Tulgar, 2017; Yusuf, 2011). These studies have also described how ELT teachers can integrate peace education into their English classes (Abid, 2016; Kruger, 2012; Natarajan, 2018; Şahin, 2011; Takkaç Tulgar, 2017). In terms of this aspect, this study has shown that the new ELTP for primary schools can also help ELT teachers study peace education with their students in primary schools. Sun (2017) and Yusuf (2011) focused on reading as a way to integrate peace education into ELT. In addition to reading, this study has demonstrated that listening and speaking can also be used for the same purpose because students in the 2nd, 3rd, and 4th grades mainly study and practice listening and speaking skills in the new ELTP. Additionally, the listening and speaking outcomes of the units are closely aligned with the themes and/or language functions of the units. Therefore, when students study and practice listening and speaking, they can learn both English and peace education, like the students who learned English grammar through peace education in Arikan's (2009) study. Research has also indicated that students can learn peace education in English language classes in middle and high schools and at universities (Arikan, 2009; Carmel & Yochanna, 2018; Chowdbury, 2013; Gebregeorgis, 2017; Gutiérrez et al., 2020). Similarly, the present study has shown that students can learn peace education in English language classes in primary schools. This study has also indicated that peace values such as friendship are embedded in the new ELTP for primary schools similarly to peace values integrated into an English language teaching coursebook (Gebregeorgis, 2017). Moreover, the results of this study are consistent with the study of Fountain (1999), who stated that peace education can be integrated into language teaching.

Conclusion

This study has revealed that peace education is integrated into the new ELTP for primary schools in Turkey through the themes and/or language functions of several units in the 2nd, 3rd, and 4th grades. According to the results of the study, themes are chosen from among topics connected with peace education, and language functions are determined according to the themes in some units in the 2nd, 3rd, and 4th grades. In other units related to peace education, though the themes of these units are not linked to peace education, the language functions studied in these units are connected with peace education. The results of this study have also demonstrated that the new ELTP for primary schools in Turkey has several units in which themes and/or language functions relate to inner peace, social peace, and peace with nature in the 2nd, 3rd, and 4th grades so that primary school students can learn and practice these aspects of peace education while learning English.

Suggestions for Further Studies

Similar studies following the same methodology can be conducted with different national English language teaching curricula, the curricula or syllabi of English language courses, English language teaching coursebooks, and English language teaching materials in terms of peace education. The results of such studies can assist English language teachers, course designers, curriculum developers, and coursebook writers to discover the strengths and weaknesses of their curricula, syllabi, coursebooks, and teaching materials and improve them.

Limitations of the Study

The present study has four limitations. First, its research focus (i.e., the new ELTP for primary schools in Turkey) creates a limitation. The second limitation is its research design (i.e., qualitative research). Thirdly, not including English language teachers in the present study is another limitation. However, the present study did not intend to investigate the perceptions of English language teachers about the new ELTP in terms of peace education or how English language teachers teach the units in the new ELTP related to peace education in their classes. Not having studied how the units related to peace education in the coursebooks that were prepared according to the new ELTP is the last limitation.



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A PHENOMENOLOGICAL INVESTIGATION OF THE EFFECTIVENESS OF THE ELEMENTARY TEACHER EDUCATION PROGRAM IN TURKEY

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Abstract

This study aims to investigate the effectiveness of the pre-service elementary teacher education program in Turkey. The study aims to explore how well, as perceived by graduates who have begun working as beginning elementary teachers, the program develops the essential qualities for elementary teachers in the 21st century. Employing criterion and maximum variation sampling strategies, 22 in-service elementary teachers participated in the study. Using phenomenological research design, the data were collected through semi-structured in-depth individual interviews, and this process was supported by a document analysis of the elementary teacher education curriculum. The data were analyzed through content analysis method with the help of NVivo 10 software. Regarding the effectiveness of the program, the participants indicated that the program was relatively 'less adequate', 'somewhat adequate', or 'more adequate' for developing the different domains of certain qualities (e.g., students with special needs, differentiation, and professional development, respectively). The results of the study provide policymakers, curriculum developers, and teacher educators with essential insights into how to improve elementary teacher education to better prepare elementary teachers in the search of raising the quality of teachers and improving teacher education.

Keywords: Elementary teachers, elementary teacher education program, pre-service teacher education, beginning teachers, phenomenology.

INTRODUCTION

Improving the quality of education for the benefit of student outcomes is an issue that has received worldwide attention as countries seek to foster social development and raise skilled individuals for their economic growth through education (Peng et al., 2014). Although policymakers have been enacting several reforms to improve schools and raise the quality of education, a common area of consensus among policymakers, practitioners, and researchers is that the quality of an education system largely depends on the quality of its teachers (Akiba & LeTendre 2018; Darling-Hammond, 2021; Goodwin & Low, 2021; Gopinathan, Tan, Yanping, Devi, Ramos, & Chao, 2008; Harris & Sass, 2011; Organisation for Economic Co-Operation [OECD], 2005; Rivkin, Hanushek, & Kain, 2005). This focus on teacher quality has been fueled by research linking teacher quality to student achievement (Azam & Kingdon, 2015; Darling-Hammond, 2015; European Commission, 2018; Goodwin & Low, 2021), and especially with the increasing interest in international benchmarking assessments over the past two decades, teacher quality has been considered as one of the most important determinants of student achievement and has emerged as a global topic of concern in teacher education (Barnes & Cross, 2020; Goldhaber & Anthony, 2003; OECD, 2018). For example, Sanders and Rivers (1996), demonstrate that the cumulative impact of effective elementary teachers on students' measured achievement over three years is estimated to yield more than a 50-point difference



in math and a 35-point difference in reading. Similarly, Chetty, Friedman, & Rockoff (2014) link the outcomes of 2.5 million children in the US, in grades 3 to 8, to measures of teacher quality and find that teacher quality strongly predicts students' both academic and social outcomes. It is therefore highly likely that the quality of teaching has a strong impact on student performance as the students who have high-quality teachers are more likely to achieve academic success than those who do not (Adnot, Dee, Katz, & Wyckoff, 2017; Chetty et al., 2014; Darling-Hammond, 2000b). In fact, many educational reports stress that it has become increasingly clear that "the quality of an education system cannot exceed the quality of its teachers and principals, since student learning is ultimately the product of what goes on in classrooms" (OECD, 2010, p. 4).

As the quality of the teacher workforce has been a subject of perennial concern in many countries (Akiba & LeTendre 2018; Goodwin & Low, 2021; Smith, 2008), it has become evident that the quality of *teacher education* is one of the most critical factors influencing the growth and success of students (Darling-Hammond & Bransford, 2007; Darling-Hammond & Lieberman, 2012; Goodwin, 2008; Hammerness & Klette, 2015; Russell & Martin, 2016). Accordingly, a study by Darling-Hammond (2000b) showed that teacher preparation was even the most influential factor in student achievement in reading and mathematics, both before and after controlling for students' demographics. It can therefore be argued that the need for high quality teachers cannot be addressed without first ensuring high quality teacher education (Chong & Ho, 2009).

While many nations have adopted a high-priority reform agenda for their education systems that calls for improving teacher quality, dissatisfaction with teacher education has been increasing (Darling-Hammond, 2000a; Ell et al., 2017; Goodwin, 2017; Korthagen, 2001; Loughran & Hamilton, 2016; Russell & Martin, 2016). The major criticisms of teacher education are that it is often ineffective in preparing teachers for the profession, unresponsive to new challenges, expectations, and the realities of the classroom, remote from practice, and facing barriers to recruit successful students into teaching (Darling-Hammond, 2000a; Korthagen, 2001), which have mostly been associated with the issues around the organization and structure of teacher education as well as the knowledge and practice of teacher education (Loughran & Hamilton, 2016). Specifically, Kosnik, Beck, and Goodwin (2016) highlight that some of the most common shortcomings of teacher education programmes are related to issues of "excessively theoretical and abstract courses; insufficient attention to subject knowledge; lack of connection between the campus programme and practice teaching schools; and minimal preparation of pre-service faculty for their role" (p. 268). Within this context, the issue of teacher quality is particularly regarded as a concern about preparation (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009; Ell et al., 2017, 2019; Liston, Borko, & Whitcomb, 2008; Loewenberg-Ball & Forzani, 2009; Rowan, Mayer, Kline, Kostogriz, & Walker-Gibbs, 2015; Sleeter, 2014), arguing that initial teacher education fails to provide teacher candidates with the knowledge, skills, and attitudes that are essential for the profession (Akin, 2017; Darling-Hammond & Baratz-Snowden, 2005; Hodgman, 2012; Kagan, 1992; Rowe & Skourdoumbis, 2019; Russell & Martin, 2016). As a result, there have been increasing complaints from graduates of teacher education programs, parents, school administrators, and other key stakeholders about the perceived mismatch between teacher education and the realities in schools (Korthagen, Loughran, & Russell, 2006), which has led to pressures to reconsider both the structure and practices of teacher education programs. Underlying this is that teacher education programs have a major impact on teacher quality, influence the development of the professional competences of new teachers, and make a difference in pre-service teachers' preparation (Berry, Hoke, & Hirsch, 2004; Boyd et al., 2009; Brouwer & Korthagen, 2005; Cooper & Alvarado, 2006; Darling-Hammond, Chung, & Frelow, 2002; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005; Kozina, 2013). Teacher education programs also have a significant role in enabling teachers to obtain the competences essential to undertake this complex job and work successfully within the profession (Darling-Hammond et al., 2002). As several studies have found evidence (e.g., Darling-Hammond, 2000a; Goldhaber & Brewer, 2000), teachers who have received high-quality preparation for teaching are generally more successful with students than those who had been prepared less adequately. Thus, students of better prepared teachers achieve more gains in learning.



Although no teacher preparation can fully prepare teacher candidates for the challenges that they might encounter within the teaching profession due to the complex nature of teaching, there is evidently a need for a systematic body of knowledge relating to teacher education programs if they are to be responsive to the expectations, needs, and practices of teachers who usually face reality shock and are overwhelmed by the number of challenges they encounter, especially during their early years in the profession (Choy, Chong, Wong, & Wong, 2011; Korthagen et al., 2006; Liston, Whitcomb, & Borko, 2006). The reality shock faced by beginning teachers is a major factor in the high rates of teacher turn over and attrition (Darling-Hammond et al., 2005; Darling-Hammond & Sykes, 2003; Goldhaber & Cowan, 2014; Ingersoll, 2001, 2003; Ingersoll, Merrill, & May, 2014; Zhang & Zeller, 2016) which, in turn, raises severe concerns about the effectiveness of initial teacher education in empowering teachers to face the new expectations of the profession and effectively meet the educational needs of students, while responding to the challenges that result from educational reforms (Choy et al., 2011). Building on these, what teacher educators and teacher education can and should do more to better prepare pre-service teachers for their initial years within the profession begins with the critical evaluation of teacher education programs.

Pre-service Teacher Education in Turkey

As is the case in many other parts of the world, teacher education in Turkey has been a cardinal and longstanding issue with respect to the search for establishing an effective system to better prepare teachers. This has been especially true since the beginning of the 20th century, in which numerous efforts have been made to improve and restructure the teacher education system (Çakıroğlu & Çakıroğlu, 2003). While the stated intention behind all those efforts was to improve the quality of teachers, it has been criticized that, in fact, there has been a focus on addressing the issue of “teacher quantity” rather than “teacher quality” (Bilir, 2011; Okçabol, 2004; Üstüner, 2004; Yıldırım, 2011), and so concerns about the issue of underqualified teachers have been exacerbated. Furthermore, the lack of a consistent teacher education framework and empirical research evaluating the effectiveness of the actions initiated has only exasperated the problem along with the frequent introduction of new policies that compete with each other (Yıldırım, 2011). Among others, the most influential areas of conflict and controversy concerning the teacher education reforms in Turkey have been the issues of subject area vs. pedagogy, theory vs. practice, unification vs. diversity, testing vs. professionalization (Yıldırım, 2011), and academic approach vs. professional approach (Yüksel, 2008). The search for improving teacher education has especially been an issue in Turkey since 1982 when the establishment of the Council of Higher Education (CHE) meant that the responsibility for teacher education was transferred from the Ministry of National Education (MoNE) to universities (Azar, 2011; Bilir, 2011; Yıldırım, 2011). Since then, teacher education programs have constantly undergone top-down structural and curricular changes, including the particular elementary teacher education program that was examined in the present study, which was redesigned and initiated by the CHE in 2006 with the purpose of improving the previous program in the light of the contemporary educational approaches and the new competences expected from elementary teachers of the 21st century (CHE, 2006). Consequently, although pre-service teacher education is deemed as being the critical first step in a teacher’s professional journey, relatively little is known about the adequacy of initial teacher education programs and their link to beginning teachers’ practices in schools. Therefore, there is much need for up-to-date, and particularly, in-depth qualitative studies, especially focusing on the first years of beginning teachers to examine how satisfied the beginning teachers are with their pre-service teacher education and to identify the areas they feel could be improved.

As a result of the increasing concerns over the pervasive and perplexing issues in teacher education systems, efforts to examine the effectiveness of teacher education programs have intensified worldwide to investigate the strengths and weaknesses of the programs to improve, redesign, and reconstruct them (Akin, 2017). However, considering the landscape of teacher education research in Turkey, it has been strongly argued that more research is needed on the effectiveness of the teacher education programs as the number of studies of this line has been scarce. Additionally, since most of the existing studies have primarily been concerned with examining the perspectives of pre-service



teachers or teacher educators, it has been suggested that there is a need for more studies to be conducted with graduates who are able to provide more accurate information as a result of their first-hand experiences through the program (Yıldırım, 2013). Specifically, considering the pre-service elementary teacher education program that was originally developed in an attempt to address and improve the shortcomings of the elementary teacher education program of 1997 and was restructured by the CHE in 2006, the results of many research studies illuminate that there are still certain aspects of the program that need to be reconsidered towards the goal of preparing highly qualified elementary teachers. For example, in evaluating the elementary teacher education program of 2006 based on the views of senior pre-service elementary teachers, Fırat-Durdukoca and Ege (2016) report that the majority of pre-service teachers did not find the subject-area courses effective in preparing them for their teaching career, and thus feel there is a need to redesign the content of those courses. Similarly, pedagogical courses are not considered to be very effective due to a lack of practice-based and student-centered learning opportunities. In a study conducted with senior pre-service teachers by Şahin and Kartal (2013), most participants felt that some of the courses in their program did not help equip them with the knowledge and skills that were essential in their future teaching career. The participants instead thought that pedagogical courses that blended theoretical discussions with adequate practice-based opportunities were the most effective courses in their program. This conclusion is supported by the results of a study carried out by Süral (2015), which explores the opinions of teacher candidates and shows that school experience and practical teaching courses were considered to be the most necessary and effective in becoming an effective elementary teacher.

There are also other research studies (Akdoğan & Uşun, 2017; Aksakal, Çiftçi, Olaç, & Kalaycı, 2016; Atik-Kara & Sağlam, 2014; Ayan, 2011; Bağcı, 2014; Baştürk, 2015; Bayındır, 2011; Çakmak & Civelek, 2013; Çaycı, 2011; Çelik, 2020; Kara, Demir, Arcagök, & Şahin, 2018; Kösterelioğlu et al., 2014; Kumral, 2010; Kumral & Saracaloğlu, 2011; Özdemir, Ceylan, & Canoğlu, 2015; Taş, Kunduroğlu-Akar, Kiroğlu, 2017; Topal, Aksu, & Karadeniz, 2011; Yılmaz & Kural, 2018) that aim to evaluate the effectiveness of the particular pre-service elementary teacher education program. The results of the aforementioned studies (e.g., Çaycı, 2011) report that the pedagogical content related courses contribute to the development of the teacher candidates more significantly than the other courses that were offered in the program in previous years. On the other hand, the study designed by Kumral (2010) yielded empirical evidence about the ineffectiveness of the pedagogical courses, which was specifically attributed to teacher educator- and teacher candidate-related factors, as well as content-related factors that negatively influenced the effectiveness of those courses. Moreover, in highlighting the factors that impacted the effectiveness of the given program, Baştürk (2015) and Topal et al. (2011) also pointed out that some courses in the program were found by pre-service elementary teachers to be unhelpful, mainly due to a lack of practice-based activities. Furthermore, Kumral and Saracaloğlu (2011) pointed to the factors related to teacher candidates (e.g., their expectations and study habits), faculty members (e.g., their attitudes towards the courses and the students, traditional teaching methods, heavy work load, lack of feedback, not being a good role model, and a lack of faculty-school collaboration), and the courses (e.g., inadequate content of the courses, inadequate course hours, the imbalance between theory vs. practice, a lack of adequate field practices, and the sequence of the courses throughout the program), which all had an impact on the effectiveness of the pedagogical courses offered in the elementary teacher education program. In another study, Bayındır (2011) reported that while the courses in the program were not found, according to the opinions of the pre-service elementary teachers, to be very effective, the teaching-learning process and content of the courses, faculty members, and the available resources were the most influential factors on the effective implementation of the particular program. Lastly, there are also research studies that aim to evaluate the given program in terms of how well it responds, particularly, to the teacher candidates' development of subject-area specific competences (e.g., Çakmak & Civelek, 2013; Kösterelioğlu et al., 2014) or the generic (core) competences (e.g., Atik-Kara & Sağlam, 2014; Ayan, 2011) that were determined by the Ministry of National Education (MoNE) more than a decade ago. In light of these studies, the results present an important need for the



program to be improved and strengthened. However, given that the number of existing studies is limited, it is evident that more research needs to be conducted to further evaluate the effectiveness of the program and draw more accurate conclusions. In addition, as most studies were conducted through surveys in the quantitative research tradition, it is clear that existing research does not sufficiently employ an in-depth qualitative research methodology, especially based on the perspectives of the graduates of the program. This is considered essential, as graduates are able to provide crucial and highly accurate data about their pre-service teacher education as a result of the actual school experiences that they gain once they have completed all of the courses and field practices and finished their teacher education program.

Drawing on these, the purpose of this study is to explore the effectiveness of the elementary teacher education program in Turkey based on the perspectives of the graduates who have entered the teaching profession and begun work as elementary teachers. In so doing, the present study allows beginning elementary teachers, who are the former graduates of the particular elementary teacher education program, to speak in their own voices about how well the program prepared them for their important roles as the educators of future generations (Zeichner & Conklin, 2008, 2009). The current study is part of larger research that initially identified the domains of qualities that were considered essential for the elementary teachers of the 21st century, based on the perspectives of teacher educators, pre-service and in-service elementary teachers, and the authorities of the MoNE and the CHE in Turkey (Akin & Ok, 2021). Accordingly, considering the fact that the 21st century has been characterized with rapid changes in the field of education, where the teacher and learner roles have changed considerably, there is a need for research to further evaluate the particular elementary teacher education program especially in terms of developing the knowledge, skills, and attitudes that are needed for elementary teachers in the 21st century. The current study therefore builds on the results of the initial study to specifically answer the following research question:

How well does the elementary teacher education program equip elementary teachers with the desired essential qualities, as perceived by the graduates who have started their teaching career?

In addressing this research question, the study provides insight into the challenges confronted by beginning elementary teachers in Turkey, and addresses how well the particular teacher education program prepares these teachers to respond to the challenges they encounter during their first years of teaching. In so doing, the study primarily sheds light upon which areas the participants feel they have been more adequately, somewhat, or less adequately prepared by their teacher education. This provides the key stakeholders, including teacher educators, faculties of education, and the policymakers in the CHE, with critical insights and feedback about how well the particular elementary teacher education program is preparing elementary teachers for the current demands of the 21st century. The study therefore seeks to pinpoint the areas in the particular program that need to be improved to provide more effective practices, offer insight into teacher education, and initiate ideas about how to re-imagine and re-construct teacher education programs and curriculum. As a result, the study attempts to provide recommendations for creating teacher education programs that are effective in supporting teachers in the development of the knowledge, skills, and attitudes that will enable them to succeed in their professional lives. In this regard, the study is especially useful for curriculum developers, faculties of education, and policymakers in the development of a better curriculum for elementary teacher education, so as to prepare teacher candidates more adequately in relation to the areas that they feel inadequately prepared for during their teacher education. Moreover, the study provides insights to teacher educators as they have a primary role in implementing the teacher education programs, supporting the teacher candidates' learning, and preparing future teachers. Furthermore, the significance of the current study is also positioned in its sample as it draws on the perspectives of the graduates of the particular teacher education program. The study therefore addresses the need to evaluate the teacher education programs based on the perspectives of the graduates, which extends beyond the existing research conducted with pre-service teachers or teacher educators. Finally, the current study also contributes to the landscape of teacher education research in



Turkey as it employs the methods and the principles of the qualitative research paradigm given that the majority of teacher education research in Turkey have been designed in the quantitative research tradition as discussed earlier.

METHODS

Design

This study employed phenomenological research as the purpose of phenomenological studies is to explore the lived experiences of several individuals regarding the phenomenon of interest based on their own perspectives (Marshall & Rossman, 2011; Merriam, 2014) in order to identify essential and common shared experiences (Creswell, 2013). Accordingly, phenomenological research was used in this study to explore the effectiveness of the elementary teacher education program in Turkey, based on the perspectives of graduates who had started their teaching career as in-service elementary teachers.

Participants

The participants included 22 in-service elementary teachers who were selected through criterion and maximum variation sampling strategies (Patton, 1990). First, using criterion sampling, it was ensured that the participants had graduated from the public universities in the capital city of Turkey, which had at least 10 years of experience in the implementation of the elementary teacher education program. Second, employing maximum variation sampling, the participants were selected from the graduates of all identified universities as variations in the implementation of the program across different higher education institutions might have accounted for differences in participants' perspectives regarding the effectiveness of the program. Moreover, based on criterion sampling, the study included only elementary teachers who had gone through this particular program and had graduated after 2010, which is when the first cohort of pre-service teachers in this program had graduated. Thus, the participants of the study had completed their teacher education program in 2014 and had been working as novice in-service elementary teachers. Finally, since the participating elementary teachers were also the participants of a previous research that set the stage for the current study, they had been previously recommended as promising teachers by their teacher educators when they were in the last year of the particular pre-service teacher education program during the conduct of the initial study. Based on this sampling procedure, the demographical characteristics of the participating 22 in-service elementary teachers are presented in Table 1.

Table 1. The profile of participating in-service teachers

Characteristics	<i>n</i>	%
Gender		
Female	17	77.27
Male	5	22.73
University		
U1	6	27.27
U2	7	31.82
U3	9	40.91
Program type		
Daytime education	18	81.82
Evening education	4	18.18
Level of education		
Bachelor's degree	16	72.73
Master's	6	27.27
Teaching experience		
3 months	6	27.27
1 year	2	9.09
2 years	14	63.64



Table 1. The profile of participating in-service teachers (*continued*)

School type		
Public	13	59.09
Private	7	31.82
Experienced in both	2	9.09
Experience in rural schools		
Yes	13	59.09
No	9	40.91
Experience as a school principal		
Yes	3	13.64
No	19	86.36
Experience in multigrade classes		
Yes	6	27.27
No	16	72.73
Grade level		
1 st grade	7	31.82
2 nd grade	6	27.27
3 rd grade	3	13.64
4 th grade	3	13.64
Multigrade	3	13.64
1 st +2 nd +3 rd +4 th graders together	1	4.55
3 rd +4 th graders together	2	9.09
Total	22	100

It can be seen from Table 1 that of the 22 in-service elementary teachers, 17 (77.27%) were female and 5 (22.73%) were male. While 6 (27.27%) participants were from University-1 (U1), 7 (31.82%) participants were from University-2 (U2) and 9 (40.91%) participants were from University-3 (U3). 18 (81.82%) of the participants were a graduate of a daytime education program and 4 (18.18%) of them had graduated from an evening program. The teaching experience of the participants ranged from 3 months to 2 years, and was either in public ($n=13$, 59.09%) or in private schools ($n=7$, 31.82%), or in both ($n=2$, 9.09%). In addition, 13 (59.09%) teachers had worked in rural schools and 9 (40.91%) teachers had not. 3 (13.64%) teachers had also worked as a school principal, whereas the majority of the participants ($n=19$, 86.36%) had not. Finally, while some participants ($n=6$, 27.27%) had experience of teaching in a multigrade class, most ($n=16$, 72.73%) did not.

Data Collection Instruments

Once approval by the human subjects ethics committee had been ensured, the data were collected through semi-structured and in-depth individual interviews as phenomenological studies are mainly conducted through in-depth interviews with participants (Marshall & Rossman, 2011) to gain a detailed understanding of how the phenomenon of interest has been experienced by the participants (Creswell, 2013) from their own perspectives and in their own words (Bogdan & Biklen, 2007). To this end, the researchers developed a semi-structured interview schedule that included demographical (e.g., gender, university, program type, teaching experience, school type, grade level) and open-ended questions (e.g., How well do you think that your initial teacher preparation equipped you with the knowledge, skills, and attitudes that are essential for responding to individual differences of students?, How well did the program provide you with the knowledge, skills, and attitudes that are essential for developing curriculum literacy?). The interview schedule was developed based on a review of the literature, purpose of the research, and the findings of the previous study that had been conducted to identify the domains of qualities that are considered essential for the elementary teachers of the 21st century, prior to the conduct of the present study.

After the interview schedule was developed, it was revised based on the opinions of five experts and piloted. In this respect, two experts were from the elementary teacher education program, two were from the department of educational sciences, and one expert was from the elementary science education program. The interview schedule was e-mailed to all the five experts to obtain their feedback on the questions. After the feedback had been used to make necessary revisions, the instrument was piloted with three in-service elementary teachers to check the appropriateness and the



flow of the questions, as well as the length of the interview. Through the pilot study, it was ensured that the interview questions were effective in eliciting rich and relevant responses for the research questions.

Once the informed consent of the participants had been obtained, each individual interview took approximately 60 to 90 minutes and was audio-recorded with the participants' permission. The interviews were conducted with the in-service teachers via virtual (Skype) meetings (Marshall & Rossman, 2011) in December 2015. This was necessary since the participants were working in different parts of Turkey at the time of the data collection. As the participants of the current study were also included in the study that was carried out prior to the present study, meetings were first arranged via the phone numbers that were already available to the researchers. Before the interviews, the corresponding author prepared a document describing the selected domains of the essential qualities that were going to be elaborated upon during the interviews. The researcher e-mailed this document to each interviewee before the scheduled interview to ensure better awareness about what those domains might refer to specifically. The aim was that the interviewees would thereby be able to evaluate the effectiveness of their teacher education more adequately, and they would all interpret the selected domains of qualities as we intended.

In addition to the interviews, the data collection was further supplemented with the document analysis of the elementary teacher education curriculum (Creswell, 2013; Marshall & Rossman, 2011), which is particularly useful for the triangulation of data and the supplementation of other perspectives to the interviews (Marshall & Rossman, 2011; Yıldırım & Şimşek, 2018).

Data Analysis

The content analysis method was used (Bogdan & Biklen, 2007) for analyzing both the interviews and the elementary teacher education curriculum. During this process, the data were, first, aggregated into small codes (Creswell, 2013), and larger categories were then derived based on the identified patterns, recurrences, and regularities among the emerging codes (Bogdan & Biklen, 2007). This involved one of the researchers initially reading the transcripts word by word and attaching codes to certain words, phrases, or paragraphs (Miles & Huberman, 1994), which meant that the text was broken down into smaller groups or codes that were then assigned labels (Creswell, 2013). The next step was that the researcher developed broader categories depending on how related the emerging codes were to the referring category (Bogdan & Biklen, 2007). This often meant that the same unit of data received multiple codes. Both the codes and the categories were developed based on the concepts in the literature by using preexisting or a priori codes (Creswell, 2013) that had already been developed in the first part of the previous study. Similarly, the codes were also developed on the basis of the new concepts that emerged from the data as a result of inductive (Patton, 1990) or open coding (Maxwell, 2013). This contributed to the depth and openness of the study by not presupposing general constructs for the analysis of data (Patton, 1990).

After a few transcripts had been coded by one of the researchers, the same set of transcripts were then emailed to three experts experienced in qualitative research and/or elementary teacher education. As part of establishing intercoder reliability, the experts were asked to code the data so that the researchers were able to check the consistency of the codes and the categories that were derived by the researchers and the experts (Marshall & Rossman, 2011; Miles & Huberman, 1994; Patton 1990). After ensuring consistency, all transcripts were coded by the corresponding author and the data were analyzed with the help of NVivo 10 qualitative data analysis software. The anonymity of the participants was ensured by means of labels and numbers (e.g., T4; Teacher 4). Finally, sample quotations were selected and translated into English to present the findings in the participants' own words. Throughout this process, the translations were checked by an expert to ensure accuracy.

Trustworthiness

Several strategies were employed to ensure the credibility, transferability, dependability, and confirmability of the present study (Lincoln & Guba, 1985; Marshall & Rossman, 2011). First, the



credibility of the study was assured through obtaining expert opinions on the interview schedule, conducting a pilot study, carrying out in-depth data collection, a prolonged engagement with the data over a long period of time, establishing intercoder reliability, triangulation of data collection instruments, and referential adequacy (Marshall & Rossman, 2011; Maxwell, 2013; Miles & Huberman, 1994; Patton 1990). Second, transferability was provided using purposive sampling strategies and presenting a thick description of the overall research process, including information on the procedures related to the selection and background of the participants, data collection, and data analysis. Finally, to enhance dependability and confirmability, an audit trail was utilized to obtain feedback on all the processes and decisions, as well as to ensure the objectivity of the results (Lincoln & Guba, 1985; Marshall & Rossman, 2011). This involved five external researchers, who are experienced in qualitative research, monitoring and evaluating the overall study for all the processes carried out and the decisions made.

RESULTS

Drawing on the domains of qualities that were initially found to be essential for elementary teachers of the 21st century (Akin & Ok, 2021), the results of the interviews are presented below with sample quotations from the participants. The results are also complemented based on the analysis of the particular elementary teacher education curriculum.

Autonomy and Collaboration

The participants reflected on how well their elementary teacher education program prepared them for autonomous work and collaborative work with other individuals. Accordingly, they highlighted that the program was only somewhat effective in terms of providing them with the opportunities to collaborate with in-service elementary teachers, and/or their mentors, during their initial teacher preparation. In addition, most participants said that the program did not offer sufficient opportunities to them to collaborate with parents. In connection with the above aspects, participants primarily drew attention to the pivotal role that practice-based courses, such as Community Service, School Experience, Practice Teaching I-II courses, play in the curriculum. To illustrate, the following teachers reflected that:

...Either in School Experience course or Practice Teaching I and II courses, we did not have any chance to meet with the parents. In addition to being offered in a limited period, such courses enabled us to interact only with the mentor elementary teachers and the school administrators. Regarding the parents, we rather had discussions during the classes in the university... (T11).

...Especially in Practice Teaching I and II, we had to have good relationships with our mentor elementary teachers because we were not only being graded by the faculty members. I mean, the mentor teachers also had an impact on our grades for the practicum courses as our teacher educators asked them to evaluate us. Thus, we were paying attention to do whatever they wanted us to do, rather than fostering partnership or collaboration (T6).

Moreover, none of the participants felt that the program effectively encouraged them to work collaboratively with other professionals, such as early childhood education teachers. Similarly, most of the beginning teachers evaluated the program as being ineffective in enabling them to collaborate with school counselors, special education teachers, and child development experts. With mention of the lack of well-structured field experiences, one teacher particularly made the following criticism:

We never had a chance to collaborate with a special education teacher or a school counselor while the field experience courses could have been considered as a great opportunity for these purposes. We were rather expected to make observations in the class or in the school. I think, the teacher educators should redesign the objectives and the activities carried out in the field experience courses and make them more effective (T7).

On the other hand, one of the teachers reflected on their past experiences in the class and suggested inviting guest speakers (also field trips) to the faculty as part of extracurricular activities:



...Throughout our teacher education program, our teacher educators invited the former graduates to the faculty and organized meetings with them for three times. I really enjoyed those meetings as it was very exciting and useful for me to learn about the real experiences of other teachers. One of our teacher educators even once invited a former graduate to the class as a guest speaker. Those graduates were good role models for us. Similarly, in the Special Education course, our teacher educator invited a student with Down syndrome, his parents, and a special education teacher to the class, which was an excellent opportunity for us to interact and collaborate with different stakeholders (T21).

Many participants also emphasized that their teacher education program was ineffective in fostering their collaboration with school administrators. In this regard, as the following teacher pointed out, the school administrators' attitudes towards teacher candidates seemed to be an important issue:

...The school principals did not take our requests into consideration very much as they might have typically considered us just as teacher candidates, not real teachers. Besides, in one of the schools that I had my field experience, the school administrators were so careless. It was totally a chaos for us being assigned to the classes in that school (T1).

The program was also found to be quite poor in terms of providing the teacher candidates with opportunities to collaborate with the local authorities in the school area, or in other institutions such as special education centers, early childhood education institutions, counseling and research centers, and nongovernmental organizations. Accordingly, the participants particularly highlighted the critical role of establishing a strong faculty-school-community partnership which stressed the need for a reciprocal relationship between the faculty and other professionals/institutions. For instance, one of the teachers stated:

...I think, first and foremost, the collaboration between the faculty of education and the nongovernmental organizations was not strong, at all. The dean of the faculty and the head of the departments could have been much more active for developing partnerships with the nongovernmental organizations so that we would have had more opportunities to collaborate with them. This collaboration is, by its nature, two-way, you cannot expect only one side to invest more time and effort in a relationship (T19).

Finally, in relation to encouraging teacher candidates to work autonomously, most of the teachers stated that their initial teacher preparation program had been quite effective. This was mostly attributed to the faculty members' (teacher educators') expectations of the courses. As an example, the following teacher explained:

...Throughout our teacher education process, we had so many assignments which included both individual and collaborative work. In most of the courses, we did not have written examinations. In most courses, we were rather expected to make individual and/or group presentations. ...I also remember that one of our teacher educators asked us each week to write an opinion paper about that week's topic before the class. Therefore, we had to review the resources and get prepared for the topic individually. Similarly, most of the time, we were asked to work in pairs or small groups in many courses to develop and present effective lesson plans (T12).

Personal and Professional Development

Concerning their personal development, most participants thought that the program was effective in terms of encouraging them to attend social and cultural activities. In this regard, it was particularly seen that the expectations, suggested activities, and assignments of certain courses, such as Children's Literature, Drama, Teaching Visual Arts, Arts Education, Museum Education, were highly emphasized, as illustrated by the following comment from one of the participants:

In certain courses, we had more opportunities to engage in social and cultural activities. For instance, we had Visual Arts course and it was very effective in this regard. Throughout this course, we went to the museums, theatre, and engaged in a lot of social and cultural activities. For instance, once we travelled to Istanbul and visited Sakıp Sabancı Museum. I also remember that we went to see a photography exhibition at Middle East Technical University (T16).



On the other hand, the participants often mentioned that their initial teacher education was highly theoretical and thus lacked adequate practice. Hence, they stated that this led to the lack of courses in the curriculum that would have supported their personal development. To illustrate, one of the participants stated that:

...Most of the courses in our teacher education program aimed at equipping us with the academic knowledge and skills. However, the program should also offer an adequate number of courses to support our personal development. In this regard, we had only two or three courses. One of those courses was the Physical Education and Sports Culture course. I think, even the aims of this course need to be reconsidered so that it would support our personal development much more (T8).

In addition, many participants did not find the program effective in encouraging them to engage in at least one type of sport or dance that might be necessary for elementary teachers in their professional lives. In this respect, one of the teachers suggested that elective courses (and the active use of bulletin boards for the announcement of such activities) should be provided in the program:

...We did not have any courses aiming to engage us in different sports or hobbies. If someone had such interests, s/he had to find additional courses in the campus or in the city. However, I believe that such courses could have been offered as elective courses throughout our teacher education as they may be very helpful for elementary teachers who mostly start working in rural areas with the lack of such opportunities (T18).

On the other hand, regarding their professional development, most participants felt that the program was highly effective in terms of encouraging them to develop positive attitudes towards ongoing learning and professional development, as well as the development of a strong commitment to the teaching profession and an understanding of professional ethics. Accordingly, the teacher educators were particularly mentioned as being critical role models who have a large impact on future teachers. For example, the following teacher expressed that:

Most of our teacher educators were highly motivated to educate us and work for our professional development. They had a high level of motivation towards their profession. Therefore, they were really good role models for us in terms of being a good teacher. To be honest, before I entered to this program, I always considered being an elementary teacher as an easy or effortless profession. However, our teacher educators always treated us as teachers and made us believe in the importance of our profession. The way that they behaved as a teacher educator helped me to a great extent to develop commitment towards my profession and love my job. Without their support, I could have quitted the program to study in another program (T13).

All participants believed that the program supported them well in terms of building a strong theoretical background regarding elementary education. A significant number of participants also highlighted that the program was quite effective with respect to encouraging teacher candidates to follow professional publications, recent developments, and events in their field. However, the participants reported that they were not sufficiently able to join or organize adequate professional development activities during their education, and struggled with a lack of mentorship from the teacher educators. Similarly, they criticized the pervasive testing that the teacher candidates needed to pass to be appointed as teachers of record by the MoNE. To illustrate, by comparing their teacher educators' practices with other education faculties, one of the participants contended:

In our university, the teacher educators were more concerned about equipping us with the professional knowledge, skills, and attitudes than preparing us for the KPSS (national teacher selection examination). In this regard, the faculty environment and the teacher educators were very professional, I believe. However, observing my colleagues who studied at other universities, I can say that their teacher educators were more concerned with the success of their students on KPSS than their professional development or the course activities to be carried out (T21).

Finally, in relation to the provision of the skills required to develop and carry out educational projects, most participants said that the program did not offer adequate opportunities.



Higher-Order Thinking Skills

A considerable number of participants found the program effective in terms of fostering their creativity. In this respect, they especially referred to the effectiveness of establishing creative learning environments within the courses, and the integration of creativity into the teaching methods. For example, one of the participants said:

As we teach young students, it is highly crucial for us to develop our creativity through our teacher education process. In this regard, our Drama course was so helpful as we had a lot of role-playing scenarios in this course. At the beginning, those scenarios were only based on the everyday situations. Later, we also started to learn how to integrate drama as a teaching method into the courses that we were expected to teach. To this end, we identified different objectives for several disciplines and developed lesson plans based on the selected objectives. I think, those activities helped us considerably to develop our creativity (T9).

Similarly, most participants evaluated their teacher education program as being effective in terms of developing their critical thinking and reflective thinking skills. On this point, it was notable that one of the teachers drew attention to the importance of student clubs in the faculty or university for fostering critical thinking skills:

...Speaking from my own experience, attending student clubs is one of the most important ways of developing creativity or critical thinking skills. For instance, I was a member of the Elementary Education student club. The activities that we did as a large group enabled me to develop a different point of view towards the issues that we discussed. ...The student clubs even share the largest part in my development at the university. I mean, listening the perspectives of others not only broadened my perspective, but it also helped me adopt a more critical approach towards the issues in life (T5).

Finally, some participants believed that the program supported them adequately in the development of problem-solving skills, whereas another group of participants criticized the program as being poor and requiring improvements in this regard.

Effective Communication

Many of the participants stated that their teacher education program was adequate in the development of their oral and written communication skills. In terms of oral communication, almost all of the participants suggested that the program supported them well in learning how to use body language, make eye contact, establish face-to-face communication, use their voice, and use “I” language effectively. However, in terms of written communication skills, most participants added that the program did not equip them with sufficient knowledge of formal written communication, which they felt was especially important as beginning teachers. This included especially the teachers who were also charged with the managerial duties of a school principal, as illustrated by the following participant:

I started my teaching career as an elementary teacher who was also charged with the managerial duties as a school principal. After a while, I was warned that I was stamping the cover letters, which is not appropriate. I was doing so because I was never taught about such issues. The only thing that I could do was to imitate whatever I observed from the documents that the previous school principal had issued. Therefore, to me, an elementary teacher should know how to manage the official documents and thereby, have the knowledge of formal written communication (T10).

The participants further reflected on how well they were prepared to communicate effectively with certain groups of individuals. A significant number of participants emphasized that the program provided them with ample opportunities to communicate effectively with young students. However, most participants criticized that they were not adequately prepared to communicate with students (and their parents) in rural areas, with whom elementary teachers are likely to have a communication barrier, especially considering that those students may not speak Turkish as their mother tongue. Accordingly, it was striking that almost all participants found the program quite ineffective in terms of preparing them to communicate, at least at a basic level, in local languages spoken in different regions



of the country, or in widely spoken foreign languages. To illustrate, the following teachers argued as follows:

I was trained to teach, but... I do not find it appropriate that we did not have any courses, including the elective courses, on communicating in local languages. Evidently, we need to learn a few local languages to, at least, communicate at a basic level with the students, parents, or villagers who might not speak Turkish as their mother tongue in the areas that we are likely to work as elementary teachers. Currently, I am working in the Southeast Anatolia in Turkey, and it is a big challenge for me to communicate with the children as they speak Turkish very little... (T14).

...For instance, the teacher candidates of the Turkish education program are offered courses on teaching Turkish to the non-speakers of Turkish. In a similar way, such an approach must have been adopted in our program (T12).

In addition, while some participants evaluated the program as being effective in preparing them to communicate effectively with students with special needs, others believed that it was not very effective in this respect. Finally, while most participants felt that the program was somewhat effective in encouraging them to establish effective communication with parents and mentor elementary teachers, it was considered generally ineffective in terms of providing them with adequate opportunities to collaborate and communicate effectively with school administrators, school counselors, inspectors, and local authorities.

Differentiation

Most of the participants thought that the program supported them well in terms of differentiating instruction, including the differentiation of teaching methods, course activities, and instructional materials, based on the individual differences of students. However, most teachers underscored that they were inadequately prepared to differentiate instruction based on the characteristics of the students with special needs and the students in multigrade classes. In particular, most participants held that the program did not help them learn how to develop effective and different (individualized) lesson plans, and that there was a lack of opportunities to have field practice in such educational settings, a lack of collaboration between the faculty and schools or relevant institutions, and a need to update the scope of the related courses. With a particular focus on teaching in multigrade classes, the following participants stated:

As the students of different grades are studying in the same classroom in multigrade classes, elementary teachers should be able to develop different lesson plans to teach the students of those different grades together... (TE10).

...Yet, in addition to the urban schools, we should also have been sent to the schools that are located in rural areas, including multigrade classes. ...For instance, the schools that I had my field practice in Practice Teaching I and II courses were in urban districts. I can say that there are huge differences between those schools and the school that I have been currently working at now (T11).

Regarding the differentiation of assessment and evaluation, a considerable number of participants believed that the program was inadequate in teaching them to learn how to differentiate the assessment and evaluation techniques based on the individual differences of students, especially including the students with special needs and the students in multigrade classes. On the other hand, for the differentiation of assessment and evaluation techniques based on the courses and given objectives, some participants believed that the program prepared them well, while a number of participants thought that the program was inadequate in this regard.

Culturally Responsiveness

The majority of the participants explained that the program prepared them well for knowing or recognizing the individual differences of students, although they felt inadequately prepared for how to respond to them in practice. On the other hand, the participants found their teacher education program quite inadequate to help them recognize the diversity in students' cultural backgrounds. Some participants particularly mentioned that the program hardly supported them in recognizing different



languages that might be spoken in different regions of the country. To illustrate, the following teachers reflected on some in-class activities and courses in the curriculum as:

...Especially in our Instructional Principles and Methods, Guidance, and Special Education courses, I remember that we had discussions on the individual differences of students. However, we mostly talked about students' different learning styles, interests, abilities, etc. Only in a few courses, we had discussions regarding the students' potential cultural and language differences (T7).

Although it is known that elementary teachers mostly start their teaching career in the eastern regions of the country, we were not taught anything regarding the different cultures, or the different languages spoken in those areas. As a result, we generally encounter with problems when we start our teaching career. We had such discussions only in our Teaching in Multigrade Classes course, in which we watched several videos or movies. Besides, once, the teacher educator brought a case to the class to discuss, which she found from a newspaper... (T5).

Along with these, the majority of the participants found their teacher education program inadequate in terms of teaching them how to respond to the differences in students' diverse cultural backgrounds, including their language, race, ethnicity, traditions, music, and so on. This was particularly the case in terms of organizing an appropriate learning environment for all students in which teachers modify the curriculum and monitor all students' development.

Information and Communication Technologies

The participating teachers found their initial teacher preparation program less effective in terms of helping them develop technology literacy, including the recognition of key concepts in instructional technologies. Likewise, most participants articulated that the program was somewhat effective in supporting them in the use of digital technologies effectively and encouraging them to integrate technology into the courses. However, they did report that the program fostered their skills well in the use of technology mainly as a tool to reach information. In relation to these, most participants emphasized the lack of adequate practice in the related theoretical courses, the teacher educators' lack of competence in instructional technologies or negative attitudes towards it, and inadequate physical infrastructure of the faculty, as the following teachers asserted:

In the first year of the program, we took the Computer Applications in Education I and II courses. However, those courses were not very effective as they were not practice-based. ...Besides, in those courses, we only learned how to use certain Office programs. They [the teacher educators] should, at least, update the scope of the course (T17).

It is ridiculous that I graduated from one of the best faculties of education without seeing a real smart board. It is also ridiculous that we still had overhead projectors in the classrooms. ...So, we were actually talking about the 21st century, right? (T1).

In relation to creating digital learning environments, the participating teachers underscored that the program did not develop their knowledge of digital games, while they believed that it was important for them to teach young children. Similarly, the majority of the participants underlined that the program did not support them in the development of digital instructional materials either.

In terms of social media, most participants stated that the program did not prepare them adequately for integrating social media into the courses. In relation to this, the majority of the participants mentioned that the program did not encourage the use of social media as a tool for any educational purposes at all, and this was mainly attributed to the teacher educators' negative attitudes towards social media, as illustrated by the following teacher:

Throughout our teacher education, we were not encouraged to use social media for the teaching purposes because most of our teacher educators believed that social media was useless and loss of time. Besides, they were firmly convinced that the social media platforms were totally rubbish and everything was distorted (T1).



Lastly, with regards to developing media literacy, the participants believed that their initial teacher preparation was also quite ineffective. Along with these, it was reported by a number of participants that the program did not offer much from the outset to encourage them to develop positive attitudes towards technology, whereas some participants thought that it supported them in this respect well.

Students with Special Needs

A large number of participants expressed that the program was effective in terms of developing positive attitudes towards students with special needs. However, with regards to developing knowledge of special education, while most participants thought that the program prepared them well, a number of participants found it to be inadequate. In particular, the majority of the participants found the program effective in helping them learn the characteristics of students with special needs. However, the participants reported that their initial teacher preparation was inadequate in showing them how to approach students with special needs based on their distinct characteristics, for which they mostly suggested incorporating field trips and guest speakers into the curriculum:

The teacher educator of our Special Education course invited a child with Down syndrome and his parents to the faculty. It was the first time for me to see a child with Down syndrome. Besides, it was very interesting for us to listen their first-hand experiences. I think, such activities are important in terms of developing empathy in teacher candidates (T22).

Similarly, in relation to managing classrooms that include students with special needs, only a few participants said that they had been adequately prepared. Moreover, only a few participants thought that they had been well prepared in facilitating the inclusion of those students in the class. Accordingly, most participants specifically underlined that the program did not prepare them well for developing effective individualized lesson plans, as articulated by the following participant:

...Either in the Special Education course or the Inclusion in Elementary Education course, we did not learn how to prepare an individualized lesson plan. Similarly, we did not have any discussions about how to collaborate effectively with the counseling and research centers. Although these are highly crucial for the elementary teachers, I tried to learn all of these by myself when I started my teaching career. In those courses, we only discussed how to facilitate the inclusion of those students, in terms of encouraging their acceptance by other students. I believe that the objectives of those courses should definitely be reconsidered (T17).

With respect to collaborating with others in order to facilitate the inclusion of students with special needs, a considerable number of participants also stated that they had not been provided with adequate opportunities to collaborate and communicate with the parents of students with special needs. Similarly, most participants did not find the program adequate in relation to collaboration with school counselors, special education teachers, or other relevant institutions such as counseling and research centers and special education centers.

Adaptation

A considerable number of participants explained that the program had not prepared them adequately for adapting to different settings, especially for rural areas. In particular, the beginning teachers stated that they had not been able to gain adequate knowledge on rural life. They also felt that they had not been provided with sufficient knowledge on the characteristics of different regions or local areas in Turkey. Along with these, most participants did not think that program had prepared them well for adaptation to the different cultures. On the other hand, a large number of participants thought that the program had prepared them well for adapting to curriculum changes or new educational approaches, especially with respect to the constructivist reform that has been implemented in the Turkish education system since 2005. For example, the following teacher said:

...As you know, the school curricula have been revised in 2004. To be able to adjust to this change and get familiar with the educational implications of the constructivist approach, we did numerous activities in our courses throughout those four years (T4).



Accordingly, the participants especially did underline the importance of the adaptation of teacher educators to such changes:

...Even the teacher educators' attitudes towards change were very influential. For instance, while some of our teacher educators were quite open to the changes towards the constructivist approach, there were also some others who did not urge themselves much to change their teaching styles, maybe for the last 10-15 years. I mean, in order for us to reflect the implications of constructivist approach into our practices, first of all, it is the teacher educators who should change their teaching styles and be good role models for us (T8).

Finally, most participants emphasized that their initial teacher education was inadequate in terms of preparing them to facilitate the adaptation of students, particularly including the first graders' adaptation to the school settings.

In addition to the results of the interviews, the content analysis of the course descriptions provided in the curriculum of particular elementary teacher education, as determined by the CHE, also verified that there was a need to, first and foremost, broaden the scope of the courses, as well as revise and update them so that they address the essential qualities that elementary teachers are expected to possess in the 21st century. Moreover, it pointed to the need to bridge the gap between theory and practice, university courses and field work, and traditional vs. constructivist approaches to teacher education, in order to develop greater structural and conceptual coherence and better prepare elementary teachers in the search to improve the quality of teachers and elementary teacher education.

DISCUSSION and CONCLUSION

The current study demonstrates that the participating elementary teachers relatively found their initial teacher education program to be 'more adequate' in terms of developing the following domains of qualities: autonomy, professional development, and higher-order thinking skills. On the other hand, they thought that the program was 'somewhat adequate' for equipping them with the knowledge, skills, and attitudes that are related to the domains of effective communication, differentiation, and culturally responsiveness. Finally, the beginning teachers concluded that the program was 'quite inadequate' in terms of preparing them for the following domains of qualities: information and communication technologies, students with special needs, adaptation, collaboration, and personal development. From these results, it can be argued that the elementary teacher education program needs to be redesigned and improved on the basis of the domains of qualities that were not, according to the perspectives of the graduates, developed adequately. In this regard, the results of the present study appear to be similar to those of the previous research that pointed out the inadequacy of the current program in several aspects (Akdoğan & Uşun, 2017; Aksakal et al., 2016; Bağcı, 2014; Baştürk, 2015; Bayındır, 2011; Çelik, 2020; Eret, 2013; Fırat-Durdukoca & Ege, 2016; Kara et al., 2018; Kumral, 2010; Kumral & Saracaloğlu, 2011; Şahin & Kartal, 2013; Taş et al., 2017; Topal et al. 2011; Yılmaz & Kural, 2018). These findings might be a result of certain sources influencing the effectiveness of the program, such as the narrow scope and objectives of the courses (e.g., Community Service, Multigrade Classes, Special Education, Turkish Education System and School Management) that need to be revised and updated along with the essential qualities that elementary teachers are expected to possess in the current era; the inadequate use of student-centered teaching-learning methods and activities in the courses; the type of assignments given to the teacher candidates and the assessment and evaluation techniques; the lack of adequate elective courses that would have responded to the emerging needs of prospective elementary teachers and to the realities of schools (e.g., culturally responsiveness, students with special needs, personal and professional development, suburban schools); as well as the lack of adequate practice-based opportunities provided by most of the courses. In addition, as implied by the results, the lack of adequate and effective field practice, as well as the structural design and sequence of the field practice courses through the four-year program (e.g., School Experience, Practice Teaching I and II), and the lack of adequate faculty-school collaboration and partnership might have a strong impact on the perceptions of the graduates of the program regarding its effectiveness. The lack of



variety in the school settings that are selected for field practice courses, such as the lack of practice in rural schools or multigrade classes, might also have led the participating in-service teachers to feel inadequately prepared for the aforementioned domains of qualities that are essential for elementary teachers. In this regard, the analysis of the particular elementary teacher education curriculum also showed the need to bridge the gap between theory and practice, university courses and field work, and traditional approaches and constructivist approaches to teacher education. It also pointed to the need to update the scope and objectives of the courses based on the essential qualities expected from elementary teachers in the 21st century.

In discussing the results regarding the effectiveness of the elementary teacher education program, previous studies have similarly highlighted the importance of certain sources that might have an impact on the effectiveness of the particular elementary teacher education program. It was argued that the following were the most important factors influencing the effectiveness of the elementary teacher education program: the scope of the courses, the irrelevancy of the course content to the realities of schools, the course activities, the teaching methods of teacher educators, the teacher candidates' level of readiness, the assessment and evaluation techniques used in the courses, the lack of effective feedback, the incompetence of teacher educators, the attitudes of teacher educators towards the courses and teacher candidates, the heavy teaching load of teacher educators, the inadequate number of teacher educators in the program, large class sizes, large number of student admissions to the program, the misalignment between the content of the courses and that of the KPSS (the centralized teacher appointment exam), the lack of adequate and effective field practices in the pedagogical courses, the design and sequence of the courses in four-year teacher education program, the lack of field practices in rural schools, the lack of variety in terms of the schools that are selected for field practices, the lack of faculty-school collaboration, and the inadequate infrastructure of the faculty buildings (Akdoğan & Uşun, 2017; Aksakal et al., 2016; Ayan, 2011; Bağcı, 2014; Baştürk, 2015; Bayındır, 2011; Çelik, 2020; Eret, 2013; Fırat-Durdukoca & Ege, 2016; Kara et al., 2018; Kumral, 2010; Kumral & Saracaloğlu, 2011; Özdemir et al., 2015; Süral, 2015; Şahin & Kartal, 2013; Taş et al., 2017; Topal et al., 2011; Yılmaz & Kural, 2018).

While the current study aimed to explore the effectiveness of the elementary teacher education program that was put into implementation in Turkey in 2006, the results of the studies that aimed to evaluate the new elementary teacher education program that was put into practice in 2018 to address the weaknesses of the previous program, also shows similarities with the results obtained from this study. For example, the results of some studies (e.g., Altunova & Aslan, 2019; Kılıç-Özmen, 2019; Susar-Kırmızı & Yurdakal, 2020; Yurdakal, 2018) point out that reconsidering the irrelevancy of some of the courses offered in the previous program and offering a large variety of new elective courses in the new program have been among the strengths of the new elementary teacher education program in 2018 in better responding to the needs of elementary teachers in the 21st century. On the other hand, showing consistency with the results of the present study, the 2018 program has also been found to be ineffective in providing teacher candidates with adequate field experiences in elementary school settings. The new program has indeed been subjected to more severe criticisms of being unable to provide teacher candidates with sufficient practice-based opportunities and clinical experience. Accordingly, the results of those studies generally suggest that not only the number of practice hours has been decreased significantly, but also some of the field practice courses (e.g., School Experience) have been removed from the new elementary teacher education program in 2018.

In addition to these points, given that teacher educators have a pivotal role in the enactment and successful implementation of teacher education programs (Cochran-Smith, 2003, 2010), teacher educators should look for ways to strengthen faculty-school partnerships and collaborations, the aim being to move towards a practice-focused curriculum for learning through teaching in university-based teacher education (McDonald et al., 2014; Zeichner, 2010). To this end, teacher educators should develop shared understandings and reciprocal, effective collaboration, especially with mentor elementary teachers and school administrators in partnership schools to improve the quality of field



practices for prospective elementary teachers. In this regard, it is noteworthy that while teacher educators serve as university-based role models and mentors for teacher candidates (Swennen, Lunenberg, & Korthagen, 2008), mentor elementary teachers are also critical role models in schools and have a significant impact on their professional development (Crasborn, Hennissen, Brouwer, Korthagen, & Bergen, 2011; Fairbanks, Freedman, & Kahn, 2000; Hudson & Hudson, 2010; Goodwin, Roegman, & Reagan, 2016; Kiraz, 2002; Kolman, Roegman, & Goodwin, 2017; Roegman, Reagan, Goodwin, & Yu, 2016). It is suggested that teacher educators should also diversify the selection of the partnership schools for field placements so that teacher candidates are placed to complete their practicum studies, allowing teacher candidates to gain an experience of teaching in different educational settings. The current study also suggests that teacher educators should develop effective collaboration with the relevant institutions and other key stakeholders in the local community, such as the special education institutions and the counseling and research centers, in order to provide the teacher candidates with diverse educational experiences in different settings, coupled with professional support and guidance.

Regarding the teaching methods and the activities utilized in the classes, the results imply that teacher educators should make use of more authentic and constructivist, learner-centered pedagogies, instructional methods, and materials (Korthagen et al., 2006; Richardson, 1997; Zeichner, 1987) (e.g., reflective teaching, writing and reflection, case studies, project-based work, videos, and action research). It is also concluded that teacher educators should employ not only traditional, but also authentic assessment and evaluation techniques. In addition, considering that they have a large influence on prospective teachers, teacher educators should develop positive attitudes towards the integration of information and communication technologies into the program, be open to change, and adapt to changing educational approaches and practices. The infrastructure and physical conditions of the education faculty buildings, classrooms, and the university should accordingly be enriched, improved, and strengthened with necessary facilities such as library, sports center, arts room, drama room, seminar room, laboratories, exhibition halls, internet access, instructional materials and equipment, and appropriate seating arrangements. Furthermore, as pointed out by some participants, extracurricular activities might also account for how well the program equips (or not) the graduates with the desired essential qualities. In this regard, the current study may provide teacher educators with further critical insights, as the results call for integrating different forms of extracurricular activities into the program, such as inviting relevant stakeholders to the faculty as guest speakers and organizing field trips to the relevant institutions and stakeholders (e.g., special education institutions, counseling and research centers). In addition to such extracurricular activities, it can be recommended for the personal and professional development of future teachers that pre-service teachers should be encouraged, through their initial teacher preparation, to attend student clubs, student exchange programs, and social, cultural, or professional development activities organized in the faculty/university. This encouragement could be especially effective via regular announcements made by teacher educators or the faculties of education, active use of bulletin boards in the faculty buildings, active use of social media platforms, and making sure the official websites of the faculties of education are kept up to date with current events, invitations, and announcements. For the professional development of teacher candidates, the results of the study also suggest that the attitudes of teacher educators, their behavior, mentorship, and guidance play a substantial role in helping future teachers develop a strong commitment to the teaching profession and an understanding of the professional ethics.

In light of the findings, the study also provides suggestions to the CHE in terms of redesigning the structure and scope of elementary teacher education curriculum. First, considering that field practice courses are offered only in the third and last year of the program for a limited period of time, it can be recommended that not only should the practicum courses be distributed over the course of the program from the first to the last year, but the program also needs to offer more practice-based courses and enriched teaching experiences to prospective elementary teachers. Second, as the results show the need for offering more relevant courses that would respond to the needs of elementary teachers, the present



study provides further insights for the CHE both for reconsidering the scope of the existing courses and also including new relevant courses in the curriculum; given that CHE is the responsible institution for the development of teacher education programs in Turkey alongside the centralized structure of teacher education which has relatively changed since 2020, when the responsibility for teacher education programs was transferred to some extent from the CHE to the faculties of education.

Based on the aforementioned discussions, it can be concluded that this study not only offers profound implications to elementary teacher education in terms of gaining insights into “how” of the quality elementary teacher education, but it also moves beyond the particular program, as this knowledge also adds to the landscape of research on teacher education globally as part of the search of improving the quality of teachers and teacher education overall.

While the study mainly draws on the perspectives of the graduates, future studies might also employ teacher observations to provide a more accurate portrayal of the competence of the program’s graduates in actual school settings. In this regard, we acknowledge that the current study is limited by its reliance on self-reported data. In addition, the tendency to social desirability might have interfered with the interviews, with the interviewees possibly perceiving any question to be inquiring essentially about themselves, even though that was not the main intention, and the purpose of this study was to evaluate the effectiveness of the particular elementary teacher education program. However, to reduce the effect of this threat, one of the researchers who conducted the interviews, kindly interrupted the interviewees at such times in order to bring them back to the actual focus of the study. Bearing these in mind, future research might also include the voices of teacher educators as one of the key actors in the preparation of future teachers and employ observations of class and faculty settings to supplement the interview data. This would allow the triangulation of the data and involve both teacher educators and pre-service teachers in portraying the process of pre-service teacher education in more detail. Finally, as suggested by qualitative research paradigm, the findings of this study are indicative of, but not generalizable to the entire population. Therefore, while there are other universities that had been implementing, with only some flexibilities offered, the same elementary teacher education program, the findings of the present study are limited to the perspectives and lived experiences of the participating beginning elementary teachers who have graduated from three particular public universities located in the capital city of Turkey and had participated in an initial study (Akın & Ok, 2021) that had been conducted as the first step of this research.

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THE EFFECT OF JIGSAW II TECHNIQUE ON MATHEMATIC ATTITUDES AND CONSTRUCTIVE LEARNING

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Abstract

The aim of this research was to examine the effects of mathematics activities prepared by using Jigsaw II technique on fourth grade students. A mixed design was used, consisting of a combination of pre-test post-test without control group a Quasi-experimental design and qualitative data. The research's study group consisted of 21 fourth-grade students. The researchers created math activities for the Jigsaw II technique which were used throughout the process. The "Mathematics Attitude Scale" and "Constructivist Learning Environment Scale" were used as pre-test and post-test data collection. In addition, at the end of the application, students' opinions on the application were recorded. The Wilcoxon Signed Ranks Test was used in the analysis of the data, and content analysis was used to analyze the student views on the application, as well as direct quotations from the students' statements. The analysis concluded that there was a significant difference between the pre-test and post-test average scores of the research group's mathematics attitude and constructivist learning environment situations of the in favor of the post-test. At the end of the process, most of the students expressed positive opinions about these activities. This technique is recommended to use more frequently in classrooms because it improves students' attitudes towards mathematics lesson and constructivist learning.

Keywords: Jigsaw II technique, mathematics, mathematics attitude, constructivist learning environment.

INTRODUCTION

Math lesson are monotonous, repetitive, and pointless due to concerns such as the fact that the topics are quite abstract in mathematics teaching, the lectures are only focused on the topic and the lessons are teacher-oriented which prevents the students from participating actively in the lesson (Akar, 2006). Studies show that, a new approach to mathematics tea can increase student success while decreasing students' negative attitudes toward mathematics (Umay, 1996). This new learning approach is a constructivist approach. It is an epistemological approach based on the understanding that an individual develops their own knowledge through active interaction with their environment. According to Piaget, the founder of Constructivism, which is used to build a structure by putting the pieces together, learners are not empty plates but create their own learning. He explains how an individual acquires knowledge as a result of active interaction with their environment via two sequential processes called accommodation and assimilation. As a result, the individual recognizes the new situation he is in and tries to recognize and make sense of it using his current knowledge and



experience. After this recognition process, they absorb the new situation, and the individual thus establishes their knowledge about the new situation (Baki, 2014; 2018; Van de Walle, 2012). In addition, constructivist approach allows the learner to structure, construct, interpret and improve the information. The constructivist approach recognizes that the learners allow them to think, understand, take responsibility for self-learning and learn basic knowledge and skills in order to control their behaviour (Von Glasersfeld, 1999; Miller, 2002; Bal & Doğanay, 2009). Mathematics educators favor the constructivist approach since mathematics is one of the areas where constructivist-learning environments can be optimized (Baki, 2014; 2018; Tezer & Cumhur, 2016). In Turkey, it occupies a particularly important place in mathematics education, thanks to the updating of the educational curriculum in 2006 and the constructivist approach. This approach has a significant impact on the development of student-centered learning and teaching approaches (Özkal, Tekkaya, Cakiroglu, & Sungur, 2009). As it has been demonstrated that traditional teacher-centered education cannot solve the problems (Keskin & Yıldırım, 2008; Yılmaz, 2004), constructivist learning defends student-centred learning and provides an effective learning environment by contributing to high level student motivation and thinking skills (Atasoy & Akdeniz, 2006). Cooperative learning in the best way to create such a learning environment (Atasoy, Genç, Kadayıfçı, & Akkus, 2007). In constructivist learning, it is possible to state that not only one student but also all members of the group are active in the cooperative learning process (Bosfield, 2004; Panitz, 1999), and that the knowledge is permanent and the learning is successful because of teamwork. Cooperative learning is a method in which students take an active role in the learning process by working together to be successful and the teacher serving as a guide at this stage (Demirel, 2011). Cooperative learning, like other methods, has positive effects on students' cognitive and affective learning. It not only improves the academic success of the student, especially in difficult subjects, but also improves the student's attitude toward the lesson, motivation and self-confidence (Genç & Şahin, 2012). Cooperative learning is a student-centered learning approach in which students work in small groups to increase the learning levels of both themselves and their group mates (Çalık, 2017).

Student Teams and Success Departments, Team-Game-Tournament, Collaborative Combined Reading and Composition Team Supported Individualization, Let's Ask Together, Learn Together, Mutual Inquiry, Jigsaw and Jigsaw II are all cooperative learning techniques (Sönmez, 2005). The Jigsaw technique, as seen, one of the cooperative learning techniques in which students are active. Eliot Aranson pioneered this technique, which includes two different applications for increasing student's collaboration in 1978 (Hedeem, 2003). This technique, also known as Jigsaw I, is similar to other cooperative learning techniques. Jigsaw II (Slavin, 1986), Jigsaw III (Stahl, 1994), Jigsaw IV (Holliday, 2002), Reverse Jigsaw (Hedeem, 2003) and subject Jigsaw (Doymuş, 2007) were developed and implemented from the original jigsaw technique. Although the basis of all Jigsaw techniques are the same, there are some differences in applications (Avcı & Fer, 2004). The groups consist of 2 to 6 people. In the Jigsaw II technique, which is one of these techniques and also used in this research. The members of the group work together and must trust each other (Aykaç, 2005; Sharan, 1999). The number of students in each group divides the subject to be covered. Each group is given the same topic, and students are asked to choose one of the divided topics, and students from different groups who choose the same topic come together in "expert groups" to work, discuss and learn about these common topics. Students who return to their original groups after learning the subject discussed in the expert group is responsible for teaching the subject, they are working on to one another within time frame specified. In this technique, all students are both learners and teachers at the same time. As a result, it is a technique that allows all students to be active in the learning process, rather than just one student in the group (Sönmez, 2005).

Looking at previous studies that used Jigsaw technique, it was discovered that mathematics achievement of secondary school students (Adams, 2013; Cumhur, 2017; Çalık, 2018; Dellalbaş & Soylu, 2012), geometry attitude and self-efficacy of secondary school students (Kaba, Özdişçi, & Soylu, 2017), success and problem solving skills of secondary school students (Sevim, 2015; Gelici & Bilgir, 2012) and self-efficacy and anxiety (Yıldırım-Doğru, 2012) of secondary school students were



examined. There are also research in the literature that examine at primary school students' mathematical problem solving skills (Carlan, Rubin, & Morgan, 2004) and mathematics achievement (Moskowitz, et. al., 2004; Slavin & Karweit, 1979; Varank & Kuzucuoğlu, 2007) are examined. Unamba and Ugochkwu (2015) stated that cooperative methods can be used in mathematics learning for all age groups, but as can be seen, the scarcity of primary school research is notable. According to this viewpoint, the findings of this study will contribute to the literature. In the light of all this, the purpose of the study is to investigate the impact of Jigsaw II technique on elementary school students' attitude towards mathematics and constructivist learning situations in the mathematics class. Answers to the following questions were pursued for this reason:

- (1) What are the students' math attitude and constructivist learning environment pretest and posttest scores?
- (2) Is there any difference between students' mathematics attitude and constructivist learning environment pre-test and post-test scores?
- (3) What do the students think about Jigsaw II activities?

METHOD

A mixed design was used in the study, which included a pre-test post-test without control group, a quasi-experimental design, and qualitative. When the controls as required by the True Experimental Design are not reached or are insufficient, the Quasi-Experimental Design is preferred (Karasar, 2005). It is a design that examines the effect of the experimental process by administering pre-test and post-tests applied to the same groups before and after the experiment. (Büyüköztürk, 2007). The limitation of this study is that the experimental design was carried out with a single group. The "Hawthorne Effect", which is defined as one of the factors affecting external validity in experimental studies, occurs when participants exhibit reactions that they would not exhibit under normal conditions as a result of the physical and psychological effects created by the experimental environment. In this case, it is assumed that the participants are aware that an experiment has been carried out on them, which has led to the development of a group action style. As they are chosen for the experimental group, participants may exhibit these behaviours (Eren, 2004). There is no control group in this study. Despite the fact that here was no sample for the study, it was ensured that the researchers spent time with other students at the same school. As a result, it was attempted to prevent the students in the application group from developing the misconception that only changes related to them were made within the scope of the research. In addition, the students' perspectives on Jigsaw II activities were also included in the qualitative dimension of the study.

Study Group

All educational levels were updated on April 11, 2012, when the education law became effective after being published in the official newspaper in Turkey. With the new Primary, secondary and high school trainings were rearranged as a result of the new education periods, which were expressed as 4 + 4 + 4 (Kol, 2019). The primary school start age is 6 years and the education period is 4 years, according to a legal agreement reached in 2012. Primary school is in the scope of compulsory education (MEB, 2019). Students attend elementary school for the first 4 years (1, 2, 3, 4th grades), secondary school for the next four years (5th, 6th, 7th, and 8th grades), and high school for the final four years (9th, 10th, 11th, and 12th grades) (Kol, 2019). In Turkey, primary school students are aged 6 to 9, secondary school students are aged 10 to 13 and high school students are aged 14 to 17 years old. Twenty-one fourth-grade students from Istanbul, Turkey, participated in the study. The acquisitions of 'Division by Natural Numbers', a sub-learning field of the "Numbers and Operations" learning area, begins in the second grade and lasts until the fourth grade (MEB, 2018). As a result, for the purpose of the study, the sample was drawn from among the fourth-grade students, the highest grade of primary school, after all division gains had been completed. Given the students' educational levels and the teaching methods employed, it was determined that a sample of fourth grade students, the final grade of



primary school, would be appropriate for the research. The principal and classroom teacher of the school where the application will be carried out were given information about the study's content. The research was also shared with the students' parents by the classroom teacher. With their approval, the research has begun. Students were invited to participate in the research on the basis of their willingness to volunteer. In the photographs used in the research, it was important to conceal the identities of students. Table 1 shows the gender distribution of the sample.

Table 1. Students' gender

Gender	<i>n</i>	%
Girl	8	38.1
Boy	13	61.9
Total	21	100.0

The sample consists of a total of 21 primary school fourth grade students, 8 (38.1%) girls and 13 (61.9%) boys.

Research Process and Materials

The study is divided into three stages. In the first stage, students were given the “Mathematics Attitude Scale” and “Constructivist Learning Environment Scale” as pre-test. The scales were used to try to specify students' attitudes towards mathematics and their thoughts on constructivist learning. The implementation of the activities was the next stage of the research.

Process

Jigsaw II was used in this study. Jigsaw II is a variation on basic structure of Jigsaw. It was created in 1986 by Robert Slavin and adds one powerful enhancement to the basic one. The distinction is in how the assessment is handled. In the original Jigsaw (Jigsaw 1), students are assessed individually and receive one score. In Jigsaw 2, quiz scores are assigned to individual students once, and then the scores of each group are averaged to produce a group score. This technique, encourages students to work harder to assist one another in learning the material (Mattingly & VanScikle, 1991). The researchers created appropriate activities that involve the outcomes in the 4th grade mathematics curriculum for the study's purpose.

The following are the outcomes of “the division of natural numbers” according to the curriculum used in Turkey (MEB, 2018, p. 46):

- Elements of the division
- This function divides the three-digit natural numbers by two-digit natural numbers.
- Convert a number with up to four digits to a one digit number.
- Divides natural numbers with up to five digits, the last three of which are zero into 10, 100, and 1000.
- Estimates the result of a division problem and compares it to the actual result of the operation.
- Realizes the relationship between multiplication and division.
- Estimates the number of digits in the quotient.
- In the division process, the remainder is always less than the divisor.
- Addresses problems that necessitate at least one division operation with natural numbers

The following activities have been planned based on the outcomes. 10 lessons were taught over the course of two weeks, with 5 + 5 period activities. Students are told during the first week of practice that they will learn to divide today in a very different way. The 21-student class was divided into seven groups of three students each. When forming groups, researchers are encouraged to be heterogeneous within the group while remaining homogeneous between the groups. The application courses' main topics are organized into seven subtitles. Children are divided into groups and given one minute to come up with a name for their group. Then, they are instructed to write and decorate the group names on A5 paper as they see fit. Sortation is used to assign subjects to students. (It is determined by selecting the topic number between 1 and 7.) After that, they divide the experts into groups based on



the numbers they have. The teacher informs the students of the time they will be able to work in the expert group. As a result, they make group plans around this time. Each student is given a set of objects based on their subject. These groups attempt to clarify the issue, and before returning to their previous groups, they must plan how to inform and educate their friends. Students from different groups who are studying the same subject are brought together and discussed.

In the process, the teacher participates by guiding and asking questions in order to accompany the students into the subject. After finishing their work in the expert group, students are given a few materials for their main group. In the expert group, they are given 10 minutes to paint and decorate these materials as they see fit. After that, students are asked to rejoin their original group. After all students have explained their topics to each other one another in the main groups, they are asked to write questions, one for each outcome. They are instructed to check and answer their questions. The teacher circulates among the groups, checking the questions. The groups write their names on the paper along with the questions. Students are expected to answer these questions by switching groups. After the students have completed their work, they are distributed to the groups that are preparing the questions for testing. . When students finish answering the questions, they send them back to the groups that prepare them for checking. The course is summarized by the researcher. In addition, students will be informed about the topic for the following week.

It is divided into 5 groups of 4 students during the second week of the process. Because the class size is 21 students, there will be six people in each group. Consideration is given to ensuring that students work in a variety of groups, as opposed to last week. The main subject of the application course is divided into five subtitles. As in the first week, students are given time to divide into groups and familiarize themselves with the materials.

Activity 1 - Elements of the Division

The student group is given a template with numbers and division for the division numbers. They are instructed to arrange these numbers in the form of a division operation. They are instructed to write down which element of the division operation these numbers they placed.

Activity 2 - The Relationship between Multiplication and Division

A card is given to each student to explain the relationship between multiplication and division. They are instructed to carefully read the problems on the card. Problems that can be solved using the multiplication process are said to be marked with the multiplication peg, and problems that can be solved using the division process are said to be marked with the division peg. They are instructed not to use both processes to mark problems. After their operations, they are instructed to write the number of pegs and to take the envelope that containing the result they discovered.

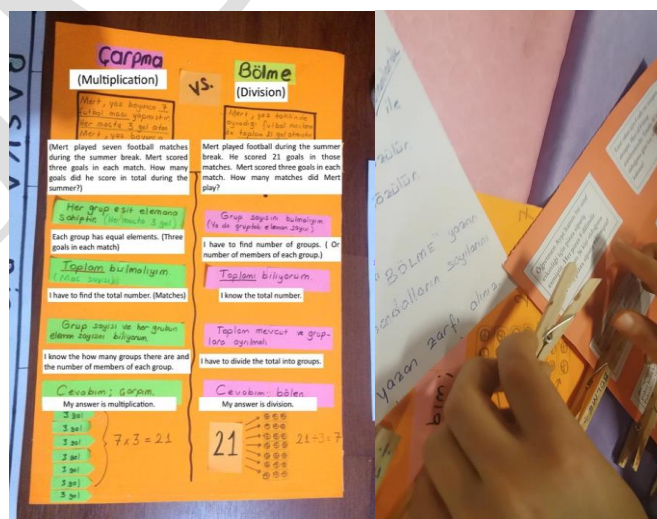


Figure 1. The relationship between multiplication and division



Activity 3 - Estimating how many digits in quotient is

A poster is distributed to the student group to serve as a guide. They are expected to comprehend the outcome via this poster before the activities begin.

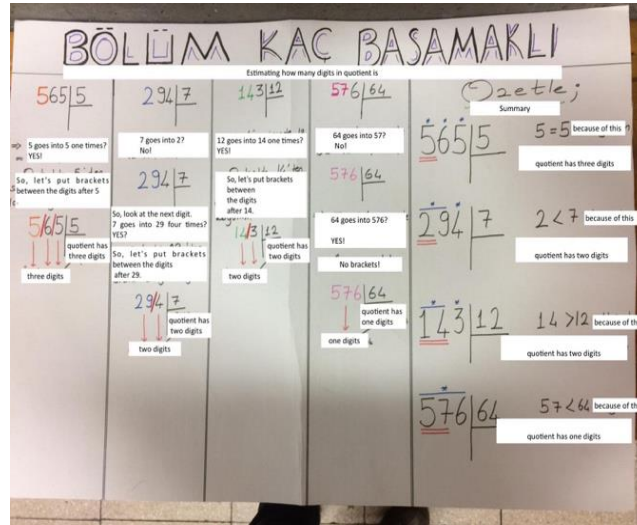


Figure 2. Estimating how many digits in quotient is

Activity 4 - An alternative division

This activity demonstrated that the student group can be divided in a variety of ways. A poster is provided to guide the student group. Then, in the activities provided, they are asked to solve the problems using this method.

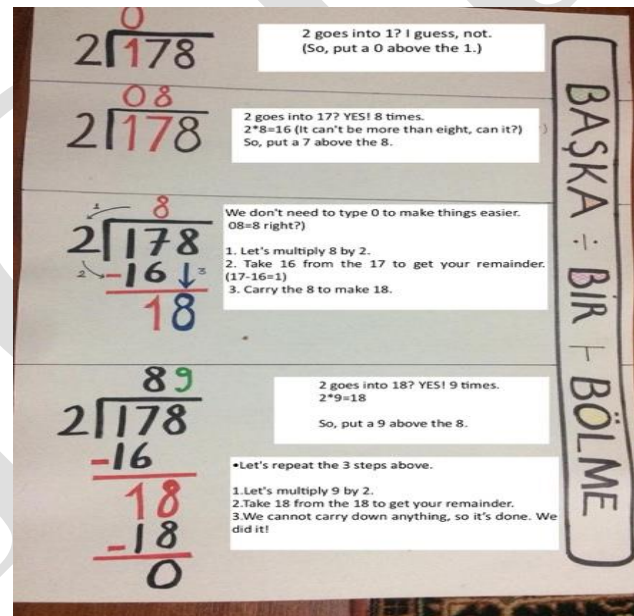


Figure 3. An alternative division

Activity 5 - Remainder is always smaller than divisor

In this activity, students are given an activity sheet, on which they will place division and chickpeas elements. For each operation, they are instructed to circle the divider and the remainder. While working on the activity sheet, the elements of the division place the chickpeas on the paper and solve the process. They are then asked to explain the relationship between divider and remainder after all transactions have been completed.

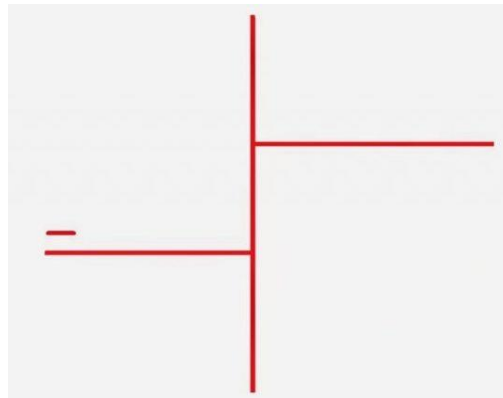


Figure 4: Remainder is always smaller than divisor

Activity 6 - Divides the one-digit natural numbers by one-digit natural numbers

In this activity, students are given a template of sheet, beans, and activities paper. The beans were placed in the center of the template papers by the students. They put the beans in the circle one by one until they divide. Every circle must have an equal number of beans. After placing 9 beans in the pentagon, one bean in each of the circles numbered 1-4, and another one in each of the circles, there is one bean in the pentagon and two beans in the circles. In the circle, the quotient is the number of beans. The remainder in the pentagon is the number of beans. After writing the results on the activity sheets, they can move on to the next exercise.

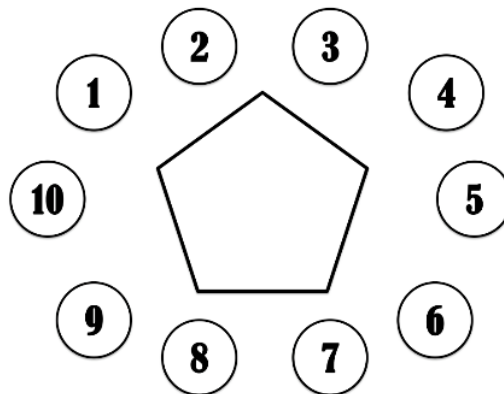


Figure 5. Template paper 1 and activity process

Activity 7 - Divides the two-digit natural numbers by one-digit natural numbers

In this activity, students are given beans, template paper, and activities. The same is true for Activity 6.

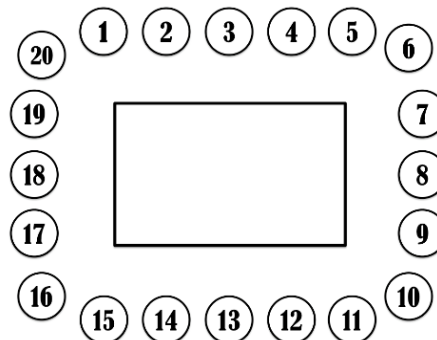


Figure 6. Template paper 2 and activity process



Activity 8-10

These three activities were developed in response to the results of dividing the three-digit natural numbers into two-digit natural numbers. Students were given posters labeled “Dividing the two-digit number into a two-digit number, dividing the three-digit number into one-digit number, dividing the three-digit number into a two-digit number”.

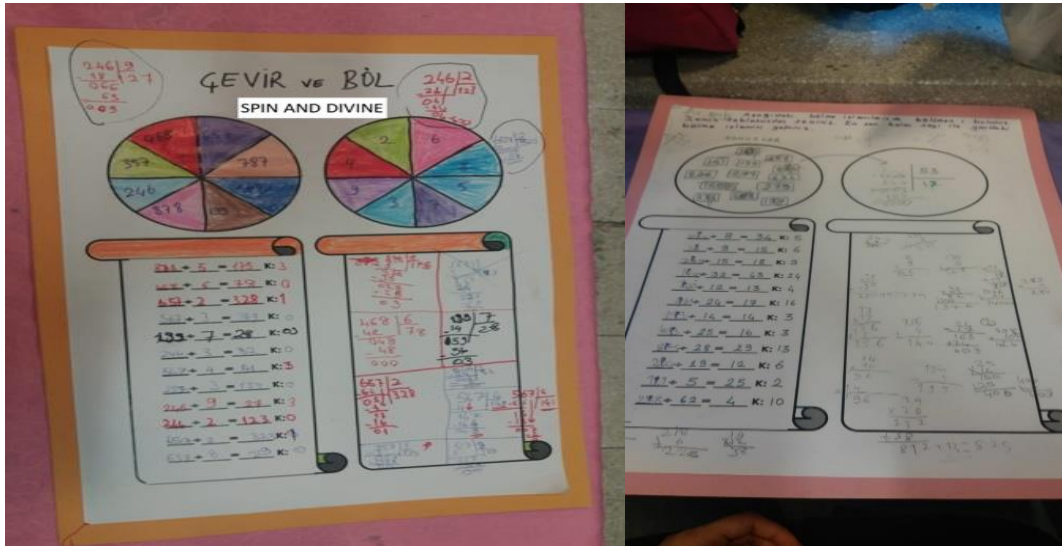


Figure 7. Spin and divide

Activity 11 - Divide in mind

There are activities in which the last three digits are zero and can divide the natural numbers up to five digits into 10, 100 and 1000. The students are asked to discuss the issue using the examples provided to the group and identify relationship. When they have grasped the subject, they are asked to perform the activities quickly without any operation.

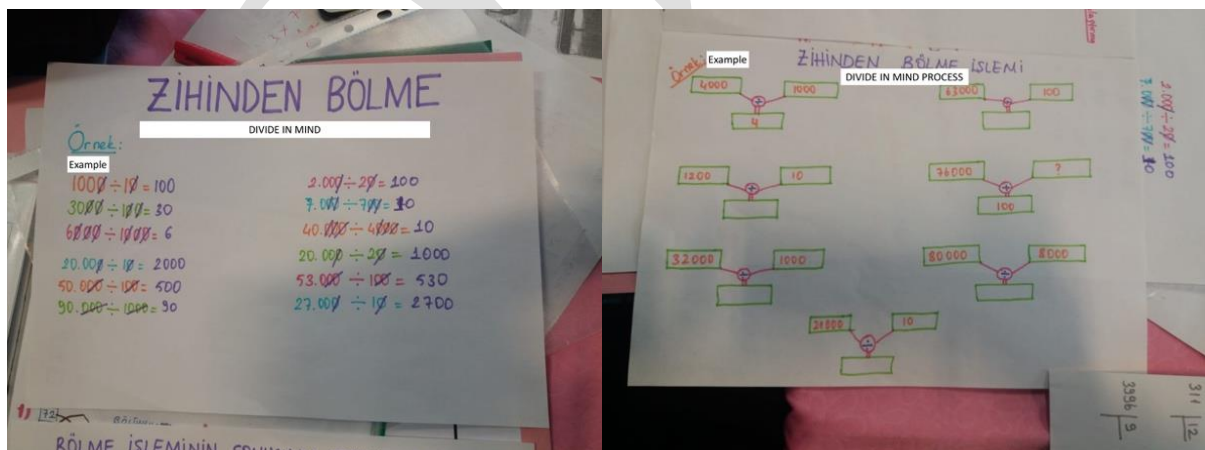


Figure 8. Divide in mind

Activity 12 - Estimating the result of dividing

In order for the students to estimate the result of the division, an explanatory paper was distributed, followed by worksheets.

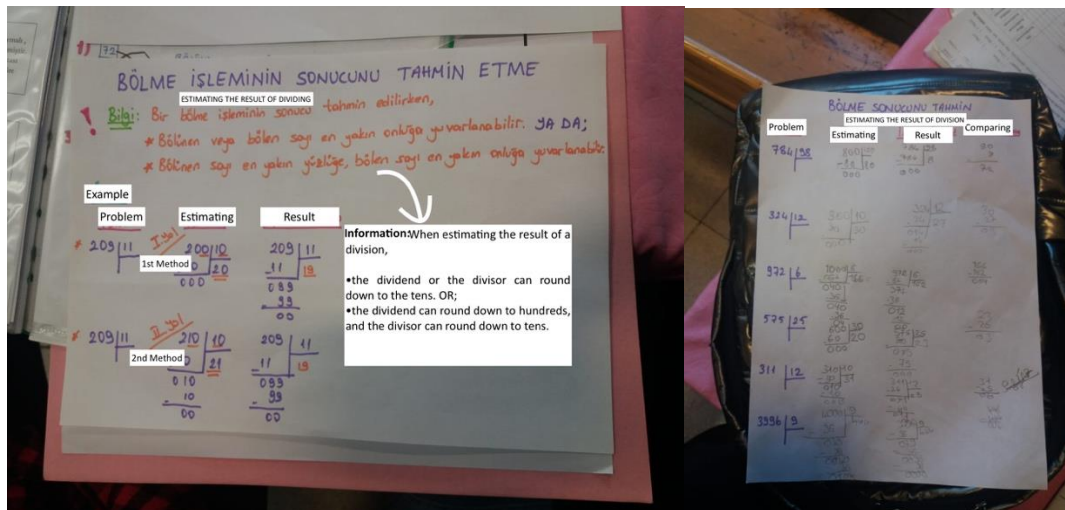


Figure 9. Estimating the result of dividing

Activity 13-Problem

To relate the subject to real life, an example of a real-life problem is shown. Then they are given another activity sheet and asked to solve these problems and write down where they can apply this problem in real life. Finally, each student in the group is asked to write a real-life problem and solve with their groupmates. The teacher guides by checking the written questions ensure that the process is progressing correctly.

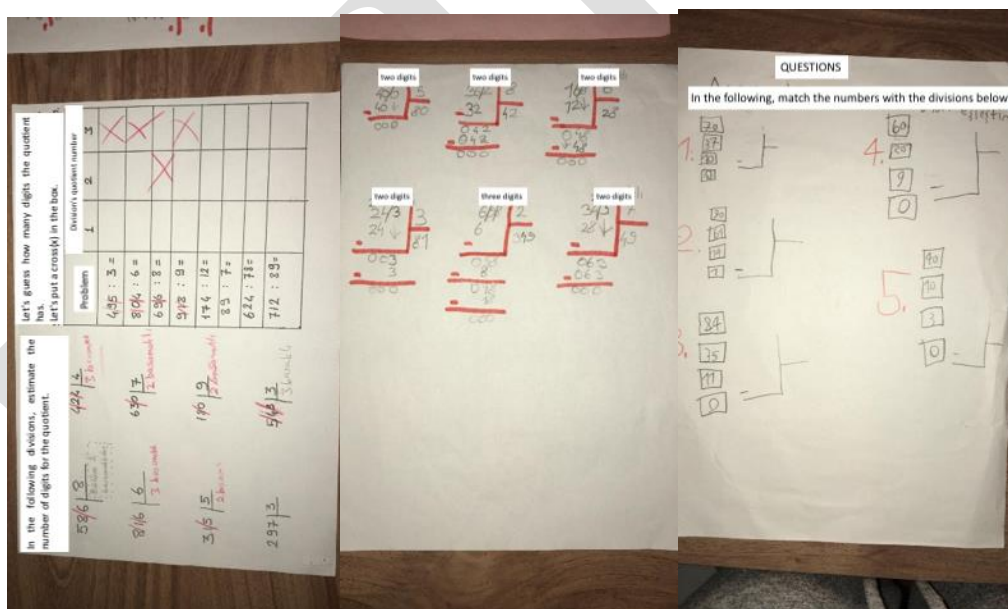


Figure 10. Problem

As the final stage of the research, the same data collection tools were used on the students as post-tests a week after the process was completed. In addition, at the end of the process, students were asked to write down their thoughts on the application.

Data Collection Tool

The “Mathematics Attitude Scale” and “Constructivist Learning Environment Scale” were used as data collection tools in the study. In addition, at the end of the application, the students were asked what they thought of the application and were asked to express their thoughts in sentences.



Mathematics Attitude Scale: The “Mathematics Attitude Scale” developed by Baykul (1990) and adapted to the fourth grade of primary school by Karalı (2017) was used as a data collection tool in research to determine students’ attitudes toward mathematics lessons. Karalı (2017) performed an explanatory factor analysis on the 30-item attitude scale and the scale was reduced to 23 items. “Mathematics Attitude Scale”, 14 positive question items rated as ‘I Disagree Strongly (1)’, ‘I Disagree (2)’, ‘I Am Undecided (3)’, ‘I Agree (4)’, ‘Strongly Agree (5)’. Respectively the items were scored as 1, 2, 3, 4, 5, and 9 negative question items were scored as 5, 4, 3, 2, and 1. The validity and reliability studies of the scale developed by Baykul (1990) were calculated as Cronbach’s Alpha coefficient .96, the adapted scale .93, and the reliability coefficient in this study .92.

Constructivist Learning Environment Scale: The Constructivist Learning Environment Scale, developed by Özkal, Tekkaya, Cakiroglu, and Sungur (2009), and 20 positive items. The scale was graded as ‘Never (1)’, ‘Rarely (2)’, ‘Sometimes (3)’, ‘Often (4)’, ‘Always (5)’. The scale can thus be used to obtain the lowest 20 and the highest 100 points. The scales’s validity and reliability were assessed in this study and the Cronbach’s Alpha coefficient was found to be .81.

Activity Evaluation Form: The form was created by researchers. This form is a form in which students in the experimental group are asked to express their thoughts after the application in a single sentence. Quotations were derived directly from the students’ thoughts.

The Validity and Reliability of the Research

The study's data collection tools' reliability is calculated and reported. The activities developed were finalized with the input of mathematics educators, especially classroom teachers. For the qualitative data analysis, the researchers conducted separate evaluations and shared their findings.

Analysis of Data

SPSS 16.0 was used to generate statistical solutions for quantitative data collected in the study. Before beginning the analysis, the Kolmogorov-Smirnov test was used to check the normality of the data distribution, as well as the Skewness - Kurtosis values of the scores. According to George and Mallery (2010), the results of the Kolmogorov-Smirnov test, it revealed that the data did not have a normal distribution because the significance value was greater than .05 and the skewness flatness coefficient was not between +2.0 and -2.0. Nonparametric tests were used in this context. Simultaneously, because the number of data points is less than 30, nonparametric techniques are thought to be appropriate (Pallant, 2005). The Wilcoxon Marked Ranks Test was used to analyze the data. Written activity evaluation forms were used to solicit student’s feedback on the application. Students were asked to evaluate how they found the application in one sentence. To analyze student perspectives on the application, content analysis was used and the expressions of the students were provided in the form of direct quotations.

RESULTS

The findings were analyzed using three questions that arose as a result of the research problem. Table 2, and Table 3 show the results of the first subproblem.

Table 2. Mathematics attitude scale scores

Mathematics Attitude	N	Mean	Std.Dev.
Pre-test	21	84.06	15.75
Post-test	21	91.40	17.10

The students in the study had pre-test point average of 84.06 and a post-test point average of 91.40 on the Mathematics Attitude Scale. As can be seen, the average of mathematics attitude points increased after the application (Table 2).



Table 3. Constructivist learning environment scale scores

Constructivist Learning	N	Mean	Std.Dev.
Pre-test	21	67.94	10.01
Post-test	21	75.62	11.20

The sample’s Constructivist Learning Environment Scale pre-test point average of the sample was 67.94, and the post-test point average was 75.62. As can be seen, the mean of constructivist learning environment has increased as a result of the application (Table 3).

Table 4, and Table 5 show the results of the second sub-problem.

Table 4. Wilcoxon Test Results According to Mathematics Attitude Scale Pre-test and Post-test Scores

	Ranks	N	Mean Rank	Sum of Ranks	z	p
Pre-test - Post-test (Mathematics Attitude)	Negative Ranks	5	9.00	45.00	-2.452	.014*
	Positive Ranks	16	11.63	186.00		
	Ties	0				
	Total	21				

*p<.05

The difference in mean Math Attitude Scale scores between pre-test/post-test was statistically significant ($z=-2.452$; $p<.05$) (Table 4). When the mean rank and total of the difference scores are considered, it is clear that the observed difference favors the positive ranks and posttest score. As a result, it can be stated that teaching mathematics with Jigsaw II activities improved their math attitude in favor of post-test.

Table 5. Wilcoxon test results according to the constructivist learning environment scale pre-test and post-test scores

	Ranks	N	Mean Rank	Sum of Ranks	Z	p
Pre-test - Post-test (Constructivist Learning Environment)	Negative Ranks	6	7.58	54.50	-2.433	.015*
	Positive Ranks	15	12.37	185.50		
	Ties	0				
	Total	21				

*p<.05

The difference in mean Constructivist Learning Environment Scale scores between pre-test and post-test was statistically significant ($z=-2.433$; $p<.05$) (Table 5). When the mean rank and total of the difference scores, it is clear that the observed difference favors the positive ranks and posttest score. It can be stated that teaching mathematics with Jigsaw II activities promotes constructivist learning over post-test learning.

The last sub-problem of the research was the students’ ability to express their thoughts about the application in one sentence. As a result of Jigsaw II Technique, students’ opinions were solicited, and based on what they wrote, they were divided into two groups; those who expressed “positive” and “negative” opinions about the technique. 17 (80.96%) of 21 students in the study thought the implementation was positive, while 4 (19.04%) thought it was negative. According to result, the number of people who like the application outnumber who dislike it. The following are direct quotations from the statements of students who expressed positive opinions:

- S1: “I always want it to be like this. I liked all the topics very much. Thank you. It was very nice. All the time, come to our class.”
- S2: “I wish, we learn all the time like that, I was never bored.”
- S4: “I like these lessons very much. They were beautiful.”



S5: “When you first arrived, I did not like mathematics at all. I mean, I loved it a little bit. Then you brought some activities, which made me very happy and satisfied.”

S6: “This practice was legendary. Thank you so much for teaching us things that we didn’t know.”

S7: “I had a lot of fun in this lesson. We are grateful to our teachers. We loved you.”

S8: “I thought the event was very nice and it worked very well. I liked it very much.”

S9: “The topics of this lesson were more beautiful than the other lessons. I had a lot of fun and learned the subjects as usual.”

S10: “I thought this application was very good. We had fun and learned from this application. I want to do this practice again.”

S11: “It was excellent, and I am very sorry. I am sorry, because we will not do activities and problems like that. It was beautiful.”

S12: “You did your best to teach us math. Thanks a lot for that. And I liked this application very, very much.”

S13: “I wish mathematics was always this enjoyable.”

S14: “It was fantastic, I loved it, and it was a good thing. I am satisfied.”

S15: “I liked the application very much. Estimating division activities were my favorites. I like this topic very much. It was a useful mathematics exercise for me.”

S17: “It was very funny. I have learned. You are the best.”

S18: “It was very nice. So, we comprehended mathematics very well. We will miss you terribly.”

S19: “I think it was all a lot of fun. I’d like for them to happen again. This is how I better understood the division better.”

As can be seen, the sentences written by the students who agreed with this technique are displayed above. The following are the statements of the students who have a negative view of this practice, albeit in one aspect:

S3: “It wasn’t bad, it wasn’t good either. In the middle.”

S16: “I like this application very much. I like it very much whether or not I can solve problems.”

S20: “The event was very nice, I was glad. But I was not satisfied with my groupmates.”

S21: “It wasn’t too bad.”

DISCUSSION and CONCLUSION

That effective learning can be achieved by implementing educational programs designed in accordance with the constructivist approach rules (Keskin & Yıldırım, 2008). The first finding of this study, which looked at the effect of a mathematics lesson in which Jigsaw II was used as a cooperative learning technique -one of the learning methods of this constructivist approach- on the mathematics attitudes and constructivist learning situations of elementary school fourth grade students, is that students’ math attitudes and constructivist learning environment improved. According to previous research on constructivist learning environments (Akay, 2005; Ayaz & Şekerci, 2016; Decorte, 2004; Özgen & Alkan, 2014), activities appropriate for constructivist learning environments had a positive effects on students’ success, attitude and motivation.

According to the second finding of the study, Jigsaw II mathematics activities improved students’ math attitudes in favor of the posttest. It is expected that their attitudes toward the lesson will improve as a result of these practices, because the students may have accessed, structured and understood the information by themselves. This may have influenced their attitudes toward the mathematics lesson. Turgut (2018) conducted a meta-analysis study on the effect of cooperative learning on mathematics attitude, 23 effect size values of 16 studies were calculated. Three of these values are negative, while the other twenty are positive. As a result, the cooperative learning technique used favored the experimental group with 20 effect sizes. Akbuğa (2009) conducted a study with fourth grade primary school students on the subject of ‘group fractions’, and significant differences in their attitude toward mathematics were discovered in favor of the experimental group. Andersen (2009) attempted to determine her sixth-grade students’ responsibilities, participation and attitudes toward cooperative learning mathematics. During this process, she also attempted to evaluate her own teaching strategies. As she continued to practice, she observed that whether the students were attempting to learn only in



their groups or not, and their studies were not limited to the group, and that their level of participation and attitudes changed. As a result of the study, the students stated that they learned better with this method, and the teacher herself changed her teaching style, enjoyed using this technique while teaching, and began to use it more frequently. In her study, Glassman (1988) looked at the effects of collaborative learning on academic achievement, lesson attitude and personal respect. The study included 24 classes of third, fourth, and fifth grade students. At the conclusion of the study, no significant difference was discovered. In a 50-day experimental study, Johnson et al. (1978) investigated the effects of cooperative learning on the academic achievements and attitudes of 30 fifth and sixth grade students. According to the findings of the study, cooperative learning is more effective in increasing academic achievement and developing positive attitude in mathematics lessons. In many experimental studies involving cooperative learning methods, students' post-experimental mathematics attitude scores favored the experimental group's post-test (Akbuğ, 2009; Barbato, 2000; Efe, 2011; Ifamuyiwa & Akinsola, 2008; Koç, 2015; Pınar, 2007; Özdoğan, 2008).

Taking into account the studies in which the Jigsaw technique was used, Kaba, Özdişçi, & Soylu (2017) concluded that this technique did not result in a difference in the attitude towards geometry in their research, which examined the effect of Jigsaw-I on the 7th grade students' attitude towards geometry and self-efficacy, one of the cooperative learning methods. In their study at the fifth-grade level, Moskowitz et al. (2004) investigated the effectiveness of the Jigsaw method in terms of students' self-attitude, dual attitude toward their friends and attitudes toward school, course success and participation variables. The method was taught to 11 classroom teachers, and the lessons were taught using this method for one semester. Pre-test and post-test applications, on the other hand, have been chosen as a control group by 13 classes. They divided the evaluation into two parts: process and result, and came to the conclusion that Jigsaw applications performed exceptionally well in process evaluation. However, in terms of outcome evaluation, they did not achieve any positive effects, even in classes where the method was intensively used. In their experimental study, Slavin and Karweit (1979) investigated co-learning techniques with 388 fourth and fifth grade students from five schools, two of which were experimental and three of which were control groups. They created language, art, mathematics, and social lessons for 6-12 weeks using the technique of Team-Game-Tournament (mathematics), Student Teams-Success Departments (language and art lessons) and Jigsaw 2 (all social lessons). They achieved significant success in their success test (CTBS-Comprehensive Test of Basic Skill) in favor of the experimental group. Other variables (academic self-efficacy, self-esteem and anxiety) concluded that social convergence increased significantly in the experimental groups, though there was a little difference between the experimental and control groups. Many studies (Adams, 2013; Dyson, 2002; Zakaria, Solfitri, Yusoff, & Abidin, 2013) show that this technique has a positive effect on students' learning.

One of the second findings of the study was that structured learning environment scores of elementary school fourth grade students who used Jigsaw II Technique were significantly higher in favor of the post-test. One of the structured learning approach's learning techniques, the Jigsaw II technique may have assisted students learn as a group by making them feel comfortable in their mathematics lessons. There are many studies that support this research finding (Akay, 2005; Liang, 1997; Moore, 2005; Mulryan, 1994; Yılmaz, 2006).

Finally, at the end of the application, students were asked to express their thoughts on how the mathematics lesson was taught. According to this, students overwhelmingly favored the application. At the end of the application, the students said that they liked this practice very much because they were not bored, they had fun while learning, they liked mathematics more, and they wished their math lessons were like this. They said that this practice was not bad, that it did not satisfy with their group friends, and it was not too bad, in a way, even though it was at a very low rate. In many studies, including this one, students preferred the applications with activities designed in accordance with the constructivist-learning environment (Altun & Büyükduman, 2007; Bal & Doğanay, 2009; Baş, 2012;



Bayrak & Hacıömeroğlu, 2018; McManus & Gettinger, 1996; Tsai, 2000; Özgen & Alkan, 2012; Özkal, et.al. 2009).

Consequently, educating children who are exposed to mathematics education at an early age is crucial, as it should have positive impact on the students' attitude toward mathematics in the future. As a result, rather than providing students with information, it would be more appropriate to use active methods and techniques for effective teaching, such as various cooperative learning techniques (Şengül & Ekinözü, 2004). The biggest limitation of this study is that it is based on a single group experimental design. Unfortunately, this limitation may have resulted in a negative situation when it came to revealing the finding of the study.

The following recommendations are made based on the conclusion that the Jigsaw II technique is effective in increasing students' attitudes toward mathematics:

- Its biggest limitation is that it can only conduct research with a single group. As a result, a study with a control group is feasible.
- It is recommended that teachers use this technique in their classrooms on a regular basis.
- Using Jigsaw technique at other lesson and classroom levels, the effect on various variables can be investigated.
- This technique's effects on other cognitive and affective characteristics can be studied.

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THE EFFECT OF WORKED EXAMPLES METHOD ON PRIMARY SCHOOL STUDENTS' FRACTIONS ACHIEVEMENT

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Abstract

Examining the effect primary school teachers' preferred teaching method has on primary school students' mathematics achievement is important. In this context, the purpose of the research is to determine whether the worked example method is effective on students' ability to learn fundamental knowledge about fractions and their success in solving mid- and high-difficulty fraction problems compared to the traditional teaching method. The research uses the experimental design with a pretest-posttest control group. The experimental group has 36 students, and the control group has 37 students. While teaching fractions was conducted in accordance with the traditional teaching method in the control group, the worked example method was applied in the experimental group. The research results from the research determined the worked example method to be more effective than the traditional teaching method in learning the fundamental knowledge about fractions and developing student success in solving mid- and high-difficulty fraction problems. The traditional teaching method was not effective at developing students' success in solving high-difficulty fraction problems. Because problem solving is a skill that develops slowly, teachers should not prefer time-consuming methods in developing problem-solving skills. Using the worked example method is suggested in primary school as it has been revealed to develop problem-solving skills in a short time and these skills' foundations are laid in primary school.

Keywords: Primary school, mathematics, worked example method, fraction, problem solving.

INTRODUCTION

Mathematics is perceived as a difficult lesson to learn all over the world. As in all levels of education, primary school students also have difficulty in mathematics classes. This situation is one of the main problems of education systems in the world. Students' knowledge and skills as well as successes and failures in the last year of primary school are a result of their own work performances as well as their primary school teachers' during primary school. Student success in learning mathematics is affected by the way their primary school teacher teaches it.

Teachers teach how they perceive their role (Olkun & Toluk Uçar, 2014). Most teachers prefer traditional classroom practices over constructivist ones. Teachers use narration and question-answer methods to convey information instead of using appropriate methods to enable students to create knowledge (Khan, Mehmood, & Jumani, 2020; Rosenthal, 1995; Venkateswarlu & Kumar, 2020). Research results in the literature also show that teachers continue to use traditional methods in mathematics classes (Behlol, Akbar, & Sehrish, 2018; Lessani, Yunus, & Bakar, 2017; Nafees, 2011). In addition, most teachers have a table listing traditional problem-solving steps in their classroom (Glover, 2019). For this reason, studies that comparatively demonstrate the effectiveness of traditional teaching methods and different teaching methods are still current (Arise, 2018; Ardeleanu, 2019; Lessani, Yunus, & Bakar, 2017; Mutrofin, Degeng, Ardhana, & Stegosauri, 2019; Nurutdinova et al., 2016; Saira & Hafeez, 2021; Seeley, 2017).

The traditional method is one in which students are passive (Zhao & Li, 2020) and the teacher conveys information to the students (Gholami et al., 2016). The traditional method is teacher-centered, and this method of teaching in is the predominant case (Lessani, Yunus, & Bakar, 2017). A



teacher using the traditional method in mathematics class performs the following steps in turn (Stonewater, 2005):

- Teacher review of previous assignments
- Teacher's demonstration of low-level problem solutions.
- Assigning homework that can be solved by imitating what the teacher shows and does not require the supervision of the teacher, which the students can do in their own turn.

Samuelsson (2008) defined the traditional method used in his research as follows: The teacher explains the process and strategy on the board at the beginning of the lesson. Afterwards, students practice by solving the questions in the textbook. Within the scope of this research, the traditional method is expressed as one that mostly uses narration and question-answer methods together. In addition, the teacher presents the students with verbal expressions of knowledge and principles in the traditional method, in which the means-ends analysis is used in teaching problem solving. These methods do not help develop students' mathematical thinking (Boaler & Brodie, 2004; Jina, 2007). On the contrary, they prevent student participation and thinking (Brodie, 2007). These teacher-preferred methods cause students to experience failure in mathematics as well as to dislike and fear mathematics. As a result, the traditional teaching method is insufficient at providing students with complex cognitive competencies in mathematics classes. For this reason, new teaching methods have been investigated that will be effective in developing students' thinking and problem-solving competencies in all education levels from primary school to university. New teaching methods require processes in which students are more participatory and active, constantly studying or practicing (Compañ-Rosique, Molina-Carmona, & Satorre-Cuerda, 2020). Experts have developed many new learning methods to facilitate the mathematics-learning process in mathematics education (Lesnussa, 2019). One of these methods is the worked examples method, which has been shown as an alternative to learning through problem solving (Van Gog, Rummel, & Renkl, 2019). The effects of this method on student achievement in mathematics have been investigated for many years and are still being investigated (Corral, Quilici, & Rutchick, 2020; Nainan, Balakrishnan, & Mohamad Ali, 2020; Rodiawati & Retnowati, 2019; Yeo & Fazio, 2019; Yeo & Tzeng, 2020).

Studies on the worked examples method focus on mathematical problem-solving processes, and this method has proven to be effective in teaching problem solving (Baars, van Gog, de Bruin, & Paas, 2017; Gupta, & Zheng, 2020; Hoogerheide, Renkl, Fiorella, Paas, & van Gog, 2019; Widyastuti & Retnowati, 2021). Mathematical problem solving is a new attempt (Krulik & Reys, 1980), an intuitive process (Polya, 1945), and a model-generating activity (Lesh & Zawojewski, 2007). Solving math problems activates mental thinking and contributes to the mental development of the individual (Goffin & Tull, 1985). While people with advanced problem solving skills use information effectively, people who have not developed problem-solving skills only carry information (Altun, 2005). Understanding mathematical knowledge and establishing relationship between this information occur in the problem-solving process, which is at the center of mathematics curriculum (Jitendra, Griffin, Buchman, & Sczesniak, 2007). Problem solving has been the subject of many studies due to its importance (Karasel, Ayda & Tezer, 2010; Nguyen, Guo, Stamper, & McLaren, 2020). Based on the results from these studies, researchers have stated students to often have problems in transferring the knowledge and skills they learned in mathematics to new situations or problems and teaching methods to be needed to solve this problem (Van Gog, Paas, & Van Merriënboer, 2004). The reason for this is that the purpose of teaching is to provide students with knowledge and skills and to prepare them to transfer these knowledge and skills to different environments (Nelson, 2006). The reason why students cannot transfer information in mathematics is shown to be that students tend to solve problems without understanding the problem's underlying principles (Catrambone, 1996; Van Gog, Pass & Van Merriënboer, 2004). Primary school students, especially those who lack the cognitive structures known as schema, need an expert model that reveals the principles related to the problem, that relates these principles and states their role in problem solving, and that shows the



implementation processes step by step. In the worked example method, students are provided with the teaching support (scaffolding) they need by presenting the expert model.

Within this scope, the research discusses the teaching of fractions, which is one of the subjects that students need the most teaching support with following natural numbers in primary school. Many reasons exist for limiting the research to the topic of fractions. One of the reasons is that the subject of fractions is an important and fundamental subject in all grades of primary school that progresses cumulatively and is connected with other mathematical topics such as algebraic operations, ratios, proportions, decimal numbers, and percentage calculations (Ayvaz Can & Türer, 2018; Van de Walle, Karp & Bay-Williams, 2019). Another reason is that students make more mistakes and have more misconceptions about fractions (Van Hoof, Engelen, & Van Dooren, 2021). For example, the students find the result of $\frac{2}{4} + \frac{6}{8}$ as $\frac{8}{12}$ by treating the numerator and denominator as if they are natural numbers. These failures are a part of the student's process of transforming and transferring information (DeBlois, 1995). These mistakes made by students are quite common (Behr, Wachsmuth, & Post, 1985; Booker, 1998; Carraher & Schliemann, 1991; D'Ambrosio & Mewborn, 1994; Davis, 2003; Keijzer & Terwel, 2003; Leinhardt & Smith, 1985; Newstead & Murray, 1998; Oliveira & Ramalho, 1994; Orton & Frobisher, 1996). Teaching fractions is one of the most difficult math subjects for teachers and learning for students. For this reason, it is extremely important for the teacher to use appropriate methods in eliminating the difficulties and failures experienced in the learning and teaching process (Kyriakides, 2006; Ma, 2010; Petit & Zawojewski, 1997). The need exists for methods that will guide teachers and enable students to learn effectively and meaningfully without misconceptions about the subject of fractions in which learning and teaching difficulties have increased remarkably. Studies in the literature (Bokosmaty, Sweller, & Kalyuga, 2015; Lockwood, Ellis, & Lynch, 2016; Pachman, Sweller & Kalyuga, 2014; Sweller, 2011) have shown the worked example method to meet this need. Therefore, usefulness is found in having primary school teachers know and apply this method.

Theoretical Underpinnings

Learning through worked examples has received much attention recently, but the concept of learning by example is nothing new. From the mid-1950s to the 1970s, cognitive and educational psychologists benefited from the paradigm of learning-by-example related strategies for studying and defining the processes of concept learning (Atkinson, Derry, Renkl, & Wortham, 2000; Bruner, Goodnow, & Austin, 1956; Bourne, Goldstein, & Link, 1964; Tennyson, Wooley, & Merrill, 1972). Educational psychologists have focused specifically on educational practices that demonstrate how to select, present, and arrange examples (Tennyson & Cocchiarella, 1986). In the 1950s, Miller conducted his first studies on the cognitive load theory, which was effective in the emergence of worked examples. Miller stated the limits of the capacity of working memory. While identifying ways to facilitate concept learning was focused upon until the 1970s, some researchers focused on more complex forms of knowledge and learning after the 1970s (Brewer & Nakamura, 1984). At that time, researchers who investigated the cognitive load theory focused on the concept of schema and often used it to reveal the performance differences between experts and novices (Chi, Feltovich, & Glaser, 1981; Chi, Glaser, & Rees, 1982; Hinsley, Hayes, & Simon, 1977; Rumelhart & Ortony, 1977; Silver & Marshall, 1990; Silver, 1979; Van Lehn, 1990). In light of these developments, Sweller conducted detailed studies on how the brain processes and stores information within the scope of cognitive load theory. Sweller planned these studies in particular on students taking mathematics problem-solving instruction.

Sweller and other researchers have continued to test the cognitive load theory over the years, focusing on explaining how worked example should be designed to encourage efficient learning in teaching environments (Darabi, Nelson, & Paas, 2007; Paas & Van Merriënboer, 1994; Sweller, 2006; Van Merriënboer & Sweller, 2005). The first studies on worked examples were carried out under controlled laboratory conditions. The findings showed the worked examples approach to be able to



applied effectively on larger scales and under everyday classroom conditions (Sweller, Ayres, & Kalyuga, 2011). The first studies on the use of worked examples in teaching were conducted in the field of mathematics. Sweller and Cooper (1985) investigated worked example in algebra. They found the failure rate of students in the experimental group in which the worked example had been used to be lower compared to the students in the control group. The students in the experimental group were also found to be faster at problem solving. Examining the effects worked examples have in mathematics has become the focus for many researchers (Brooks, 2009; Carroll, 1994; Chen, Retnowati, & Kalyuga, 2020; Corral, Quilici, & Rutchick, 2020; Faulkner, 1999; İltüz, 2016; Özcan, Kılıç, & Obalar, 2018; Pass, 1992; Pease, 2012; Pillay, 1994; Paas & Van Merriënboer, 1994; Rodiawati & Retnowati, 2019; Sweller, 2020; Sweller & Cooper, 1987).

The Worked Examples Method

The worked examples method is the teaching method preferred by cognitive load theorists and is used by teachers to reduce students' cognitive load in complex learning tasks. Worked examples are the tools of this method (Morrison & Anglin, 2005; Van Gog & Rummel, 2010). A worked example is a step-by-step example of how to solve a problem or perform a task (Clark & Mayer, 2011; Clark, Nguyen, & Sweller, 2006; Da Costa & Seok, 2010; Renkl, 2002, Sweller, Ayres & Kalyuga, 2011) and consists of three elements; the problem, solution steps, and the final result (Renkl & Atkinson, 2003; Renkl, 1997; Renkl, 2005). Worked examples typically have a structure that shows a problem, a goal, and solution steps. It allows the goal to be reached from the problem (Van Gog, Paas, & Van Merriënboer, 2004). For this reason, the learner focuses only on the problem and the solution steps they will use to solve the problem while learning with worked example. This process significantly reduces the amount of load on working memory and facilitates learning (Kalyuga, 2008).

In the worked examples method, one or more principles related to the relevant field are given first. Later, students are presented with several sufficient examples (Renkl & Atkinson, 2010). In the worked examples method, the proper steps to solving problems are presented in predetermined problem categories (Faulkner, 1999). In this way, students have the necessary solution steps for solving problem (Brooks & Crippen, 2005). Worked example can be categorized as completion and full-worked examples. Completion examples provide partial solution steps, and students are expected to solve the rest of the problem based on the partial solution. Unlike the completion example, the full-worked example shows all steps of the problem solving process (Gupta & Zheng, 2020).

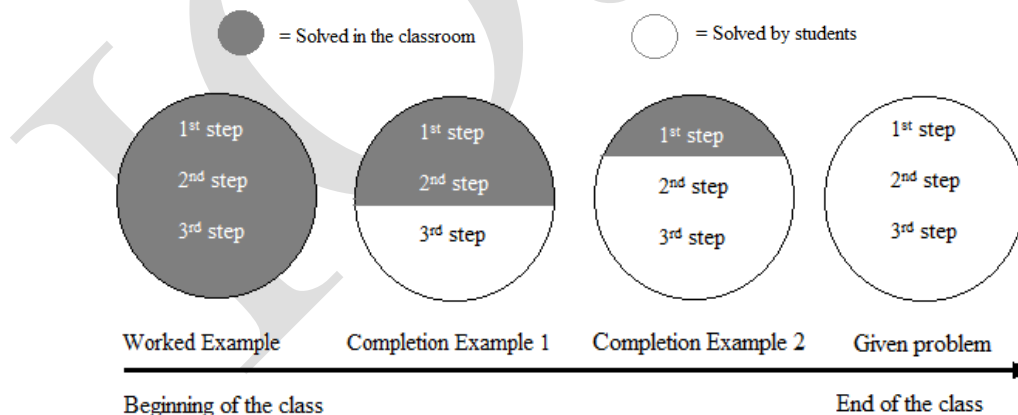


Figure 1. Transition from worked examples to problems (Clark, Nguyen, & Sweller, 2006)

Assuming the teaching of a probability calculation, it is first started with the worked example presented with all sides, represented by the gray circle on the left. Then it is passed to a second example where the last step is not done. This example matches the second circle in Figure 1. The first two steps are explained to the students, and the last step is left for the students to complete. At the end, students are asked a probability problem as an exercise problem to work out on they own. This



situation matches the rightmost circle. In this process, students gradually perform an increasing mental process (Clark & Mayer, 2011).

Worked Examples in Mathematics

Until the 1960s, traditional problem-solving strategies had been widely applied in educational settings in mathematics problem-solving teaching (Tuovinen, 1997). While solving a mathematical problem, an individual goes through many complex cognitive processes such as understanding the problem clause, choosing the necessary data for the solution, solving the problem, and deciding whether the answer is logical (Charles, 1985). Cognitive load theorists who study problem-solving processes have criticized the use of problem-solving strategies commonly used in problem solving teaching (Ashman, Kalyuga, & Sweller, 2020; Darabi, Sikorski, Nelson, & Palanki, 2006; Sweller, 2006; Sweller, Ayres, & Kalyuga, 2011). In the traditional approach, teachers use means-ends analyses (determining what is given and asked). Determining what is given and asked in the traditional approach means deciding what the problem is and what to do. Experienced problem solvers immediately identify what is given and asked in the problem, namely the means and the ends that will lead to the goal. Novice problem solvers may focus on unnecessary details (Senemoğlu, 2020). Therefore, working memory can be overloaded due to its limited capacity. Conducting studies to minimize cognitive load, Sweller adapted worked examples onto the mathematics problem-solving teaching process. Sweller argued that students who study using worked examples learn better. Sweller attributed this to the minimization of cognitive load.

According to the cognitive load theory, the use of traditional problem-solving strategies requires especially inexperienced students to make a significant amount of mental effort in the process of problem solving (Paas & Van Merriënboer, 1994; Paas, Renkl, & Sweller, 2004; Sweller, 1988; Van Gog, Paas & Van Merriënboer, 2004). For this reason, the working memory is easily overloaded during teaching activities, especially in the early stages of learning when students' capacity is limited (Clarke, Ayres, & Sweller, 2005; Sweller, 1988). Cognitive load theory emphasizes that the load that occurs on the working memory should be brought under control in order to realize efficient learning (Sweller, 2006; Van Merriënboer & Sweller, 2005). The cognitive processes in the learning process with respect to this theory are given in Figure 2.

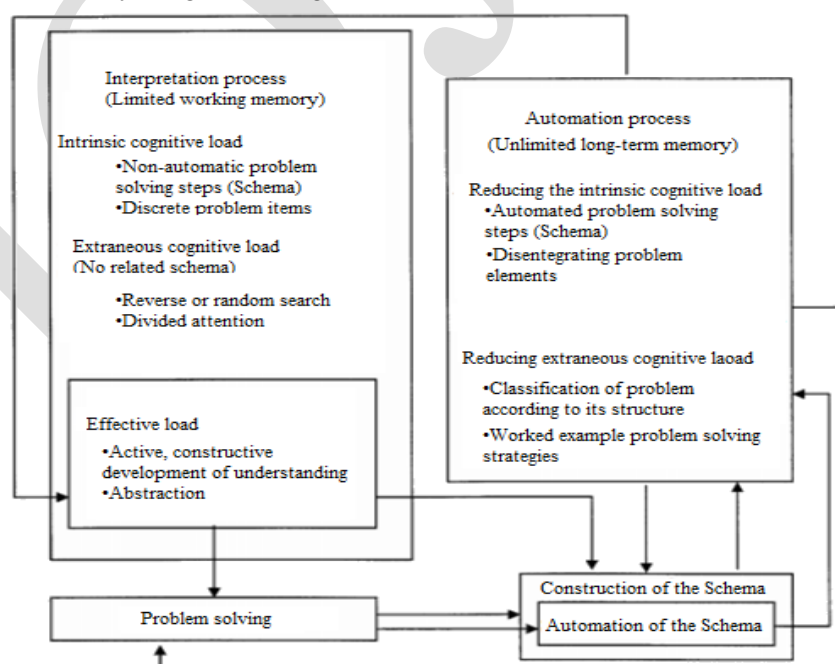


Figure 2. The learning process (Brooks, 2009)



When examining the Figure 2, cognitive loads in the learning process are seen to occur in the working memory, which has a limited capacity. When this burden is not brought under control, the development of schemata is prevented; automation cannot be realized and slow learning occurs as a result (Brooks, 2009). For this reason, traditional problem-solving teaching is ineffective on inexperienced students who have not yet acquired a comprehensive cognitive schema (Sweller, 1988).

Researchers studying the cognitive load theory have focused on the concept/schema construction process. Researchers have argued one of the ways to positively use the relationship between cognitive loads in short-term memory in the learning process to be to use worked examples in the learning process (Hollender, Hofmann, Deneke, & Schmitz, 2010). The worked example used in problem-solving teaching and the processes of traditional problem-solving approach are given in Figure 3.

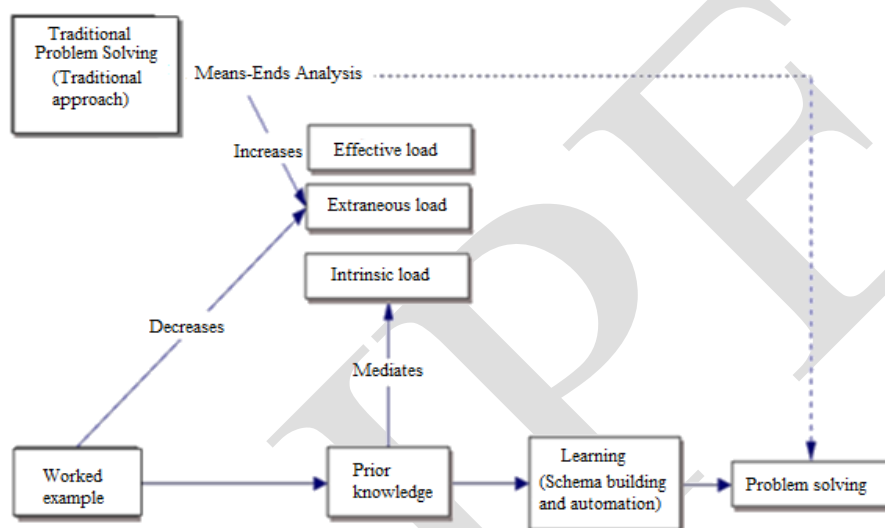


Figure 3. Worked example in learning (Brooks, 2009)

In traditional problem solving approach, means-ends analysis is used. Means-ends analysis enables to determine what is given and what is desired, what the problem is and what should be done (Senemoğlu, 2020). Experienced problem solvers immediately identify what is desired and given in the problem, namely the purpose and the means that will lead to the goal. Novice problem solvers can focus on unnecessary details (Senemoğlu, 2020). This situation causes an increase in extraneous load in working memory (Sweller, 1988). Because of the limited working memory, means-ends analysis has been criticized by cognitive load theorists (Sweller & Levine, 1982). In other words, cognitive load theorists criticized the use of problem solving strategies in the educational environment (means-ends analysis) (Darabi, Sikorski, Nelson, & Palanki, 2006). Cognitive load theorists have stated that even though general strategies such as means-ends analysis are effective problem-solving strategies, they are not suitable for the limited capacity of working memory and this technique is insufficient in creating schema (Sweller, 1998).

According to cognitive load theorists, working primarily with worked example in problem-solving teaching provides student with an analogy while solving the problem. When moving to problem solving without using an analogous example, most of the capacity of working memory is used to find the best solution strategy. Very little of it is used for schema construction (Clark, Nguyen, & Sweller, 2006). Rather than focusing on goals or sub-goals with worked example, the learner's attention focuses on the problem situation and operations. This way forms effective structures between cognitive schemata and helps form methodological skills (Clark & Mayer, 2011; Van Gerven, Paas, Van Merriënboer, & Schmidt, 2002). Subsequently, extraneous cognitive loads are reduced by transitioning to exercises that help consolidate and automate new information through worked examples, as seen in Figure 3 (Clark & Mayer, 2011). Thus, efficient use of cognitive capacity is ensured in the learning process. To sum up, the worked example method is an important pedagogical



method that can be used in the formation of schemata that support problem-solving skills and in providing faster learning (Abdul-Rahman & Du Boulay, 2014).

The Use of Worked Examples in Primary School

The worked examples method helps novice students in particular who do not have much experience in problem solving. Novice students are defined as students who lack the cognitive structures (schema) for learning new information. The needs of novice students should be met with well-structured target-oriented educational approaches (Jones, 2014). The worked examples method provides well-structured training. In addition, many studies have found that young children need more teaching support than adults for completing a difficult task (Hsin & Wu, 2011; Wood, Bruner, & Ross, 1976). For this reason, Hsin and Wu (2011) recommend that educators provide more scaffolding for young children to help them achieve cognitive goals. With the worked examples method, children of primary school age can be provided with the scaffolding they need.

When examining the results from the studies in the literature, the worked examples method provides the scaffolding needed by novice primary school students who do not have enough experience and lack cognitive structures. Therefore, the effects of this method on mathematics lessons at the primary school level and should be examined.

Research Hypothesis

The aim of this research is to reveal whether the teaching method used by primary school teachers in mathematics lessons has an effect on primary school students' mathematics achievement. In this context,

The mathematics achievement of students who learn mathematics with the worked examples method is different from those who learn according to traditional teaching methods.

To test this hypothesis, the following sub-hypotheses are developed and tested.

Sub-Hypothesis 1: The worked examples method effects the development of primary school 4th-grade students' achievement in learning fundamental knowledge about fractions and solving mid- and high-difficulty fraction problems.

Sub-Hypothesis 2: The traditional teaching method effects the development of primary school 4th grade students' achievement in learning fundamental knowledge about fractions and solving mid- and high-difficulty fraction problems.

Sub-Hypothesis 3: The effects of the worked examples method and the traditional teaching method differ from each other in how primary school 4th-grade students' learn fundamental knowledge about fractions and how they develop success in solving mid- and high-difficulty fraction problems.

METHOD

Research Model

A pretest–posttest quasi-experimental design was used in the current study. This design is the best way to explain the cause-effect relationships between variables (Fraenkel & Wallen, 2009). The design of the study are indicated in Table 1.

Table 1. The design of the study with the assessment instruments

Group	Pretest	Procedure	Posttest
Experimental Group	Fundamentals about Fractions Learning Achievement Test, Problem Solving Achievement Test 1 and Problem Solving Achievement Test 2	Worked example method	Fundamentals about Fractions Learning Achievement Test, Problem Solving Achievement Test 1 and Problem Solving Achievement Test 2
Control Group	Fundamentals about Fractions Learning Achievement Test, Problem Solving Achievement Test 1 and Problem Solving Achievement Test 2	Traditional teaching method	Fundamentals about Fractions Learning Achievement Test, Problem Solving Achievement Test 1 and Problem Solving Achievement Test 2



While in the experimental group was applied the worked examples method, in the control group was applied the traditional teaching method.

Participants

The experimental group has 36 students in total (18 female, 18 male). The control group has 37 students (19 female, 18 male). Their ages range from 9 to 10 years. Students studying in the 4th grade of primary school were chosen as the participants of the study. The reason is that, according to the Primary School Mathematics Curriculum, the problem-solving outcomes related to fractions examined within the scope of the research occur for the first time at the 4th grade level. Due to students' pre-test scores not being normally distributed, the non-parametric test was applied. Mann Whitney U-Test results regarding the scores the students got on the pre-tests are given in Table 2.

Table 2. Pre-test success scores of the students in the study group Mann Whitney U Test results

Score	Group	N	Mean Rank	Sum of Ranks	U	p
Fundamentals about Fractions Learning Achievement Test	Control G.	37	36.16	1338.00	635.00	.72
	Experimental G.	36	37.86	1363.00		
Problem Solving Achievement Test 1	Control G.	37	37.20	1376.50	658.50	.93
	Experimental G.	36	36.79	1324.50		
Problem Solving Achievement Test 2	Control G.	37	37.77	1397.50	637.50	.72
	Experimental G.	36	36.21	1303.50		

Primary school 4th-grade students' scores from the Fundamentals about Fractions Learning Achievement Test ($U=635.00$, $p>.05$), from the Problem Solving Achievement Test 1 ($U=658.50$, $p>.05$), and from the Problem Solving Achievement Test 2 ($U=637.50$, $p>.05$) do not show any statistically significant difference with respect to being in the control or experimental group.

Measurement Tools

The research uses three two-tier achievement tests of varying difficulty levels developed by the researcher: the Fundamentals about Fractions Learning Achievement Test (FFL-AT), Problem-Solving Achievement Test 1 (PS-AT 1), and Problem-Solving Achievement Test 2 (PS-AT 2) (Ayvaz Can, 2018). The two-tier tests were developed by Treagust (1988). While the first tier of two-tier tests involves a multiple-choice question, the second tier involves a question about the reason for the answer to the first tier question (Haslam & Treagust, 1987). The necessity of revealing the reason in two-tier tests is a sensitive and effective way to measure students' meaningful learning (Tamir, 1989). The structure of the two-tier achievement tests is suitable for students who are able to express their own thoughts and reasoning easily during the problem-solving process, which is one of the objectives of the mathematics curriculum. An open-ended two-tier test type was used in the research from three different two-tier test types: multiple-choice, classification, and open-ended. Two-tier achievement tests were developed following the methods suggested by Treagust (1988) and Treagust and Chandrasegaran (2007) and consist of three parts. The first part takes the determination of the content into consideration. The second part takes the determination of conceptual knowledge into consideration. The third part lastly takes the tiers related to test development into consideration.

These tools scores ranged from 0 to 100. The reliability of FFL-AT was calculated as .92. Mean item difficulty was .716 and mean discrimination index was .536. The reliability of PS-AT 1 was calculated as .93. Mean item difficulty was .528 and mean discrimination index was .516. The reliability of PS-AT 2 was calculated as .92. Mean item difficulty was .282 and mean discrimination index was .468. The FFL-AT, PS-AT 1 and PS-AT 2 was implemented as a pre-test and post-test. According to the classification of different item difficulty index ranges, the item difficulty index range of easy questions in the study is .65-.79. Those with medium difficulty ranged from .35 to .64 and those of difficult questions between .20 and .34 (Crocker & Algina, 1986). PS-AT 1 consists of mid-difficulty fraction problems and AT 2 consists of high- difficulty fraction problems.



Procedure

Sakarya ranks 54th among Turkey's 81 provinces in terms of educational development level (Hendek District Strategic Plan, 2015). Sakarya's educational achievement is not at an acceptable level. The same is true for Sakarya's Hendek district. For this reason, conducting research to develop the math problem-solving skills of primary school students studying in Hendek has been deemed valuable. First, the teaching of 23 classroom teachers was observed one year before the experimental study in order to determine how the classroom teachers process the fraction sub-learning area to be examined in the study. At the end of the observations, it was observed that all classroom teachers presented the problems to the students by using means-ends analysis (saying/asking /writing what is given and what is asked). It was observed that no teacher used the worked examples method. A school was chosen randomly from the schools observed, and voluntarily participated in the study. There are 6 different 4th grade branches in this school. A pre-test was applied to all the students who wanted to participate in the study voluntarily in all branches. First, a branch was chosen as the control group. Afterwards, students from the other five branches who got close to the pre-test scores of the students in the control group were selected and the experimental group was formed. Accordingly, the research continued for a total of five weeks (20 lesson hours) at two days per week (4 lesson hours) at a primary school in Hendek. The time devoted to the learning outcomes to be addressed in the 5-week process was shared with the experimental and control groups before the experiment.

The training program applied in the experimental group was developed in accordance with the teaching principles of the worked examples method. This process investigated problem types related to fractions and created the categories of "fraction problem categories" by taking expert opinions. These categories are: "fraction problems related to determining the specified fraction of a multiple", "fraction problems that require adding fractions with common denominators", "fraction problems related to subtracting fractions with common denominators", "fraction problems that require both addition and subtraction with common denominators". The worked examples and problems presented to the students in each category in the experimental group and were included in the curriculum after obtaining expert opinion.

For instance, worked examples, completion examples and problem used in the category "Fraction problems related to finding the asked fraction of a multiplicity and proving the specified condition" are given below. This process has progressed as in Figure 1.

- There are 115 animals in a herd. $\frac{2}{5}$ of these are goats. How many goats are there in this herd? (Full worked example)
- An automobile covered first $\frac{2}{7}$ and then 65 km of the 280 km road. How many kilometres has the car covered? (Completion worked example 1)
- Mert will share $\frac{3}{4}$ of his 360 balls equally to his four friends. How many marbles will each get? (Completion worked example 2)
- A hardware store sells $\frac{1}{5}$ of a 40 m hose to a customer and $\frac{2}{5}$ to another customer. How many meters of hose did the hardware store sell to these two customers? (Problem)

Problems are presented in an order from easy to difficult. The problems are listed in a way where each forms the lower step of the subsequent problem. This way enables students to transfer their knowledge and skills from the previous problem to the solution for the next problem. In the experimental group, the teacher presented the worked examples to the students because the students are expected to model problem-solving processes from an expert. Students are not passive in this process. The teacher solved the problem by explaining the solution to the problem being solved. The teacher includes students in the problem-solving process by asking questions. The teacher provides enough (at least four for each category) worked examples and also asked problems for the students to solve independently. These problems the teacher asks consist of problems that can be solved in line with the experience obtained from the worked examples. This process is not planned as a contest. A completely learning-oriented climate was created.



The worked-example problems were solved in line with the problem-solving steps of Polya (1945). Polya's (1945) problem-solving steps were developed for math problems as a process consisting of four steps: understanding the problem, making a plan, implementing, and evaluating the plan. The problems were solved by using the figure drawing strategy, which is among Polya's (1945) problem-solving techniques (heuristics). Because primary school students are in the concrete operational period, the strategy of figure drawing is among the most appropriate strategies used in concretizing the problems. The problems solved within the scope of the research consist only of routine problems. While presenting the solutions of the worked-example problems to the students, the information is given in consecutive rows, not holistically.

The training program applied in the control group was performed in line with the Mathematics Lesson Teacher Guide, Mathematics Lesson Student Book, and Workbook approved by the Ministry of National Education. The lessons in the control group started with the problems presented in accordance with the traditional approach. In addition, the lessons continued with the subsequent problems the students were. In the experimental group, the learning process started with more than one worked example and continued with practice problems.

As a result, the different methods were used in the experimental and control groups within the scope of this research. The traditional problem-solving approach applied in the control group did not focus on developing an appropriate schema specific to the field. In the worked examples method applied in the experimental group, the focus was on developing schema or transforming the existing schema. In the experimental group in which the worked examples method is applied, the learning process was planned in a way where the learner would be able to transfer knowledge in the process of schema construction, development, and change. This was not the case in the group where the traditional problem-solving approach is applied.

Data Analysis

As a result of examining the kurtosis and skewness coefficients and Shapiro-Wilk test, the measurements of the dependent variables were found to not be normally distributed. The decision was made to use nonparametric statistics. The Wilcoxon signed-rank test was used to compare the pre-test and post-test success scores for the students in both the experimental and control groups (Table 3 and Table 4). The Mann-Whitney U test is used for comparing the experimental and control groups' post-test success scores (Table 5). A p value of $<.05$ was taken as statistically significant. Effect size is a standard measure showing how much effect the independent variable has on the dependent variable (Murphy & Myers, 2004). For this reason, the effect size was also examined in the research. Effect sizes ranges have low level if $r < .20$, medium level if $.20 < r < .50$, and high level if $r > .50$ (Cohen, 1988). Two experts worked separately for the scoring of the open-ended second stage of the two-stage achievement tests. The reliability of the research was ensured by considering the consistency among the evaluators.

RESULTS

The research first tested Sub-Hypothesis 1 (The worked examples method has an effect on the development of primary school 4th-grade students' achievement of learning the fundamental knowledge about fractions and solving mid- and high-difficulty fraction problems). The obtained findings are given in Table 3.

When examining Table 3, a statistically significant difference is seen to exist between the success scores for learning fundamental knowledge ($z = -5.28, p < .05$) about fractions before and after the experiment of the students learning about fractions with the worked examples method solving mid-difficulty fraction problems ($z = -5.32, p < .05$) and high-difficulty fraction problems ($z = -5.29, p < .05$). Considering the mean rank and totals of the different scores, these observed differences are seen to favor the post-test score. Accordingly, the worked examples method has an effect on students' learning the fundamental knowledge about fractions and developing their success in solving mid- and high-difficulty fraction problems.

**Table 3.** Comparing the pretest and posttest success scores of the experimental group learning fractions with the worked examples method

Score	Group	N	Mean Rank	Sum of Ranks	z	p	r
FFL-AT	Negative Ranks	0	.00	.00	-5.28	.00	-.88
	Positive Ranks	36	18.50	666.00			
	Ties	0					
PS-AT 1	Negative Ranks	0	.00	.00	-5.32	.00	-.89
	Positive Ranks	36	18.50	666.00			
	Ties	0					
PS-AT 2	Negative Ranks	0	.00	.00	-5.29	.00	-.88
	Positive Ranks	36	18.50	666.00			
	Ties	0					

The effect of the worked examples method on increasing the success of learning fundamental knowledge about fractions is $-.88$. Its effect on increasing success in solving mid-difficulty fraction problems is $-.89$. Its effect on increasing success in solving high-difficulty fraction problems is found to be $-.88$. These findings show the worked examples method to have a high-level effect on increasing students' success in fractions. As a result, Sub-Hypothesis 1 is accepted.

The research also tested Sub-Hypothesis 2 (Traditional teaching methods have an effect on primary school 4th-grade students' learning fundamental knowledge about fractions and on developing their success in solving mid- and high-difficulty fraction problems). The obtained findings are given in Table 4.

Table 4. Comparing the control group's pretest and posttest success scores on learning about fractions using traditional teaching methods

Score	Group	N	Mean Rank	Sum of Ranks	z	p	r
FFL-AT	Negative Ranks	0	.00	.00	-3.28	.00	-.54
	Positive Ranks	36	18.50	666.00			
	Ties	1					
PS-AT 1	Negative Ranks	0	.00	.00	-2.22	.00	-.37
	Positive Ranks	34	17.50	595.00			
	Ties	3					
PS-AT 2	Negative Ranks	2	4.5	9.00	-1.07	.13	
	Positive Ranks	22	13.23	291.00			
	Ties	13					

When examining Table 4, a statistically significant difference is seen between pre- and posttest success scores for learning fundamental knowledge ($z=-3.28, p<.05$) about fractions for the students learning about fractions with the traditional teaching method for solving mid-difficulty fraction problems ($z=-2.22, p<.05$). However, no statistically significant difference was concluded to have occurred between the pretest and posttest success scores ($z=-1.07, p>.05$) for solving high-difficulty fraction problems. When considering the differences in mean rank and totals of the scores, the observed differences is seen to be in favor of the post-test score. Accordingly, the traditional teaching method has an effect on developing students' success in learning fundamental knowledge about fractions and solving mid-difficulty fraction problems but no effect on developing success in solving high-difficulty fraction problems.

The effect of traditional teaching methods on increasing the success in learning fundamental knowledge about fractions is $-.54$. Its effect on increasing success in solving mid-difficulty fraction problems is found to be $-.37$. The traditional teaching method has a moderate effect on increasing students' success in learning fundamental knowledge about fractions while solving mid-difficulty fraction problems. However, this method does not have an effect on increasing students' success in solving high-difficulty fraction problems. As a result, Sub-Hypothesis 2 has been partially accepted. Increases in the achievement scores for the students in the experimental and control groups for the pretest and posttest scores are given in Figure 4.

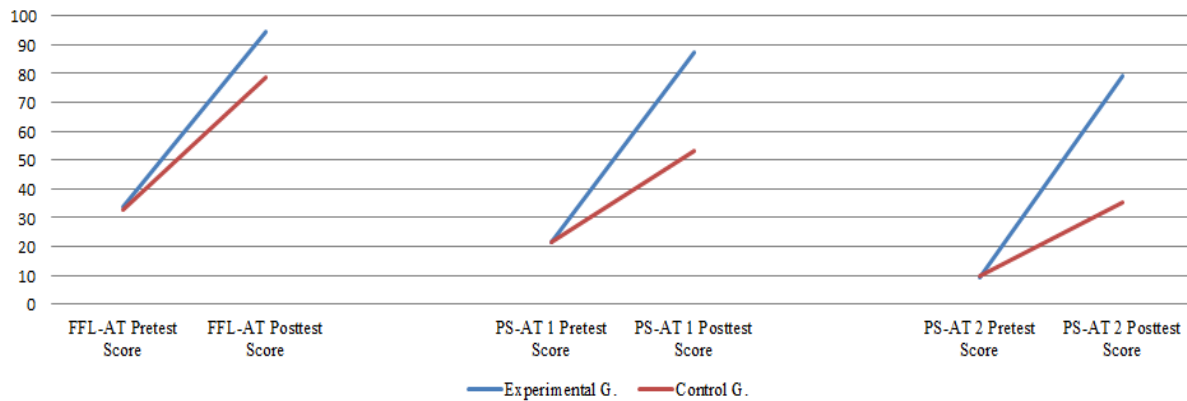


Figure 4. Comparison of the success scores from students in the experimental and control groups for the pre-test and post-test

For students in the control group, the average FFL-AT score increased from 32.97 to 78.65, the average PS-AT 1 score increased from 21.62 to 52.97 and the average PS-AT 2 score increased from 9.73 to 35.14. Their average FFL-AT score increased by 45.68 points, their average PS-AT 1 score increased by 31.35 points, and their average PS-AT 2 score increased by 25.41 points.

For the students in the experimental group, the average FFL-AT score increased from 33.61 to 94.44, the average PS-AT 1 score increased from 21.68 to 87.22, and the average PS-AT 2 score increased from 9.45 to 79.45. Their average FFL-AT score increased by 60.83 points, their average PS-AT 1 score increased by 65.54 points, and their average PS-AT 2 score increased by 70 points.

When examining Figure 4, the average post-test success scores for students in both the experimental and control groups were higher than their pretest average success score for all three tests. In this way, the research tests Sub-Hypothesis 3 (The effects of the worked examples method and the traditional teaching method differ from each other in how primary school 4th-grade students learn fundamental knowledge about fractions and how they develop success in solving mid- and high-difficulty fraction problems). The obtained findings are given in Table 5.

Table 5. Comparing the post-test success scores for students in the experimental and control groups

Score	Group	N	Mean Rank	Sum of Ranks	U	p
FFL-AT	Control G.	37	22.15	819.5	116.50	.00
	Experimental G.	36	52.26	1881.5		
PS-AT 1	Control G.	37	20.46	757.00	54.00	.00
	Experimental G.	36	54.00	1944.00		
PS-AT 2	Control G.	37	23.19	858.00	155.00	.00
	Experimental G.	36	51.19	1843.00		

The scores obtained from the FFL-AT, which measures the success of 4th-grade students in the experimental and control groups on learning fundamental knowledge about fractions, show a statistically significant difference with respect to their groups ($U=116.50, p<.05$). When considering the mean rank (MR), the success scores of students in the experimental group ($MR_{exp}=52.26$) were found higher than those in the control group ($MR_{cont}=22.15$). Based on this finding, the worked examples method has been concluded to be more effective than the traditional teaching method in increasing student success in learning fundamental knowledge about fractions.

The scores for the 4th-grade students in the experimental and control groups from the PS-AT 1, which includes the mid-difficulty fraction problems, show a statistically significant difference when comparing the experimental and control groups ($U=54.00, p<.05$). When considering the MR, the success scores for the students in the experimental group ($MR_{exp}=54.00$) are found to be higher than



those in the control group ($MR_{\text{cont}}=20.46$). Based on this finding, the worked examples method is concluded to be more effective than the traditional teaching method in increasing student success in solving mid-difficulty fraction problems.

The scores for the 4th-grade students in the experimental and control groups from the PS-AT 2, which includes high-difficulty fraction problems, show a statistically significant difference according to the groups they are in ($U=155.00$, $p<.05$). When considering the *MR*, the success scores for the students in the experimental group ($MR_{\text{exp}}=51.19$) are found to be higher than those in the control group ($MR_{\text{cont}}=23.19$). Based on this finding, the worked examples method is concluded to be more effective than the traditional teaching method in increasing student success in solving high-difficulty fraction problems.

DISCUSSION and CONCLUSION

This research has aimed to reveal whether the teaching method primary school teacher's use in mathematics lessons has an effect on primary school students' mathematics achievement. In this context, the effects of the worked examples method and the traditional teaching method have been compared. At the end of the experimental procedures, the worked examples method was found to be more effective than the traditional teaching method. The reason for this is thought to be that the worked examples method reduces the extraneous cognitive load of primary school students with little experience; extra cognitive loads negatively affect learning in the process of complex skill acquisition. In addition, not exceeding the capacity of the working memory is considered as another reason why the worked examples method is effective.

The research has also found the worked examples method to be more effective than the traditional teaching method in developing the achievement of primary school 4th-grade students in learning fundamental knowledge. When reviewing the literature, the worked examples method is seen to be an effective method in teaching fundamental knowledge and concept knowledge. Kim, Weitz, Heffernan, and Krach (2009) concluded the worked examples method to be an effective method for students to acquire conceptual knowledge. Özcan, Kılıç, and Obalar (2018) stated that students' success in showing fractions on the number line increased in their research using the worked examples method. At the end of an experimental study on the worked examples method, Tüker (2013) found it to be an effective method for students to understand a subject. As a result of the research conducted by Booth et al. (2013), the worked examples method was found to be useful in developing conceptual understanding in students. With the use of the worked examples method, students learn fundamental information and concepts more easily as they have better learning performance (Carroll, 1994; Zhu & Simon, 1987). Zhu and Simon (1987) found that students in classrooms applying the worked examples method showed better learning performance than students in classrooms using traditional methods. Carroll (1994) found students in algebra classes to benefit more from the application processes of the worked examples method compared to traditional applications. The results obtained by Kim, Weitz, Heffernan, and Krach (2009); Tüker (2013); Özcan, Kılıç, and Obalar (2013); Zhu and Simon (1987); and Carroll (1994) support this study's conclusion that the worked examples method is an effective method for students to learn fundamental knowledge obtained from this study.

The research found the worked examples method to be more effective than the traditional teaching method in improving the success of primary school 4th-grade students in solving mid- and high-difficulty problems. The most important prerequisite for successfully solving problems is to know the schemata appropriate to the problem type (Gick & Holyoak, 1983; Reed, 1993). When a problem is encountered, if this problem belongs to a problem category with known structural properties, the relevant schema is taken from memory. The worked examples method has proven to be one that supports schema acquisition according to problem types, especially in the early stages of skill acquisition (Gerjets, Scheiter, & Catrambone, 2006). The situations emphasized in the literature by Gick and Holyoak (1983) and Gerjets, Scheiter, and Catrambone (2006) support this study's result that the worked examples method is an effective method for improving problem-solving skills.



This research showed the problem-solving performance of the students in the experimental group, which used the worked examples method to be higher than that of the students in the control group. In other words, the results from the research observed the positive effects worked examples have on problem-solving performance. A worked example consists of a problem statement, the steps leading to a solution, and a final answer; worked examples guide students about a systematic and complete problem-solving process (Atkinson, Renkl, & Merrill, 2003; Renkl, 1997). This guidance helps students develop problem-solving skills and perform better in problem-solving processes (Rourke & Sweller, 2009; Van Gog, Kester, & Paas, 2011). This situation supports the fact that the problem-solving success of students in the control group who were not applied this guidance within the scope of the purpose of the research was lower than the success of the students in the experimental group. In the literature, Hurioğlu and Efendioğlu (2017) concluded the worked examples method to be effective in providing students with problem-solving skills, which also supports the result of this research. Kusuma and Retnowati (2021) conducted a research to improve problem-solving skills and operational fluency. The results from their study stated the worked example method to be effective in gradually gained problem-solving skills and operational fluency. In addition, Kusuma and Retnowati (2021) stated that worked examples provide informational aid to novice students that can be used as scaffolding. The results obtained from this study are consistent with the results they obtained. In addition, Corral, Quilici, and Rutchick (2020) examined the effect of schema acquisition on math problem solving in their research. Students were shown to have benefited from worked examples in the schema-acquisition process. The results from their study found the participants in the group in which worked examples had been applied to show better problem-solving performance.

The current research has found the worked example method to be effective at increasing students' success in solving difficult problems. However, the traditional teaching method was not found to be an effective method. When examining the literature, Chen, Retnowati, and Kalyuga (2020) are seen to have conducted experimental research on worked examples. Participants from their study were 52 primary school students. At the end of the research, they concluded choosing the worked examples method to be advantageous in teaching complex problem-solving steps to primary school students, who they defined as novice students. Stating the process of solving difficult problems to involve complex cognitive processes, Berthold, Eysink, and Renkl (2009); Jones (2014); Rourke and Sweller (2009); Van Gog, Paas, and Van Merriënboer (2006); and Van Gog, Kester, and Paas (2011) found the worked examples method to be effective on complex learning processes. The results obtained from the studies in the literature coincide with the results from this research.

Difficult problems are not problems that can be solved by memorization. Students in the class in which the worked examples method had been applied did not solve difficult problems by memorization. Worked examples are used as teaching tools that reflect the problem-solving processes of an expert and enable students to learn by imitating the experts' processes. Students model creative problem-solving processes this way (Mayer, Sims, & Tajika, 1995). Thus, one example of the problem-solving approach is presented rather than suggesting a list of steps offered to the student to memorize (Pease, 2012). The increase in the performance of students in the experimental group while solving difficult problems shows that the students do not solve these problems by rote. It also shows that they used the example of the problem-solving approach presented in the worked examples.

This research uses the two-tier success test. The first tier of the tests consists of marking the correct option. The second tier of the tests consists of explaining the operations done for solving the problem. The student who complete both tiers correctly got full points. At the end of the experiment, a difference was found in favor of the experimental group in terms of the the problem-solving successes of the two groups. This situation shows the students in the group in which the worked examples method had been used to have been able to explain the reasoning steps correctly while solving the problems. According to Budé, Van De Wiel, Imbos, and Berger (2012), students with little experience in problem solving often fail to explain the reasoning steps internally while solving a problem.



Therefore, the use of worked examples benefits this process. This benefit from using worked examples is also reflected in the research results.

In this research, students' success in solving fraction problems was developed using the worked examples method over a short time of 5 weeks. The performance of students who learned through the worked examples method in this short time was found to be higher than for the students who learned using the traditional teaching method. The results obtained from Paas and Van Merriënboer (1994) showed the worked examples method to be effective over a short time. In addition, studies have shown trying to solve problems to take more time than studying examples (Sweller, 2006). This situation shows the performance of students who learn using the worked examples method to improve over a short time.

Although many studies have determined the worked examples method to be effective (Carroll, 1994; Cooper & Sweller, 1987; Crissman, 2006; Pawley, 2004; Lee, Nicoll, & Brooks, 2004; Shen, 2005; Sweller & Cooper, 1985; Zhu & Simon, 1987), researchers' opinions are divided on certain issues. Some researchers have claimed the worked examples method to not be universally effective for students (Catrambone & Holyoak, 1989; Renkl, 1999; Ward & Sweller, 1990). According to these researchers, students have claimed being unable to apply what they learned with the worked examples method to new problems due to differences in the presentation of worked examples or individual differences such as students' prior knowledge levels. Some studies have shown that, while teaching through worked examples is effective for students with little problem-solving experience, it can reduce the performance of more experienced students (Bokosmaty, Sweller, & Kalyuga, 2015). Faulkner (1999) used a problem-based teaching method in one group and the worked examples method in the other group. At the end of the research, Faulkner found no statistically significant difference to be present in the success scores of the two groups. This result Faulkner found does not coincide with the results from the current research. The reason for the different results and opinions is considered to be the country, year, grade level, and individual differences of the students in the research group. Variables such as being experienced or not are also thought to affect the different results and opinions.

This research has shown the worked example method to be more effective than the traditional teaching method for learning fundamental knowledge and improving success in solving mid- and high-difficulty fraction problems for primary school students who still lack sufficient experience.

Limitations and Suggestions

In terms of the study group, the research is limited to students attending the fourth grade of a primary school and participating in the application. In terms of subject, this research is limited to the sub-learning area of fractions in the numbers learning area in the Primary School Mathematics Curriculum. The effects of worked example method on other grade levels and other mathematical subjects can be investigated. In addition, the effects of the worked example method can be studied at the primary school level in the field of science.

In the research, it was found that the worked examples method is an effective method in improving the performance of solving medium and difficult problems. For this reason, problem type classification can be made for all levels and subjects of primary school and in accordance with worked examples method. Student textbooks and workbooks can be created by taking these classifications into consideration. In this way, students' problem solving performance can be improved by supporting the schema development.

Ethics Statement and Funding Information

For this research, necessary permission was obtained from the R&D Commission of the Provincial Directorate of National Education. In addition, the permission of the Ethics Committee was obtained by the resolution of the Social and Human Sciences Ethics Committee at Erciyes University dated 27.07.2021 No. 347. The rules of scientific, ethical and citation were followed in the writing process of the study titled "The Effect of Worked Examples Method on Primary School Students' Fractions



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EVALUATION OF THE MEDIATING ROLE OF ATTENTION IN THE RELATIONSHIP BETWEEN SOCIAL COMPETENCE, AGGRESSION AND EARLY LITERACY

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Abstract

This study aims to examine the mediating role of attention in the relationship between their social competence, aggression and early literacy by constructing a path model for children's early literacy. This research was designed in a causal pattern. The sample of this study consisted of 256 children attending pre-school education. The data were collected using the Personal Information Form, Social Competence and Behavior Evaluation Inventory-Parent Form, Early Literacy Skills Assessment Tool and Frankfurter Test Für Funjahrige Konzentration-(FTF-K). Path analysis technique was used in data analysis. The significance of its indirect effects was evaluated using the bootstrapping method. The findings obtained in this study showed that social competence predicted attention positively, whereas aggression predicted attention negatively. Attention positively predicted early literacy. The findings suggested that attention had a fully mediating role between social competence, aggression and early literacy.

Keywords: Social competence, aggression, early literacy, attention.

INTRODUCTION

Early literacy is based on the understanding that children master basic skills and gain awareness before they learn to read and write (Niessen, 2003). Studies show that the developmental origins of reading and writing skills are laid in early childhood (Lonigan, Burgess, & Anthony, 2000). Every experience in early childhood is significant in brain development given that learning experiences have a positive effect on brain development. Brain research also emphasizes the significance of early experiences in preparing children for reading and writing education. Early literacy skills, in which the foundations of literacy proficiency are laid in the preschool period, include oral language skills, vocabulary, phonological awareness skills, alphabet and letter knowledge, print awareness and writing skills. These skills form the basis of literacy development for children (Strickland & Riley-Ayers, 2007; Skibbe, Gerde, Wright, & Samples-Steele, 2016; Wright & Cervetti, 2017). It is also significant to create a developmentally appropriate environment and family support in raising awareness of literacy skills in children (Jackman, 2012). Thus, the education of children in the preschool period should be scientific and systematic (Shedd, 2005). It is very important for them to provide qualified and repetitive literacy experiences in promoting early literacy in preschool classes (Sandall & Schwartz, 2008).



Children who grow up around early literacy equipped with rich stimulants in early childhood can successfully transition from the early literacy process to the formal literacy process in primary education (Birgisdottir, Gestsdottir, & Geldhof, 2020). In primary education, some children succeed in literacy gains and others fail due to their differences in children's knowledge and skills related to early literacy (Kennedy, Dunphy, Dwyer, Hayes, McPhillips, Marsh, O'Connor, & Shiel, 2012). Early literacy studies contribute to gaining interest, attitude and motivation towards reading and writing and form the basis for being a good literate in adulthood (Altinkaynak & Akman, 2016). Early literacy studies in early childhood help teachers become aware of children's reading and writing problems, prevent them, and decide which aspects of early literacy skills to support. Children in this period can prepare for school and catch up with the general curriculum by applying special education programs to children with speech development and/or language disorders. Early literacy studies are important for preventive programme (Wilcox, Gray, & Reiser, 2020).

Cognitive and social development is the basis for early childhood, school preparation and success. Executive functions in early childhood are effective children acquire early literacy skills. Executive functions are neurocognitive skills involved in targeted problem solving in new or challenging situations. The executive function shows a rapid developmental increase in early childhood, especially between the ages of three and five (Garon, Bryson, & Smith, 2008). Executive function in early childhood is divided into hot and cold executive functions. Cold executive function is associated with the cognitive aspects of problem solving and often involves abstract, symbolic tasks. Definitions of cold executive functions arise from cognitive neuropsychology and often include working memory, attention shift, or flexibility and inhibition. Cold execution function is associated with academic indicators of school readiness. Cool executive functions are related to early literacy, math, and writing development, which are important in preschool preparation and academic success. Hot executive function is directly related to motivation; it refers to problem-solving in contexts where there is a delay in satisfaction, such as increased mental arousal and/or delaying pleasure. Therefore, there are two significant factors in the gaining of early literacy skills in early childhood: cognitive function, which is cold executive function, and social, which is hot executive function. Cognitive competence of children in gaining early literacy skills while representing cognitive processes, social processes and develop early literacy skills in a learning environment where teachers, represents competence in peer and adult interactions (Ladd, Birch, & Buhs, 1999; Mann, Hund, Hesson-McInnis, & Roman 2016; Razza & Raymond, 2015).

Biological, social, emotional and environmental factors, individual differences such as attention and behaviour in children affect children's executive functions. Disorder in cold executive functions such as behavioural and attention problems are risk factors for children's academic difficulties / failures. Attention disorder causes individuals to lack the ability to focus on relevant information while ignoring distractions or distracting selective attention, which makes the acquisition of literacy skills difficult (Stevens, Harn, Chard, Currin, Parisi, & Neville, 2013). Attention disorder causes individuals to be deprived of focusing on relevant information while ignoring distractions or using selective attention, which makes it difficult to acquire literacy skills (Stevens et al. 2013). Attention deficit has a wider impact on the visual and auditory domains in linguistic and non-linguistic contexts. Therefore, visual and auditory perception is an important factor in children's phonological awareness, alphabet awareness and acquisition of memory skills. Attention deficit in children makes it difficult to acquire early literacy skills by negatively affecting their visual and auditory perceptions. Children with attention deficits benefit less than other children from early literacy activities offered at home and in preschool classrooms. In addition, the attention of children in early childhood is important in acquiring vocabulary and reading comprehension skills. Attention deficit can prevent children from acquiring reading skills (Dally, 2006). Attention deficit may prevent children from acquiring reading skills. Impairments in hot executive functions, such as social skills and social relations problems, are risk factors for children's early literacy problems (Denham, 2006). Social skill is the behavior shown in the face of a social situation or event. Social competence, on the other hand, refers to the consistency in behaviors that give clues about the individual's subsequent behaviors due to



understanding, evaluating and the individual's next behavior because of the evaluation. Social competence includes the child's ability to succeed in social interactions. Self-control and adaptation in early childhood are related to social competence (Hogan, Scott, & Bauer, 1992).

Children with high social and emotional competence can understand and manage their emotions, and they can better develop and maintain peer relationships. Aggression, the negative sub-dimension of social competence, is often defined as an act that deliberately harms others (Crick & Grotpeter, 1995). Aggressive children are not able to react with more appropriate strategies because they lack social skills, so these children who act aggressively towards their peers are socially inept children. According to the peer aggression model resulting from a lack of social skills, aggressive children do not have the necessary social skills (Randall, 1997), they cannot see appropriate social behaviors, or they do not have empathy skills (Olweus, 1993). Therefore they behave aggressively towards their peers. Children who cannot acquire social behavior miss important learning opportunities. Because these children do not listen to the teacher, they do not participate in class activities, and are excluded by their friends due to their inappropriate behavior. Close and positive friendship relationships in early childhood support children's cognitive development in general and more specifically early literacy skills (Haak, Downer, & Reeve, 2012).

Children use peer interactions in complex learning activities in preschool classrooms. In addition, children learn and experience new demands and expectations in this environment. Socially undeveloped children have been documented to display maladaptive behaviors such as dislike of school, school phobia, low academic motivation, less collaborative classroom behavior, and lower achievement in areas such as math, writing, and reading. Also, peer interactions can support or stress children's social and academic lives. Therefore, children who cannot acquire social behaviors may have difficulty focusing their attention on academic skills as they cannot cope with the stress they experience in peer interaction (Farran & Son-Yarbrough, 2001). In the review of the related literature, it is seen that there are studies on the prediction and effect of attention and social behaviors on early literacy skills.

In conclusion, since children with attention and social competence problems miss important learning opportunities, it is very important to create early learning environments to overcome this situation. Close and positive friendships in early childhood support children's cognitive development in general and early literacy skills more specifically (Haak, Downer, & Reeve, 2012). In addition, children come to the classroom with different social competence and attention levels, and children's social competence and attention are critical for early childhood. Ladd and Burgess (2001) stated that children who exhibited more prosocial behaviors in early childhood participated in class activities and were more associated with their subsequent academic achievements than children who exhibited aggressive behaviors. Elias and Haynes (2008) found that social competence and peer relationships in early childhood are important factors in their academic success in primary school. Dice and Schwanenflugel (2012) found that there is a correlation between attention and early literacy skills. They also stated that literacy in primary school and attention in early childhood are important. Stevens et al. 2013 found that children at risk in learning to read and write have low attention skills. Teachers stated that preschool children generally do not have the necessary basic competencies such as following instructions, focusing and maintaining their attention, working independently, relations with friends, and controlling anger and aggression (Rimm- Kaufman, Curby, Grimm, & Nathanson, 2009). Although there are studies on attention (Razza, Martin, & Brooks-Gunn, 2012; Reynolds & Besner, 2006; Willcutt, Betjemann, McGrath, Chhabildas, Olson, De Fries, & Pennington, 2010) and social behaviors (Enerem, 2018; Rabiner, Godwin, & Dodge, 2016; Taylor & Leung, 2020; Vitiello & Williford, 2016), there is no research on the effects and effects of both attention and social behaviours' (social competence and aggression), which are very important in the acquisition of early literacy skills in early childhood, on early literacy. It is necessary to take care of attention problems, lack of social competence skills and aggressive behaviours in early childhood by examining the relationship between early literacy skills (Elias & Haynes, 2008; Wilcox, Gray, & Reiser, 2020).



Therefore, this study aims to examine the mediating role of attention in the relationship between their social competence, aggression and early literacy by constructing a path model for children's early literacy. For this general purpose, the following research hypotheses have been created:

H_{1.1}. Social competence positively predicts attention.

H_{1.2}. Aggression negatively predicts attention.

H_{1.3}. Attention positively predicts early literacy.

H_{1.4}. Social competence positively predicts early literacy.

H_{1.5}. Aggression negatively predicts early literacy

H_{1.6}. Attention has a mediating effect on the relationship between social competence and early literacy.

H_{1.7}. Attention has a mediating effect on the relationship between aggression and early literacy.

METHOD

Research Model

This study aims to examine the mediating role of attention in the relationship between their social competence, aggression and early literacy by constructing a path model for children's early literacy. For this purpose, this research was carried out in a causal pattern. Causal pattern deals with the relationships between variables in the context of cause and effect. In this study, the cause variables were attention, social competence, and aggression. The dependent variable is early literacy. Figure 1 shows the hypothetical model.

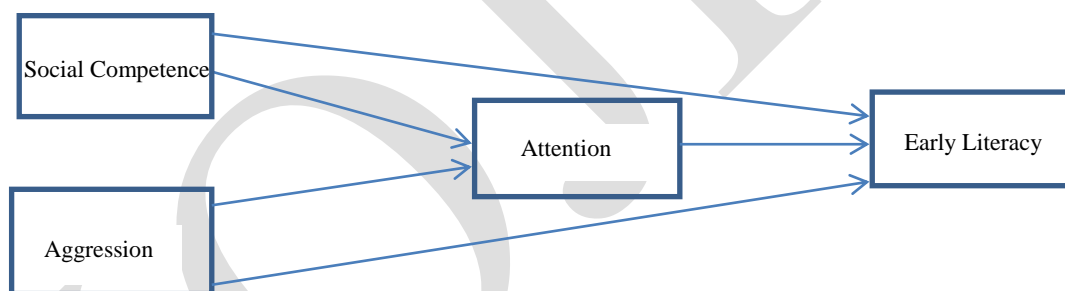


Figure 1. Hypothetical model

Research Sample

The sample of this research consists of 256 children aged 5-6 years who attend pre-school education institutions in Eskişehir city center in Turkey. The sample of this research was determined by the criterion sampling method, one of the purposeful sampling methods. Being in the 5-6 old, attending pre-school education, and having no developmental problems were determined as criteria. 60.2% of the children participating in this research were five years old and 39.2% of them were six years old. 53.9% of the children are girls and 46.1% were boys. 18.8% of the mothers of the children participating in this study had a certificate of primary education, 36.7% were high school graduates, and 44.5% were university graduates and postgraduates. 16.8% of the fathers of the children participating in this study had a certificate of primary education, 33.6% were high school graduates, and 49.6% were university graduates and postgraduates. The family income of 27.7% of the children participating in the research was between 0-2500 TL, 31.6% of them was between 2501-5000 TL and 40.6% was 5001 TL or above.



Table 1. Demographic characteristics of the sample group

Status	Group	f	%
Age	5 age	154	60,2
	6 age	102	39,8
Gender	Girl	138	53,9
	Boy	118	46,1
Mother Educational Status	Primary Education	48	18,8
	High School Graduates	94	36,7
	University Graduates/ Postgraduates	114	44,5
Father Educational Status	Primary Education	43	16,8
	High School Graduates	86	33,6
	University Graduates/ Postgraduates	127	49,6
Family Income	0-2500 TL	71	27,7
	2501-5000 TL	81	31,6
	5001 TL. or above.	104	40,6

Data Collection Tools

Personal Information Form

It is the form used to determine the demographic qualities (age, gender, mothers' and fathers' educational status, and family income) of the children in the research group.

Social Competence and Behavior Evaluation Inventory-Parent Form

The scale was developed by LaFreniere (1990). It is used to evaluate the social competence and decency of children aged three to six years, based on parental observation and consists of 30 items. Scale items are graded on a six-point likert scale. The aim of selecting this scale in the study is that the social competence and aggression of children are suitable for evaluation by their parents, and the validity and reliability levels of the scale are high. Cronbach's alpha coefficient of the original scale ranged from .73 and .82. In the Turkish adaptation (Dereli-İman, Danişman, Yaya, & Akın Demircan, 2014) the scale was applied to determine discovery factor analysis to data from 317 children and, it was determined that the scale with 76.26% variance had a three-factor structure in its original form. A confirmatory factor analysis was performed in the other dataset (300 children) to confirm the resulting structure, and a good fit of the model was determined (GFI=.91, AGFI=.88, CFI=.98, RMSEA=.06, $\chi^2/sd = 2.07$). Cronbach's Alpha coefficient was found .82 for the overall scale, and .97, .86 and .92 for lower sub-dimensions. In this study, it was found as an internal consistency coefficient according to the results of the reliability analysis of the scale .92 social competence sub-dimension and .82 aggression / anger sub-dimension.

Early Literacy Skills Assessment Tool

This tool was developed by Karaman (2013). The Early Literacy Skills Assessment Tool consists of 96 items and consists of five sub-dimensions including phonological awareness, print awareness. Matching images, story comprehension, pre-writing skills. Each item in the assessment tool is given 1 point for correct answers and "0" points for incorrect answers. In the assessment tool, each dimension can be scored separately or scored as a total score. The variance explained as a result of the exploratory factor analysis was 59.73% for Phonological Awareness Skills, 40.01% for Print Awareness, 40.22% for Story Comprehension, 55.741% for Matching Images, and 56.70% for Pre-Writing Skills. The reliability coefficient was found as .91, .92, .76 for Phonological Awareness Skills, .75, .72, .60 for Print Awareness, .61, .75, .64 for Story Comprehension, .71, .64, .70 for Matching Images, and .77, .86, .72 for Pre-Writing Skills. Confirmatory Factor Analysis was performed on the assessment tool in order to verify the structure obtained and the acceptable fit index of the model was determined (Phonological Awareness Skills: GFI=.83, AGFI=.82, CFI=.97, RMSEA=.045, $\chi^2/sd=1.9$; Print Awareness: GFI=.99 AGFI=.99 CFI=1.00, RMSEA=.090,



$\chi^2/sd=2.12$; story comprehension, $GFI=.94$ $AGFI=.90$ $CFI=.91$, $RMSEA=.094$, $\chi^2 /sd=5.2$; matching images: $GFI=.95$ $AGFI=.92$ $CFI=.95$, $RMSEA=.077$, $\chi^2 /sd=3.7$; Pre-writing Skills: $GFI=.81$ $AGFI=.67$ $CFI=.83$, $RMSEA=.20$, $\chi^2/sd= 19.5$). The KR-20 reliability coefficient was found as .91, .92, .76 for Phonological Awareness Skills, .75, .72, .60 for Print Awareness, .61, .75, .64 for Story Comprehension, .71, .64, .70 for Matching Images, and .77, .86, .72 for Pre-Writing Skills. In this study, the reliability analysis of the early literacy skill assessment tool was examined with the internal consistency coefficient and internal consistency coefficient was found to be .91.

Attention gathering test of five years old children (Frankfurter test für funjahrige konzentration–FTF-K)

In this test, which aims to measure children's attention skills, children are asked to find and Mark pears from mixed apples and pears within 90 Seconds. There are a total of 42 pears in the test. It is a neuro-psychometric test developed by Raatz and Möhling (1971). The Test was administered to 1,170 children in 1970. In 1971, the test for validity and reliability in this study, age, gender, and socioeconomic status of the standardized 3-week intervals and Child 29 test-retest method was applied and the correlation coefficient $R=.85$ was. Standardization of the test within the scope of validity and reliability was carried out again by Gözüm and Kandır (2018). Children's attention points were found to differ by gender and socio-economic level. In the reliability study of the test, the Pearson product moment coefficient $r=.78$ between the first application and the second application was found .74 test-for retest reliability (Gözüm & Kandır, 2018).

Data Analysis

Preliminary analyses were checked before data analysis. In this context, the normality assumption was tested. Hence, kurtosis and skewness values were examined. According to Finney and DiStefano (2006), ± 2 for skewness and ± 7 for kurtosis can be evaluated within the scope of normality criteria. Among the observed variables in this study, skewness was found to vary between $-.49$ and $.81$, and kurtosis varied between -1.51 and $-.94$ (see Table 1). Consequently, these values indicated that the data of the observed variables in this study were normally distributed. Also, it was seen that the correlation coefficients between the observed variables in this study were below .90 (see Table 2). This finding meant that there was no multiple linear correlation problem between variables. After the preliminary analyses, path analysis was started. Since this study aimed to reveal the cause-effect relationship between the observed variables, the path analysis technique was used in the analysis of the data. In determining this cause and effect relationship, the significance of the path coefficients and the goodness of fit indexes were examined. In this study, the goodness of fit indices was considered X^2 , X^2/sd ratio, GFI , NFI , CFI , TLI and $RMSEA$. Acceptance values were accepted as $X^2/sd \leq 3$; GFI , NFI , CFI and $TLI \geq .95$ and $RMSEA \leq .05$ (Hu & Bentler, 1999; Tabachnick & Fidell 2007). In addition, the stages suggested by Baron and Kenny (1986) were considered in the mediation test. Finally, the bootstrapping method was used to test the significance of its mediation (Shrout & Bolger, 2002). In this context, 5000 bootstraps were created in this research. Accordingly, confidence intervals (lower-upper limit) and bootstrap coefficient were obtained. As an acceptance criterion, the fact that the lower and upper limits in the confidence interval do not include zero as a result of the bootstrap procedure indicates that their indirect effects are significant.

In addition, the stages suggested by Baron and Kenny (1986) were taken into account in the mediation test:

1. There is a statistically significant relationship between the independent variables (aggression and social competence) and the dependent variable (early literacy).
2. There is a statistically significant relationship between the independent variables (aggression and social competence) and the mediator variable (attention).
3. There is a statistically significant relationship between the mediator variable (attention) and the dependent variable (early literacy) and this relationship continues when the effect of the independent variables (aggression and social competence) is controlled, and the mediating variable (attention) is the dependent variable (early literacy), the significant decrease in the amount of relationship between



the independent variables (aggression and social competence) and the dependent variable (early literacy) is evaluated as "partial mediation", while the meaningful meaningfulness of this relationship is defined as "full mediation". Finally, the bootstrapping method was used to test the significance of its mediation (Shrout & Bolger, 2002). In this context, 5000 bootstrap were created in this research. Accordingly, confidence intervals (lower-upper limit) and bootstrap coefficient were obtained. As an acceptance criterion, the fact that the lower and upper limits in the confidence interval do not include zero as a result of the bootstrap procedure indicates that their indirect effects are significant (Hayes, 2017).

RESULTS

In this study, descriptive statistics, kurtosis and skewness values were given first. Then, relationships between observed variables were reported. Finally, information about the path analysis model between observed variables was presented. .

Table 2. Descriptive statistics, kurtosis and skewness values

Variables	N	Mean	Std.Dev.	Skewness	Kurtosis
Social Competence	256	38.07	14.80	-.49	-.98
Aggression	256	9.93	3.81	.41	-1.00
Attention	256	24.53	12.59	-.08	-1.51
Early Literacy	256	44.68	27.07	.81	-.94

Table 3. Pearson moment correlation results between observed variables

Variables	Social Competence	Aggression	Attention	Early Literacy
Social Competence	-	-.612**	.727**	.434**
Aggression	-.612**	-	-.652**	-.366**
Attention	.727**	-.652**	-	.644**
Early Literacy	.434**	-.366**	.644**	-

**p<.01

As given in Table 3, there were significant relationships between all observed variables. The highest correlation coefficient was found between social competence and attention as high and positive ($r=.727$, $p<.01$). In addition, the lowest correlation was between aggression and early literacy at a medium level and negatively ($r=-.366$, $p<.01$). On the other hand, the standardized path coefficients of the hypothetical model as a result of the path analysis are shown in Figure 2. The path analysis results of the hypothetical model are also given in Table 4.

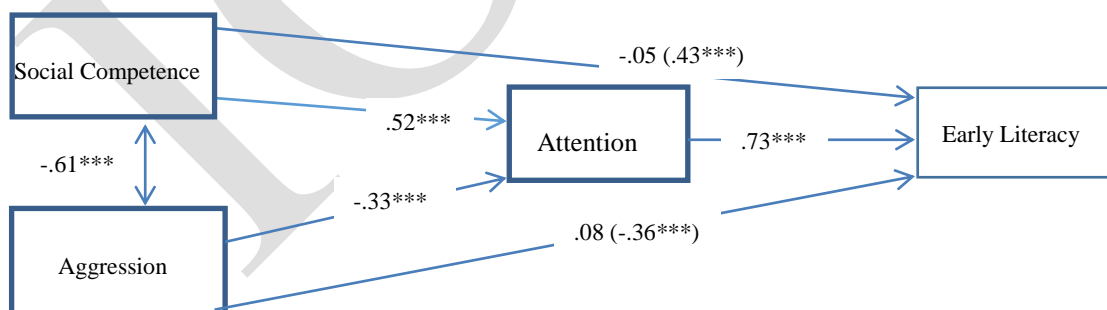


Figure 2. Standardized path coefficients of the hypothetical model

As given in Table 4, social competence significantly and positively predicted attention ($\beta=.52$, $p<.001$) and attention significantly and positively predicted early literacy ($\beta=.73$, $p<.001$), while aggression significantly and negatively predicts attention ($\beta=-.33$, $p<.001$). Also, Table 3 shows that some path coefficients were not statistically significant. In this context, paths that were not statistically significant were excluded from the analysis and analyzed again.



Table 4. Path analysis results of the hypothetical model

Dependent Variable	Independent Variable	B	SH	β	t
Attention	<--- Social Competence	.44	.04	.52	10.45***
Attention	<--- Aggression	-1.09	.16	-.33	-6.59***
Early Literacy	<--- Social Competence	-.09	.13	-.05	-0.68
Early Literacy	<--- Aggression	.58	.46	.08	1.25
Early Literacy	<--- Attention	1.57	.16	.73	9.74***

***p<.001

The goodness of fit values for the final model obtained by repeating the analysis are presented in Table 5.

Table 5. The goodness of fit values of the final model

Fit Parameter	Coefficient
CFI	.99
GFI	.99
NFI	.99
TLI	.99
RMSEA	.03
df	2
χ^2	2.66
χ^2/sd	1.33

In Table 5, the goodness of fit values of the final model reached after the insignificant paths were removed and analyzed again are given. As shown in Table 5, it was found 2.66 for chi-square (χ^2), $p>.01$, 2 for degrees of freedom (df) and 1.33 for χ^2/sd . In addition, fit indices were determined as CFI: .99, GFI: .99, NFI: .99 and TLI: .99 and the RMSEA value was determined as .03. In conclusion, the fact that this model is less than 3 ($\chi^2/sd \leq 3$) indicates a good fit between the replicated and observed covariance matrices. In addition, GFI, NFI, CFI and TLI $\geq .95$ indicates that the data are compatible with the obtained path analysis model. The results of the path analysis of the final model obtained by excluding insignificant paths are given in Table 6.

Table 6. Path analysis results of the final model

Dependent Variable	Independent Variable	B	SH	β	t
Attention	<--- Social Competence	.44	.04	.52	10.45***
Attention	<--- Aggression	-1.09	.16	-.33	-6.59***
Early Literacy	<--- Attention	1.38	.10	.64	13.42***

***p<.001

In Table 6, accordingly, one-unit increase in social competence increases students' attention by .52 unit ($t=10.45$; $p<.001$). Also, a one-unit increase in aggression reduces students' attention by .33 unit ($t=-6.59$; $p<.001$). In addition, a one-unit increase in attention increases students' early literacy by .64 unit ($t=13.42$; $p<.001$).

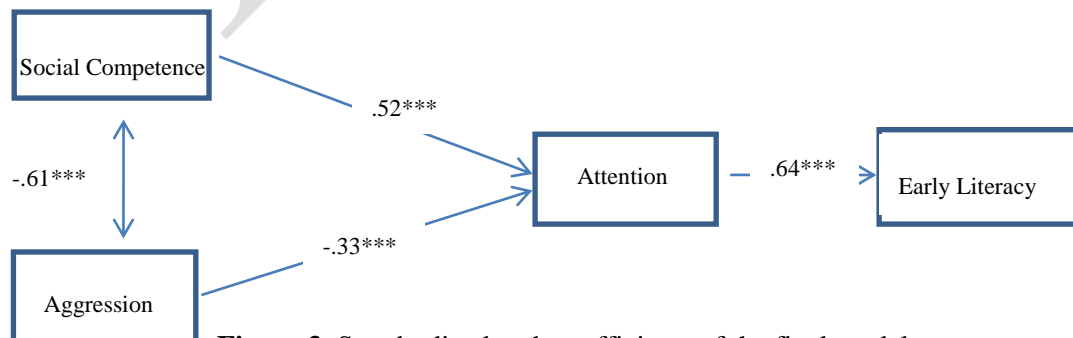


Figure 3. Standardized path coefficients of the final model



Standardized path coefficients are given in Figure 3. Accordingly, one-unit increase in social competence increased students' attention by .52 unit ($t=10.45$; $p<.001$). Also, a one-unit increase in aggression reduces students' attention by .33 units ($t=-6.59$; $p<.001$). In addition, a one-unit increase in attention increased students' early literacy by .64 units ($t=13.42$; $p<.001$).

When the indirect effects were examined, it was found that attention had a full mediating effect on the relationship between aggression and early literacy and the relationship between social competence and early literacy. This finding is based on the mediation effect criteria determined by Baron and Kenny (1986). The relationship between aggression and early literacy alone was significant ($\beta: -.36$; $t=-6.27$; $p<.001$). When the mediating effect of attention was added to this relationship, it was found that the relationship between aggression and early literacy was not statistically significant ($\beta: .08$; $t=1.25$; $p>.05$). This finding showed that attention was fully mediator. Likewise, it was found that the relationship between social competence and early literacy alone was significant ($\beta: .43$; $t=7.68$; $p<.001$). When the mediating effect of attention was added to this relationship, there was no significant relationship between social competence and early literacy ($\beta: -.04$; $t=-.68$; $p>.05$). This finding suggests that the mediating effect of attention is full. The mediating effect of attention between students' social competence and early literacy was found at .33 and the mediating effect of attention between students' aggression and early literacy was -.21.

The bootstrapping method was used to test the significance levels of indirect effects. In this context, 5000 bootstraps were created in this research. Accordingly, confidence intervals (lower-upper limit) and bootstrap coefficient were obtained. As an acceptance criterion, the fact that the lower and upper limits in the confidence interval do not include zero as a result of the bootstrap procedure indicates that their indirect effects are significant (Hayes 2017). The findings obtained as a result of the analyses made within this scope are shown in Table 7.

Table 7. Bootstrap analysis finding

Independent Variable		Mediating Variable		Dependent Variable	Bootstrap Coefficient (β)	%95 Confidence Interval(Lower-Upper Limit)
Social Competence	-->	Attention	-->	Early Literacy	.33*	[.272, .411]
Aggression	-->	Attention	-->	Early Literacy	-.21*	[-.279, -.149]

* $p<.05$

Table 7 shows that the path social competence indirectly affected early literacy was significant (bootstrap coefficient =.33, 95% GA=.272, .411). Likewise, it was understood that the path aggression indirectly affected early literacy was also significant (bootstrap coefficient =-.21, 95% GA=-.279, -.149). As a result, attention was proven to play a fully mediating role between children's social competence, aggression and early literacy.

DISCUSSION and CONCLUSION

Hypothesis that social competence positively predicts attention was confirmed. It is associated with social competence in the development of attention skills in early childhood. Children with good social competence skills can better recognize and respond appropriately to the cues shown by their peers (Pellegrini, 1991). Social interactions are crucial in the development of attention in early childhood. Attention in early childhood is defined as a social process in which parents and children regulate their behavior with joint or interactive attention (Ruff & Rothbart, 2001). Socially competent children can consider the perspectives of others, maintain their attention to the play task and maintain self-control in conflict situations. Children with social competence behavioral deficiencies are those who are rejected by their peers and often have difficulty focusing their attention and controlling their behavior (Kostelnik, Soderman, Whiren, & Pupier, 2017). Bennett-Murphy, Laurie-Rose, Brinkman, and McNamara (2007) found that positive relationship between children's social competencies and their continuous attention.



Hypothesis that aggression negatively predicts attention has been proved. Childhood aggression tends to be a fixed behavioral trait associated with various persistent psychosocial difficulties such as adult aggression and criminal behavior, as well as social skills deficits and peer rejection. Focusing and sustaining attention requires the coexistence of cognitive, emotional, and motivational resources. Davies, Woitach, Winter, and Cummings (2008) stated that children's attention skills affect aggressive behaviors. Especially aggressive behavior disrupts an individual's self-regulation skills, causing safety concerns. Therefore, aggression is stressful for children, and high levels of stress negatively affect attention performance. The inability to focus and maintain attention is basic feature of aggressive children (De Bellis, 2001). Eck, Flory, and Malone (2013) found that the aggressive behavior of preschoolers predicts attention.

Hypothesis that attention predicts early literacy positively was confirmed. Children with attention problems may have difficulty in focusing on language and literacy skills in the classroom (Haak, Downer, & Reeve, 2012). Children who cannot concentrate benefit less from literacy activities at home and in pre-school classes. Children's decoding skills require attention skills. Delays in decoding skills, on the other hand, delay children's early literacy skills. However, good attention skills allow children to develop good literacy skills by allowing them to develop decoding skills at an early stage (Haak, Downer, & Reeve, 2012). The relevant literature supports the research findings. In the relevant literature, a significant association was found between attention skills in kindergarten and early literacy skills (Welsh, Nix, Blair, Bierman, & Nelson, 2010), this attention is a determinant of later reading ability with its effect on early literacy skills (Lonigan, Burgess, & Anthony, 2000; Rabiner, Godwin, & Dodge, 2016) decreed that there is a significant positive association between attention and phonological and written information in preschool children (Lonigan, Anthony, Bloomfield, Dyer, & Samwel, 1999), attention problems in preschool period predicts phonological awareness and letter knowledge after one year (Walcott, Scheemake, & Bielski, 2010). These findings support the literacy model in which children's attention affects the development trajectory of their literacy skills, and attention affects early literacy skills.

Attention has been found to have a fully mediating role between social competence, aggression and early literacy. This finding obtained in this study reveals the role of executive functions in children's early literacy skills. Executive functions in early childhood are divided into two as hot executive function and cold executive function (Peterson & Welsh, 2014). Cold executive functions require logic and critical analysis (Rubia, 2011) and usually involve the conscious control of thoughts and actions without an emotional component. Hot executive function involves goal-oriented, future-oriented affective-cognitive processes that occur in contexts that create a tension between emotion, motivation and instant gratification and long-term rewards (Zelazo & Carlson, 2012). Attention in this research is related to cold executive function, while social competence and aggression are related to hot executive functions. The full mediator role of attention between social competence, aggression and early literacy reveals that the hot and cold dimensions of executive functions work together in children's early literacy skills, and the role of cold executive functions in hot executive functions. Thus, executive function refers to a set of interrelated and complex high-level cognitive and social behavioral processes. It enables children to maintain attention, keep information in mind, avoid immediate response, manage new information, counteract distraction, think about the consequences of different behaviors, work harmoniously in the face of social demands and plan for the future (Carlson, Zelazo & Faja, 2013; Hughes & Ensor, 2008; McClelland, Acock, & Morrison, 2006). These qualities of executive function can be an important factor in developing children's early literacy skills. Delayed pleasure, one of the hot executive functions, is related to the social aspects of school readiness and school success. Therefore, there are two significant factors in the acquisition of early literacy skills by children in early childhood: cognitive function, which is cold executive function, and social, which is hot executive function (Ladd, Birch, & Buhs, 1999; Mann et al., 2016; Razza & Raymond, 2015).



Conclusion and Recommendations

In this study, the findings showed that social competence predicts attention positively. First, the children who have difficulties in their social competence skills can be identified and then the results can be evaluated by applying training programs to increase the social competence of the children. The findings have shown that attention predicts early literacy positively. The results can be evaluated by applying training programs to increase the attention skills of children with attention deficits. In this research, attention had a fully mediating role between social competence, aggression and early literacy. The results can be evaluated by implementing educational programs to increase the executive functions of children. This study was carried out in Turkey sample. The findings and theoretical explanations of this study can be an important source for cross-cultural comparison studies that are possible in different countries.

Acknowledgments

At the meeting of Eskisehir Osmangazi University Social and Human Sciences Human Research Board dated 12.08.2021 and numbered 2021-14, it was decided that the research is in accordance with the human research ethics committee directive.

Limitations

The limitation of this study is data obtained from children in preschool, and the status of the same children in primary school is not determined.

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EXAMINING THE EFFECTIVENESS OF READER STRATEGY IN INTELLECTUALLY DISABLED STUDENTS' MATHEMATICAL PROBLEM SOLVING

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Abstract

Mnemonic strategies provide information about which steps should be followed respectively while solving students' mathematical problems. The main purpose of this study is to examine the effectiveness of READER problem solving strategy, which is one of the mnemonic strategies, on problem solving performances of students with intellectual disabilities. In the study, the generalization of students' performances in change problems to classification and comparison problems and their ability to maintain this performance were determined. Three students participated in the study and "Multiple Probe Design", one of the experimental designs with a single subject, was used in the study. READER strategy teaching was carried out with the Self Regulation Strategy Development teaching approach. Findings were graphically illustrated and analysed. Research findings showed that the READER strategy was effective in solving change problems for students with intellectual disabilities and that the students who gained this strategy continued their problem solving performance 1, 3 and 5 weeks after the intervention ended. In addition, it was found that students generalized their change problem-solving performances to classification and comparison problem types, and continued their generalized performance even after 2, 3 and 4 weeks. Research findings were discussed within the framework of problem solving literature and theoretical views. Suggestions were also made for future research.

Keywords: READER strategy, math problem solving, SRSD, intellectually disabled.

INTRODUCTION

It is important for students to acquire basic academic skills in order to be successful in their school life and to live independently in the society. It is aimed to provide students with basic academic skills in the school. These basic academic skills can be listed as reading, writing, basic arithmetic operations, and problem solving. It is emphasized that problem solving is at the centre of mathematics education and is one of the main objectives. In this regard, the main objectives of the mathematics curriculum include students' expressing their own thoughts and reasoning in the problem solving process, and developing a self-confident approach to mathematical problems. In addition, problem solving is considered as one of the target behaviors in all of the learning areas of mathematics (numbers and operations, algebra, geometry and measurement, data processing and probability) (National Council of Teachers of Mathematics, NCTM, 2000).



Mathematical problem solving is defined as a complex cognitive activity involving several processes and strategies (Montague, 1992). Students who are competent in problem solving have a repertoire of strategies and can use these strategies appropriately (Karabulut & Özmen, 2018; Özkubat & Özmen, 2020). However, unlike these students, especially students with special needs have difficulties in solving mathematical problems (Özkubat, Karabulut, & Özmen, 2020). Students with special needs have significant difficulties in understanding the problem in general, in determining the important information in the problem, in converting verbal information and numerical information into operations, in applying their previous knowledge effectively when they encounter a situation they have not encountered before, and in using effective strategies for problem solving (Özkubat, 2019). In addition, students with intellectual disabilities often have limitations in the effective use of cognitive and metacognitive strategies while solving math problems (Geary, 2010). The use of cognitive processes and cognitive strategies in problem solving plays a key role from reading the problem to reaching the solution and controlling the solution and process (Rosenzweig, Krawec, & Montague, 2011). Metacognitive strategies are used to regulate the cognitive processes used in solving mathematical problems, to manage these operations and to regulate students' own problem solving performance (Montague, 1992). Thus, process-based teaching is needed to help especially the students with intellectual disabilities who have limitations in both cognitive and metacognitive strategies gain problem solving skills. In process-based teaching, unlike product-based teaching, the focus is not on the accuracy of the result of the problem, but on the problem solving process. In this process, the process is completed by paying attention to the processes and especially to the cognitive and metacognitive strategy used (Montague & Boss, 1986).

There are several studies in which various process-based teaching methods are applied in which the use of cognitive and metacognitive strategies is taught in order to improve the problem solving skills of students with special needs. Mnemonic strategies, diagram-based teaching, and Solve it! can be given as examples to process-based approaches that are effective in solving math problems (Karabulut, 2015). Mnemonic strategies indicate which cognitive steps should be respectively taken while solving students' math problems and are strategies in which the first letters of the strategy are reminders (Reid & Lienemann, 2006). Strategies such as FOPS (Jitendra & Star, 2012); RUN (Fuchs, Powell, Cirino, Schumacher, Marrin, Hamlett, & Chngas, 2014); DOTS (Xin & Zhang, 2009); PASS (Iseman & Naglieri, 2011; Kroesbergen & VanLuit, 2003; Naglieri & Johnson, 2000) READER (Mancl, 2011); STAR (Gagnon & Maccini, 2001; Maccini & Hughes, 2000; Maccini & Ruhl, 2000; Özkubat, Karabulut & Uçar, 2021; Peltier & Vannest, 2016); SOLVE (Freeman-Green, O'Brien, Wood, & Hitt, 2015); LAP (Test & Ellis, 2005); FAST DRAW (Tok & Keskin, 2012) are among the strategies that are used to increase the problem solving performance of students with special needs. The schema-based teaching strategy is a strategy that helps students with special needs understand how problems should be placed within diagrams and how to choose the correct action when solving problems (Jitendra, DiPipi, & Perron-Jones, 2002). The effectiveness of schema-based problem solving strategies has been tested in students with learning difficulties ((Alghamdi, Jitendra, & Lein, 2020; Griffin & Jitendra, 2009; Jitendra, Hoff, & Beck, 1999; Jitendra et al., 2002; Jitendra, Griffin, Haria, Leh, Adams, & Kaduvettoor, 2007; Jitendra & Hoff, 1996; Morin, Watson, Hester, & Raver, 2017; Walker & Poteet, 1990; Xin, 2008; Xin, Jitendra, & Deatline-Buchman, 2005), students with intellectual disabilities (Baki, 2014; Karabulut, Yıkıms, Özak, & Karabulut, 2015; Kot & Yıkıms, 2018; Tufan & Aykut, 2018), students with normal development (Jitendra Burgess & Gajria, 2011; Owen & Fuchs, 2002), students with low performance in mathematics (Jitendra et al., 2002), students with autism spectrum disorder (Rockwell, Griffin, & Jones, 2011) and students with visual impairment (Tuncer, 2009). With schema-based teaching, it is stated that the number of schemas used by students with special needs increased, their level of use of diagrams improved, and they generalized the use of diagrams to different problems (Özkubat, Karabulut & Akçayır., 2021; Powell & Fuchs, 2018). The problem-solving model called "Solve This!" was developed by Montague (1992). This model consisted of seven cognitive strategies and three metacognitive strategies. While seven cognitive strategies in problem solving are defined as reading, paraphrasing, visualizing, hypothesizing,



predicting, calculating, and checking, the cognitive operations used in the process are specified as comprehension, translation, transformation, planning, prediction, calculation, and evaluation. Metacognitive strategies are listed as self-instruction, self-questioning, and self-monitoring, while metacognitive operations are described as the knowledge, use, and control of strategy (Montague, 1992). Research conducted with students with learning difficulties have shown that Solve It!, which is a strategy used for improving students' problem solving performances, is an effective strategy (Daniel, 2003; Krawec, Huang, Montague, Kressler, & De Alba, 2013; Montague, 1984; Montague, 1992; Montague & Bos, 1986; Montague, Enders & Dietz, 2011; Montague, Krawec, Enders & Dietz, 2014). It is seen in research that Solve It! strategy is taught with a clear expression by following the stages of modelling, thinking aloud, guided, and independent intervention, and generalization. When all research results are examined, it is emphasized that the cognitive and metacognitive strategies applied in the problem solving process improve the mathematics skills of students with learning difficulties. Effectiveness results obtained in research with students with learning difficulties have shown that Solve It! strategy increases the problem solving performance of students with other types of disabilities such as autism spectrum disorder (Whitby, 2012), mental disability (Chung & Tam, 2005; Karabulut & Özmen, 2018) and spina bfida (Coughlin & Montague, 2011). Research conducted with students with autism spectrum disorder, those affected by mental disability, and spina bfida has demonstrated that Solve It! is an effective strategy (Chung & Tam, 2005; Coughlin & Montague, 2011; Whitby, 2012). In the literature, in order to improve the mathematical problem-solving skills of students with special needs and increase their performance, in addition to process-based teaching approaches in mathematics problem solving teaching, concrete-semi-concrete-abstract problem-solving approach (Butler, Miller, Crehan, Babbitt, & Pierce, 2003; Hunt & Vazquez, 2014; Maccini & Hughes, 2000; Maccini & Ruhl, 2000; Scheuermann, Deshler, & Schumaker, 2009; Strickland & Maccini, 2012) and problem-based learning approach (Bottge & Cho, 2013; Bottge, Ma, Gassaway, Toland, Butler & Cho, 2014; Bottge, Rueda, Grant, Stephens, & Laroque, 2010; Bottge, Rueda, LaRoque, Serlin, & Kwon, 2007) are also used (Özkubat et al, 2021b).

In process-based approaches, in mnemonic strategies, students can be taught which steps should be applied to solve their mathematical problems, respectively (Montague & Boss, 1986). One of these strategies is READER strategy, the effectiveness of which is examined in this study. READER strategy, developed by Mancl (2011), is taught with the help of mnemonics consisting of the initial letters of strategies (READER / Read the problem-Examine the question information-Abandon irrelevant- Determine the operation, using the diagrams if needed- Enter the numbers- Record the answer). It is stated that the READER strategy is effective for students with special needs because it specifies the steps to be taken in problem solving in order (Mancl, 2011). Each letter of READER Strategy points to a cognitive strategy step. Table 1 shows the main and intermediate steps of READER strategy.

Table 1. READER strategy steps

Mnemonics	Strategy Steps
R	Read the problem.
E	Examine the questions.
A	Abandon irrelevant information.
D	Determine the operation using the diagrams, if needed.
E	Enter numbers.
R	Record answer.

In READER strategy, in the read the problem step, the student is aimed to understand the problem; in the step of examining the information contained in the problem, the student determines the relevant and irrelevant information contained in the problem before solving the problem; in the step of abandoning the irrelevant, the student is aimed to be able to distinguish the information that is not



included in the solution of the problem and is considered unnecessary; in determining the operation step, the students decides on the basic arithmetic operation to be used by expressing the problem visually (pictorial); in entering the numbers step, the student uses the numbers that will lead the student to a solution; in the record the answer step, the student records the answer using the mathematical expressions included in the problem (Mancl, 2011).

In this research, READER strategy teaching was carried out with the Self-Regulated Strategy Development (SRSD) teaching approach (Harris & Graham, 1992). This approach is frequently preferred for students with special needs to gain academic skills and to improve their existing academic skills and can be used together with cognitive strategy teaching (Case, Harris, & Graham, 1992; Cassel & Reid, 1996; Chung & Tam, 2005; Graham & Harris, 2003; Hutchinson, 1993; Maccini & Hughes, 2000; Montague, Applegate, & Marquard, 1993; Karabulut & Özmen, 2018; Sanders, Losinski, Parks Ennis, White, Teagarden, & Lane, 2019). This approach involves the basic components of all cognitive strategy teaching routines. The six stages included in the approach are defined as: a) activating prior knowledge for the implementation of strategies and procedures required for problem solving, b) discussing the strategy considering the students' current performance, explaining the strategy, and describing how these strategies will help students increase their problem solving skills, c) modelling by using think-aloud in the problem solving process, d) memorizing the strategy steps and expressions used by students for self-regulation, e) supporting the use of strategies by practicing appropriate examples, f) completing the mathematical problem solving process by using self-regulation strategies independently (Montague & Dietz, 2009).

When the studies in national literature to support the problem solving performance of students with special needs are examined, it is seen that schema-based teaching strategy was used in students with intellectual disabilities (Baki, 2014; Karabulut et al., 2015; Kot & Yıkmış, 2018; Tufan & Aykut, 2018) and students affected by visual impairment (Tuncer, 2009), Solve It! teaching strategy is used in students with intellectual disabilities (Karabulut, 2015; Karabulut & Özmen, 2018) and students with learning difficulties (Gencan, 2020), mnemonic strategies are used in students affected by mental disability (Özkubat et al., 2021). At this point, it can be said that there are a limited number of studies examining the effects of different problem-solving interventions among the studies conducted to support the mathematical problem-solving skills of students with intellectual disabilities in our country. Moreover, there is a similar situation when the national literature is examined in terms of Self-Regulation Strategy Development teaching approach, which is used together with cognitive strategy teaching in teaching problem solving skills to students with mental disabilities (Karabulut, 2015; Karabulut & Özmen, 2018). For this reason, it is thought that READER mnemonic strategy teaching, which was examined in this study, will both increase the quantity of problem solving research in the field of special education and offer a different perspective on teaching problem solving to researchers and practitioners by using the Self-Regulation Strategy Development teaching approach in teaching problem solving skills. In this regard, the general purpose of this research is to determine the effectiveness of READER strategy in problem solving skills of students with intellectual disabilities. In line with this general purpose, answers are sought for the following questions:

1. Is the READER strategy effective in solving change problems for students with intellectual disabilities?
2. After teaching with the READER strategy, do students with intellectual disabilities maintain their change problem solving performance after 1, 3, and 5 weeks?
3. After teaching with the READER strategy, can students with intellectual disabilities generalize their performances in change problems to classification and comparison problems?
4. After teaching with the READER strategy, do students with intellectual disabilities maintain their classification and comparison problem solving performances after 2, 3, and 4 weeks?



METHOD

Participants

The participants of the study consist of three students affected by intellectual disability. Some prerequisites and skills were determined for the selection of the participants in this study. Participants are required a) to be diagnosed with intellectual disability by the relevant state or university hospitals, b) not to have an additional disability such as visual, hearing and physical disability, c) to perform two-digit addition with carrying and two-digit subtraction with borrowing at an accuracy of at least 80%, d) to be able to correctly solve at least one and at most three of the change problems including 10 addition and subtraction operations on average, e) to have their parents' consent to participate in the research.

In order to determine the participants, firstly, special education classroom teachers were interviewed. In this interview, information was obtained from the teachers about the performances of students in addition-subtraction operations and problem solving. Secondly, as a result of the evaluation of the obtained information, seven students were found to be eligible for the prerequisite evaluation. Thirdly, the precondition evaluation session was held to evaluate whether these students had prerequisite skills or not. As a result of the evaluation, two students were not included in the study because they could not perform two-digit addition with carrying and two-digit subtraction with borrowing according to the specified criteria, and two students could not solve change problems in the specified criteria. As a result, it was decided to include three students in three different primary school special education classes of the same school as participants. Information about the participants is presented in Table 2.

Table 2. Demographic information of participants

Participants	Gender	Age	Intelligence Department Score	Disability Type
Participant 1	Male	10 years 4 months	65	Intellectual Disability
Participant 2	Male	10 years 9 months	68	Intellectual Disability
Participant 3	Male	10 years 6 months	67	Intellectual Disability

Practitioners

Two of the practitioners have a doctorate degree from the Department of Special Education, and one is at the dissertation stage. Practitioners have publications on mathematics problem-solving interventions applied to students with special needs (Karabulut, 2015; Karabulut et al., 2015; Karabulut & Özmen, 2018; Karabulut & Özkubat, 2019; 2021; Özkubat, 2019; Özkubat & Karabulut, 2021; Özkubat et al., 2020; Özkubat et al., 2021a, 2021b; Özkubat & Özmen, 2018; Özkubat & Özmen, 2020). In addition, the researchers took courses on Cognitive Strategy Teaching during their doctoral education.

Environment and Time

The intervention process of the research was carried out in the library within the school. A tape recorder was used to record all sessions of the research and to calculate observer and practice reliability. All sessions were held by the first author between 12.00-13:30 am on weekdays.

Dependent and Independent Variable

The dependent variable of this research is the percentage of solving change problems involving one-stage addition or subtraction. The independent variable of the research is the READER strategy.

The Experiment Process

The experiment process of the research is composed of five stages: a) baseline sessions, b) instruction sessions, c) post-instruction evaluations, d) generalization, and e) monitoring phases. The stages of the experiment process are explained below.

Baseline sessions

In baseline sessions, which is the first stage of the research, the performances of the participants in solving change problems including one-stage addition or subtraction processes were determined. In



this process, students were given and asked to solve 10 one-stage worksheets consisting of change problems, including addition or subtraction. By evaluating the worksheets, the students' baseline performances were calculated as a percentage and plotted on the chart.

Instruction sessions

Instruction sessions were started with the participants who obtained stable data at the baseline sessions. The instruction sessions were continued until the students solved change problems that included one-stage addition or subtraction operations with the READER strategy with 90% accuracy and showed stable data. Teaching sessions were designed according to Self-Regulation Strategy Development. Instruction sessions consist of six stages: a) activating prior knowledge, b) discussing the strategy, c) modelling, d) memorizing the strategy, e) guided practices, and f) independent practices. In the stage of activating the prior knowledge, the key words (left, increased, decreased, spent, etc.) were provided to the students to help them use the strategy effectively while solving the problem. At the stage of discussing the strategy, explanations were made about the benefits of using the strategy, the fact that the READER strategy enables solving mathematical problems and reminds numerical skills and general problem solving steps, and the READER strategy consists of six steps and what these steps are. Where and how to use the READER strategy steps were explained, and whether they would be useful in the problem solving process was discussed with the participants. In the stage of modelling, when and how to use the strategy steps, thinking out loud, interactional dialogues were used as a model. At the beginning of the session, 10 worksheets containing change problems including one-stage addition and subtraction were introduced to the student. In the worksheets, each problem is placed in the READER strategy form in the annex (Appendix 1). For the first step of the strategy, the worksheet was given to the student and the student was asked to read the first problem. Then, the student was asked to put a plus on the read the problem stage in the prepared form. Then he was asked to examine the information contained in the problem. At this stage, the practitioner guided the student and enabled him to focus on the important information in the problem. Then, in the same way, the student was asked to put a plus sign in the review the information box in the READER form. In the next step, the student was asked to abandon unnecessary information in the problem. Unnecessary information in the question was removed under the guidance of the practitioner and a plus sign was placed in front of the relevant item in the form. Then, the operation to be carried out for the solution of the problem were determined and if necessary, a figure was drawn and written in front of the relevant item in the form. Then, the student was asked to enter the numbers that he will use in the operation he will perform in front of the record stage. In the last stage, the student was asked to record the result, on the record the answer box in the form, by performing the operation. At the stage of memorizing the strategy, the six steps of the READER strategy were recited by the student in order. In the guided practices stage, when the student needed help in strategy steps, the practitioner provided guidance. During the instruction sessions, the practitioner guided the student at each step, and explained the steps of the strategy again at the points he was stuck. In each step, the correct responses of the student were reinforced. If the student gave incorrect answers or was unresponsive, the practitioner provided verbal cues and the student was able to reach the correct answers. During the independent practices stage, the student was given the opportunity to independently implement the strategy steps. The student was expected to remember the strategy and fulfil the criteria for implementation in order to pass from one stage to the next. This stage continued until the student used the strategy competently and increased the number of correct problem solving to 9 or more. Ten worksheets consisting of one-stage change problems including addition or subtraction were used in the instruction sessions. After the instruction sessions, the post- instruction evaluation session was started. Teaching sessions, conducted as described, consisted of 11 sessions in total: one session to activate prior knowledge for each participant, one session to discuss the strategy, four sessions for modelling, one session for memorizing strategy, two sessions for guided practices, and two sessions for independent practices.



Post-instruction evaluation

In the post- instruction evaluation sessions, the process performed in the baseline sessions was followed. The students were asked to solve 10 worksheets consisting of change problems including one-stage addition or subtraction. Then, the worksheets were evaluated, and the students' post-instruction evaluation performances were calculated as a percentage. When the 90% accuracy level, which is the criterion determined for each student, was reached and stable data was obtained in three consecutive sessions, the instruction and post- instruction evaluation sessions were terminated, and the process sessions were repeated for the next student in the same way.

Generalization sessions

Generalization sessions were held to determine the level of generalization of students' performances in change problems to classification and comparison problems. Generalization data were collected by pre-test and post-test data before teaching. During the process of collecting the generalization pre-test data, students were given worksheets consisting of 10 classification and 10 comparison problems including addition or subtraction, and they were asked to answer the questions. The answers given by the students were evaluated and the correct answer percentages were determined and graphed. Generalization data were collected once for the classification problem for the first participant and once for the comparison problem, twice for both problem types for the second student and three times for both problem types for the third participant. After the completion of the one-stage change problem solving instruction with READER strategy, one session generalization instruction was given for the problem types to be generalized, and the post-test sessions were started immediately after. In the post-test sessions, as in the pre-test sessions, the students were given worksheets consisting of 10 classification problems and 10 comparison problems, and they were asked to answer the questions. The answers given by the students were evaluated and the correct answer percentages were determined and graphed.

Monitoring sessions

Following the completion of the instruction, monitoring sessions were initiated. In the monitoring sessions, it was aimed to determine the students' level of maintaining the READER strategy 1, 3 and 5 weeks after the completion of the instruction. In these sessions, they were asked to solve 10 one-stage addition or subtraction problems in the worksheets similar to the post- instruction evaluation sessions. Monitoring sessions were held for each student in the determined weeks, monitoring data was collected, and the correct response percentages were graphed.

Following the generalization sessions

Generalization monitoring sessions were initiated. In the generalization monitoring sessions, it was aimed to determine the students' level of maintaining their generalized problem solving performances 2, 3 and 4 weeks after the completion of the generalization sessions. In these sessions, they were asked to solve worksheets consisting of 10 one-stage addition or subtraction operations and 10 comparison problems similar to generalization sessions. Afterwards, the worksheets were evaluated and the performance of the students to continue generalization was calculated as a percentage, and they were entered in the generalization monitoring data section of the graph. A generalization monitoring session was held for each student in the specified weeks, data was collected, and the percentage of correct answers was graphed.

Data Analysis

In this study, students' data on change problem-solving, data on maintaining their change problem-solving performance, data of generalizing their performances to classification and comparison problems, and classification and comparison problem-solving data were shown with a line graph and analysed graphically. The graph shows the number of sessions on the horizontal axis and the number of correct answers on the vertical axis. The increase in the level of the data at the end of the intervention of the independent variable according to the baseline level revealed the effect of the



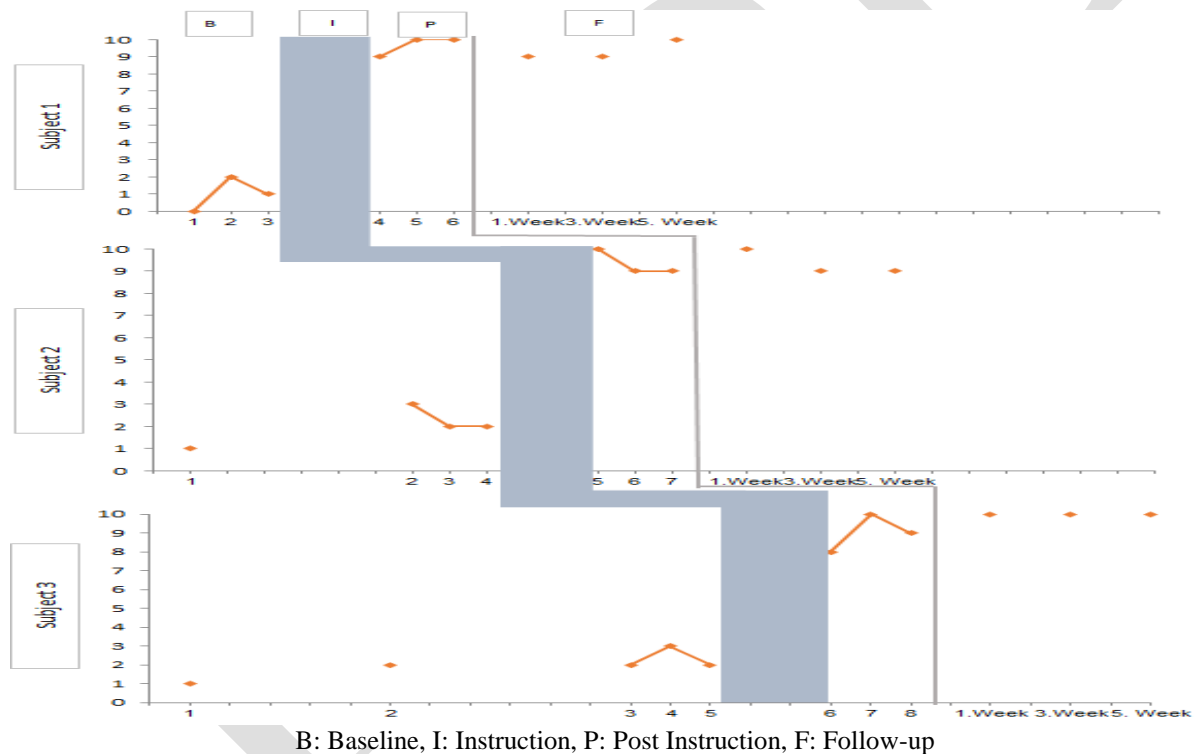
applied strategy. The monitoring data were compared with the end-of- instruction data, and it was determined whether there was a difference in level.

Inter-Observer Reliability and Intervention Reliability

Inter-observer reliability calculation was made by dividing the total consensus of the researcher and the observer by the sum of the consensus and divergence and multiplying by 100 (House, House, & Campbell, 1981). The observer is a research assistant with a doctorate in special education. The observer was told how to score the data and asked to evaluate participants' answers to the problems as wrong or correct and fill in the Observer Reliability Registration Form by marking Yes or No columns. Accordingly, the inter-observer reliability for each of the three participants was found to be 100%. Intervention reliability was calculated by dividing the observed researcher behaviour by the planned researcher behaviour and taking the percentage (Billingsley, White, & Munson, 1980). Accordingly, the intervention reliability for each of the three participants was found to be 100%.

RESULTS

The baseline, post- instruction and follow-up findings of the participants' levels of solving change problems that include one-stage addition and subtraction are shown in Graph 1.



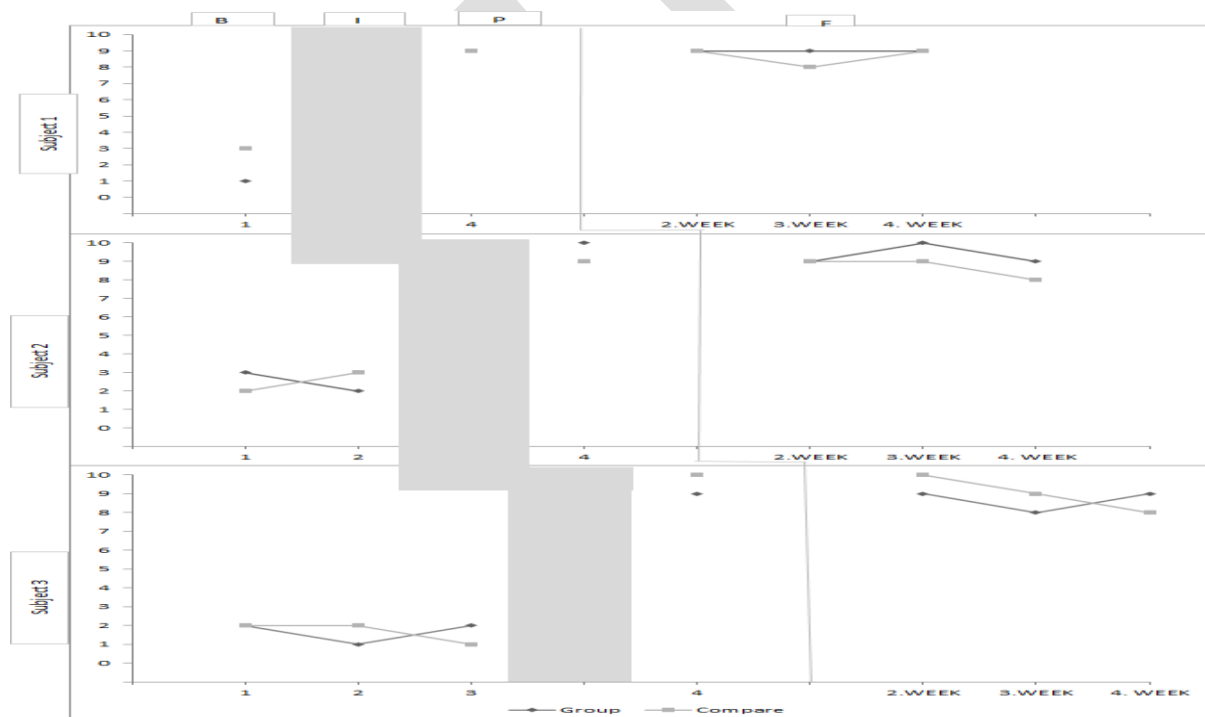
Graph 1. The baseline, post-instruction and follow-up findings regarding the subjects' solving levels of change problems including one-stage addition and subtraction

While the first participant gave correct answers to an average of 1 problem, at least 0 and at most 2, out of 10 change problems involving three consecutive sessions of addition or subtraction at the baseline level, at the end of the READER strategy teaching, he gave correct answers to an average of 10 problems, with a minimum of 9 and maximum of 10. In post- instruction follow-up sessions, he gave correct answers to 9 problems one week later, 9 after three weeks and 10 problems after five weeks, respectively. The second participant gave correct answers to an average of 2 problems, at least 1 and at most 3, out of 10 change problems involving addition or subtraction in four sessions at the baseline level. The attendance data obtained at the beginning of the experimental process and the baseline data obtained before starting the instruction did not differ. At the end of the READER



strategy teaching, he gave correct answers to an average of 9 problems, with a minimum of 8 and a maximum of 10. In post- instruction follow-up sessions, he gave correct answers to 10 problems one week later, 9 after three weeks, and 9 problems after five weeks, respectively. The third participant gave correct answers to an average of 2 problems, at least 1 and at most 3, out of 10 change problems that included addition or subtraction in five sessions at the baseline level. At the end of the READER strategy teaching, he gave correct answers to an average of 9 problems, with a minimum of 8 and a maximum of 10. The participant gave correct answers to all problems in the follow-up sessions held one, three and five weeks after the instruction. As a result, there is a difference between the number of correct answers given by all three participants to the problems involving one-stage addition and subtraction at the end of the READER strategy teaching and the baseline level. As seen in Graph 1, the level of the data path obtained at the end of the instruction is higher in all participants compared to the baseline level. All three participants met the 90% accuracy criteria determined at the end of the instruction. This progress was not observed before the intervention of the independent variable but was observed after the intervention of the independent variable. For this reason, the READER strategy was found to be effective in solving change problems involving one-stage addition and subtraction. In addition, there was no decrease in the follow-up sessions after the instruction compared to the end of the instruction. This finding shows that the READER strategy is effective in maintaining the performance of participants in change problems involving one-stage addition and subtraction after 1, 3, and 5 weeks.

The findings before and after the instruction regarding the classification and generalization levels of the participants' performance of solving change problems including one-stage addition and subtraction process to comparison problems are shown in Graph 2.



B: Baseline, I: Instruction, P: Post Instruction, F: Follow-up

Graph 2. Generalization level of participants' performance of solving change problems including one-stage addition and subtraction to classification and comparison problems involving one-stage addition and subtraction.

While the first participant gave correct answers to 1 out of 10 classification problems that included one-stage addition and subtraction during the generalization pre-test stage, after the READER strategy



and an instruction session generalization instruction were applied, he gave correct answers to 9 problems. In the generalization follow-up sessions held after the instruction, he gave correct answers to 9 problems after two weeks, 9 after three weeks and 9 after four weeks, respectively. There was no decrease in the number of problems that the participant solved in the generalization follow-up sessions compared to the end of the instruction. Likewise, while he gave correct answers to 3 out of 10 comparison problems including one-stage addition and subtraction during the generalization pre-test phase, after the READER strategy and a generalization instruction were applied, he gave correct answers to 9 problems. In the post-instruction generalization follow-up sessions, he gave correct answers to 9 problems after two weeks, 8 after three weeks and 9 after four weeks, respectively. There was no decrease in the number of problems that the participant solved in the generalization follow-up sessions compared to the end of the instruction. While the second participant gave correct answers to at least 2 and at most 3 of the 10 classification problems in the generalization pre-test phase, which includes one-stage addition and subtraction, after the READER strategy and a generalization instruction were applied, he gave correct answers to all of the problems. In the post-instruction generalization follow-up sessions, he gave correct answers to 9 problems after two weeks, 10 after three weeks, and 9 after four weeks, respectively. Compared to the end of the instruction, only an average of 1 problem decreased in the number of problems solved by the participant in the generalization follow up sessions. Similarly, while he gave correct answers to at least 2 at most 3 out of 10 comparison problems that include one-stage addition and subtraction in the generalization pre-test phase, after the READER strategy and a generalization instruction were applied, he gave correct answers to 9 problems. In the generalization follow-up sessions held after the instruction, he gave correct answers to 9 problems after two weeks, 9 after three weeks and 8 problems after four weeks, respectively. Compared to the end of the instruction, only an average of 1 problem decreased in the number of problems solved by the participant in the generalization follow up sessions. While the third participant gave correct answers to at least 1 and at most 2 of 10 classification problems that include one-stage addition and subtraction in the generalization pre-test phase, he gave correct answers to 9 problems after the READER strategy and a generalization instruction were applied. In the post-instruction generalization follow-up sessions, he gave correct answers to 9 problems after two weeks, 8 after three weeks and 9 after four weeks, respectively. Compared to the end of the instruction, there was no decrease in the number of problems that the participant solved in the generalization follow-up sessions. Similarly, while he gave correct answers to at least 1 at most 2 out of 10 comparison problems that include one-stage addition and subtraction at the generalization pre-test phase, he gave correct answers to all problems after the READER strategy and a generalization instruction were applied. In the post-instruction generalization follow-up sessions, he gave correct answers to 10 problems after two weeks, 9 after three weeks, and 8 problems after four weeks, respectively. Compared to the end of the instruction, in the generalization follow-up sessions, there was only an average of 1 problem decreased in the number of problems solved by the participant. As a result, there is a difference between the pre-test and post-test data of all three participants. At the end of the instruction, the participants reached an accuracy level between 90% and 100% in solving classification and comparison problems. Therefore, students with intellectual disabilities who participated in the study generalized their problem solving performance in change problems to solving classification and comparison problems.

In conclusion, this research has shown that READER strategy is effective in solving change problems involving one-stage addition and subtraction for students with intellectual disabilities, and students who have gained READER strategy continue to use these strategies after the intervention is completed. In addition, in this study, it was revealed that with the READER strategy, students with intellectual disability generalize both the problem solving performance and the strategy performance they have shown in change problems involving one-stage addition or subtraction to different types of problems and maintain their generalized performance.



DISCUSSION and CONCLUSION

In the present study, it was investigated whether the READER strategy was effective in students with intellectual disabilities in solving change problems involving one-stage addition or subtraction, generalization of students' performances in change problems to classification and comparison problems, and their performance in maintaining these performances. Findings obtained from the research show that the READER strategy used in this study is effective in students' problem solving, that students can generalize their performance to different problem types and maintain their performance. In the literature, READER strategy has been tested only on students with learning difficulties and its effectiveness has been found (Mancl, 2011). In this study, READER strategy was found to be effective in students with intellectual disabilities. In this respect, the research results are consistent with the results of the research conducted by Mancl (2011).

Studies conducted on how students solve mathematical problems show that students solve mathematical problems by using their own solutions in the first and second grades (Cawley, Parmar, Yan, & Miller 1998; Ginsburg, 1997). However, when students reach the secondary school level, it is observed that they abandon their personal problem solving strategies and start using the problem solving strategies they learned at school (Romberg, 1993). At the secondary school level, students tend to operate automatically with the numbers included in the problem. In this context, teaching strategies for solving mathematics problems are especially effective for secondary school students (Montague, 1997). In this respect, the effectiveness of the READER strategy used in this research is an expected finding that is consistent with the literature.

READER strategy shows the steps students will follow while solving the problem, as well as focusing on the cognitive strategies to be used at each step and the metacognitive strategies used for the students to monitor and control themselves during the problem solving process. Knowing these steps is important for students with intellectual disabilities who have limitations in managing their own learning process and cognitive processes in order to be a good problem solver (Karabulut, 2015). Self-monitoring was used as a metacognitive strategy in this study. Self-monitoring helps students to follow the steps of the strategy accurately and completely, and to follow which task to do in which step while solving problems, thus helping them to control themselves (Montague, 2007). In this regard, self-monitoring helped the participants in this study to easily monitor whether the strategy steps used in problem solving were implemented, self-control and evaluation, and learn the strategy steps. It is thought that this situation is effective in increasing the strategy experience of the participants. The increase in strategy performances, on the other hand, played a key role in generalizing their problem solving performances to different environments and different problems, and in their permanent performance. In addition, the supporters used in cognitive strategy teaching were included in this study to help participants become independent in the strategy. This is the READER strategy tracking sheet that contains the stages of the READER strategy. The sheet helps the student monitor himself and learn strategy steps by marking the steps he went through while solving problems.

One of the reasons for the READER strategy to be effective in the study is thought to be the Self-Regulation Strategy Development (SRS) teaching approach used in the instruction. It is stated that there are certain reasons why this teaching approach is frequently used in students (Graham & Harris, 2003). Firstly, it can be shown that this strategy has emerged as a result of years of research and has been used effectively for nearly 20 years (Graham & Harris, 2003). Secondly, the strategy has an overarching feature that focuses on the cognitive, motivational, and academic characteristics of students with learning difficulties. In this context, Self-Regulation Strategy Development includes basic information in the context of providing metacognitive information on strategies to be applied to students with academic limitations and with special needs and making information processing more efficient. The third reason is that different self-regulation strategies (self-monitoring, self-instruction, self-reinforcement, and goal setting) can be used together in the teaching approach. It is stated that using these strategies together is more effective. The fourth and last reason is that this approach can



be applied by classroom teachers in accordance with classroom teaching (Graham & Harris, 2003). The main purpose of this teaching approach, whose advantages are stated, is to train students who are self-regulated (Reid & Lienemann, 2006). To achieve this, cognitive and metacognitive strategies should be combined with appropriate self-regulation strategies and applied in coordination (Reid & Lienemann, 2006). For these reasons, it is thought that the presentation of the READER strategy according to the SRSD stages has a significant role in the ability of students with intellectual disabilities to apply these steps, thus increasing the number of correct problems they solve.

In the teaching approach of SRSD, being a model is especially important for the success of teaching (Karabulut & Özmen, 2018; Montague & Dietz, 2009). Cognitive modelling is generally used as a model for the process by using think aloud protocols while applying a cognitive activity (Montague & Dietz, 2009; Özkubat & Özmen, 2018). At this stage, the implementer becomes a model for how strategic learners or master problem solvers think and act when faced with an academic task. With this technique, students have the chance to learn by imitation, and observe and hear how master problem solvers understand the problem, analyses the problem, develop a solution plan to solve the problem, complete the task, and evaluate the result (Montague & Dietz, 2009). In this study, it was observed that the participants included thinking aloud, which they did not include at the baseline level while solving the problem, in the guided practices and the independent practices stages. These observations show that the participants have started to internalize the strategy. In addition, the participants expressed that they were happy to use the strategy and they were satisfied with the problem solving by using this strategy. For example, participants gave self-regulation expressions such as ‘I know what to do while solving problems, problem solving is easy for me now.’ Although these statements are not included as a direct purpose in this study, they give clues about their social validity.

In the study, it is thought that one of the reasons that READER strategy is effective in mathematical problem solving skills is the visualization strategy. The fourth stage of the READER strategy involves the use of drawings and / or diagrams when deciding operations related with visualization (Mancl, 2011). In fact, there are research findings in the literature to support this data (Gersten, Chard, Jayanthi, Baker, Morphy, & Flojo, 2009; Ives, 2007; Jitendra et al., 2002; Van Garderen 2006). In this respect, the visual aids (pictures, drawings, etc.) used in problem solving can increase the level of understanding the problem by bringing together the information contained in the problem (Ives, 2007; Van Garderen, 2007). It provides a way for students to understand problems visually and solve them correctly (Ives, 2007; Van Garderen, 2007). With the implementation of the curriculum including the visualization strategy, it was found that students with learning difficulties increased the number of diagrams they use in the problem solving process, their level of using the diagrams improved, they generalized the use of diagrams to different problems (Van Garderen, 2007), and they performed better in solving problems (Jitendra et al., 2002). Visualization emerges as a useful strategy in drawing the student's attention to the problem, organizing the student's existing knowledge, and associating the concrete statements and abstract expressions in the problem (Ives, 2007; Karabulut & Özmen, 2018).

In the current study, it is a fundamental limitation that students and teachers' opinions about the strategy are not determined after READER strategy teaching is completed in order to obtain social validity data. At this point, a social validity questionnaire was created by the researchers, but the last sessions of the intervention process coincided with the transition period of the schools to the summer holiday, so it could not be applied due to time limitations. Based on the research findings, there are suggestions for education, practice, and further research. In this study, the READER strategy was found to be effective in the ability of students with intellectual disabilities to solve mathematical problems. Within the framework of this finding, it is recommended that teachers who work with intellectually disabled students use the READER strategy while teaching problem solving skills. In order to increase the generalizability of the research findings, the research can be repeated especially with participants with learning difficulties, different problem types, participants in different educational environments and different researchers. At the same time, the effect of READER strategy



on the problem solving skills of students with intellectual disabilities can be analysed by creating a teaching package that includes self-regulation strategies, self-instruction, self-assessment, and self-reinforcement. In addition, the scope of the research can be expanded by adding variables related to the problem solving performances of students with intellectual disabilities and their perception of performance towards mathematics, and their attitudes towards mathematics and mathematical problem solving.

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Appendix 1. READER Worksheet

Problem: Jack is a talented student in his art class. His art teacher likes Jack's paintings very much. Jack lost 4 of the 10 crayons he used in painting class. How many crayons does Jack have left?	
Read the problem.	✓
Examine the questions.	✓
Abandon irrelevant information.	Jack is a talented student in his art class. His art teacher likes Jack's paintings very much. style="text-align: right;">✓
Determine the operation using the diagrams, if needed.	I will do the subtraction. style="text-align: right;">✓
Enter numbers.	$\begin{array}{r} 10 \\ 4 \\ \hline \end{array}$ style="text-align: right;">✓
Record answer.	$\begin{array}{r} 10 \\ 4 \\ \hline 6 \end{array}$ style="text-align: right;">✓



THE EFFECT OF COLLABORATIVE PROJECT ACTIVITIES ON SELF-EFFICACY AND ATTITUDES TOWARDS RESEARCH AND INQUIRY OF GIFTED STUDENTS

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Abstract

The aim of this research is to determine the effect of collaborative project activities on gifted students' self-efficacy perceptions and their attitudes towards research inquiry. In the nature of research mixed pattern was conducted. Study group consists of six gifted students. In this research, cooperative project activities designed according to the project-based learning approach were implemented. Self-efficacy perception scale ($\alpha=.83$), Attitude scale ($\alpha=.75$) and semi-structured interview form was used as data collection tools. Wilcoxon marked rows test and contend analyses were used. As a result, after the collaborative project activities, there was an increase in the attitudes of gifted students towards research inquiry and their self-efficacy towards research inquiry and this difference was statistically significant. As a result of the student interviews, it was determined that gifted students' opinions about cooperative project activities were positive.

Keywords: Attitude towards research questioning, self-efficacy for inquiry, gifted students.

INTRODUCTION

As the world changes rapidly, it is possible to say that gifted individuals with special abilities who make a difference come to the fore. As in history, gifted individuals have managed to attract the attention of societies and it is desirable to benefit from the potential of gifted individuals who have special skills in fields such as management, science, art, sports and economics in Turkey as well as all over the world. It is possible to say that these gifted persons, hidden powers, lead societies with their creativity and innovative ideas, find solutions to the problems of societies and contribute to their development (Davis & Rimm, 2014). The education of gifted individuals, which are considered as national treasure all over the world, is vital for the future of countries. Gifted individuals are highly motivated individuals who learn fast, are interested in learning, and are creative, like also to learn in-depth research according to their peers (MONE, 2013; Silverman, 2013). Individuals who differ significantly from their peers in terms of creativity, intelligence, and productivity, problem solving are defined as gifted individuals (Robinson, Shore, & Enersen, 2014). A study by Clark (2015) found that gifted individuals perform superiorly to their peers in many areas, especially with high language skills. According to the Science and Arts Centers Directive, where gifted students are educated in Turkey, gifteds are defined; "faster learners than their peers" as "individuals who are at the forefront of capacity for leadership, creativity, art, and have special academic skills, understand abstract ideas, like to act independently in their interests and perform at a high level" (MEB, 2007).



Considering that the characteristics of gifted students; it has been determined that they have problem solving skills and high mental capacity, can analyze, synthesize, make original interpretations, engage in seemingly irrelevant processes, develop different solutions to problems (Davis & Rimm, 2014; Silverman, 2013). With their fast learning, creativity and productivity, gifted students in classroom environments differ from their peers (Dağlıoğlu, 2010). However, in schools in Turkey, gifted students are educated in the same educational environments as their peers, at the same level, in the same methods (Levent & Bakıoğlu, 2013). If different educational programs are not implemented for gifted students who are fast learners according to their peers and perform at a high level academically, it will not be possible to meet the educational needs of gifted students (Sak, 2011). Unless appropriate educational environments are provided, event content and program are differentiated, gifted students feel embarrassed and cannot perform. Students' motivations, therefore, decrease and they cannot reveal their abilities or potentials. To meet the educational needs of gifted students and to reveal their abilities, a different program must be implemented apart from the normal curriculum they receive with their peers. In educational environments, it is aimed that gifted students use their high-level cognitive skills, develop their creativity, productive thinking skills, leadership characteristics, seek real life problems and find solutions to these problems, and use different disciplines together (Dereli, & Deli, 2022; Sak, Ayas, Sezerel, Öpengin, Özdemir, & Gürbüz, 2015). The role of teachers is great at the point of implementing the educational programs needed to provide gifted students with these skills (Tortop, 2014). Teachers are able to meet the educational needs of gifted students by using different methods and educational environments, enriching educational programs and using different disciplines together (Dereli & Deli, 2021; Sak, 2011). According to Cutts and Moseley (2004), the purpose of educational enrichment is to be able to use talents completely, expand the field of knowledge, deepen understanding, develop skills, increase motivation, develop thinking, encourage and develop creativity. It is recommended to use project-based learning, problem-based learning, and collaborative learning and STEM methods that allow students to learn both individually and with groups to develop these characteristics of gifted students (Kazu & Şenol, 2011). On the other hand, in the Directive of the Ministry of National Education (MEB) and Science and Art Centers, design a project and management are considered as an educational program and special emphasis is placed on project-based teaching.

Collaborative learning method, which is one of the learning methods that can be used as an alternative in education, stands out in terms of enriching educational environments and meeting different educational needs (Kırbaş, 2010). The collaborative learning method can be defined as small group studies that give students the opportunity to learn from each other and form a positive bond between students. Collaborative learning activities; in educational environments, students work in small groups to achieve group success by supporting each other's learning for the same purpose (Johnson ve Johnson, 2011). With collaborative project activities, students learn to respect, share, exchange ideas, appreciate the talents of their friends, make decisions when necessary and interact positively with their friends while doing group work (Gillies, 2014). In collaborative learning, students work together to achieve the common goal as a group, that the group task is also the duty of each member, and that their success and failures belong to all group members (Bölükbaş, 2014). Collaborative learning at one and the same time, group work allows students to talk, discuss, experience and learn, and reveal leadership and entrepreneurial aspects (Saban, 2014). In this process, students are able to show different abilities, use their high-level cognitive skills by creating solutions to daily life problems, and take responsibility for their own learning and use leadership characteristics and work in harmony in group work (Genç & Şahin, 2015; Koç, 2014).

The current societies need individuals who are aware of their abilities and can develop their abilities, think critically, look at things in a multifaceted way, and use leadership qualities in harmony. It is considered to be possible to increase the number of individuals who try to understand, investigate, question and solve problems encountered in everyday life by bringing the learning approaches in which these skills are acquired to educational environments (Çakal, 2012). In educational settings where collaborative project activities are preferred, students are effectively apprehended scientific



process skills such as thinking about a problem, conducting research, questioning, interpreting, problem solving, and making decisions (Adams, 2013). Research, experiments, activities conducted by students in such learning environments where research and inquiry skills are acquired also help the learned knowledge to be permanent and gifted students to use the knowledge they have learned (Tatar & Kuru, 2009). Students with research and questioning skills learn how to solve the problems they will face in the future by researching and finding solutions. In a learning environment that requires research-inquiry skills, students take responsibility for the learning process by researching, asking themselves the questions they are curious about, accessing the information themselves, and taking responsibility for the information in the learning process (Kardaş & Yeşilyaprak, 2015). Research inquiry-based learning approach, centered on the student; is an approach that allows the student to ask questions, make reviews, observations, look for solutions to problems and activate the student in the learning environment (Davis & Rimm, 2014). Research inquiry-based learning is a learning approach in which students collect data, analyze data and interpret the results they find in order to solve the problem put forward (Contant, Tweed, Bass, & Carin, 2018). Students' scientific research skills and thinking skills develop in the research process in research inquiry-based learning (Wilder & Shuttleworth, 2005).

Students increase their motivation and self-confidence when they fulfill the task assigned to them by conducting research in the process, and they take part as individuals who make a difference in society (Fansa, 2012). The positive outputs of collaborative project/learning activities in educational environments have been revealed by researches and practices in many countries around the world such as the Netherlands, Israel, Australia, America, and Lebanon (Gillies, 2014; Veenman, Denessen, Akker, & Rijt, 2000). Countries desiring get high-level efficiency from the talents and potentials of highly gifted students having quick thinking abilities compared to their peers and different educational needs note that characteristics of gifted students as preparing their education plans (Cutts & Moseley, 2004). Given the characteristics of gifted students and their different educational needs; it can be said that both project and collaborative learning methods can make important contributions in research, inquiry, problem solving, develop decision-making skills and meet different educational needs. Accordingly, in this research, both project-based learning and collaborative learning methods are used together to create a teaching based on collaborative project activities. As mentioned above, it is possible to find many studies on the effectiveness of individual project-based learning and collaborative learning methods. However, there has not been enough indication regarding the effectiveness of the teaching designed by using these two methods together. Similarly, it hasn't been considered of the self-efficacy and attitudes of gifted students towards research inquiry in the literature. In this study, unlike the literature, both the self-efficacy and attitudes of gifted students towards research and inquiry were discussed. In addition, the effect of especially collaborative project activities on these variables has been tried to be revealed. Thus, it is thought that such activities can make important contributions to the literature on how these activities affect research and inquiry skills. In this context, the aim of this research is to determine the effect of collaborative project activities on the self-efficacy perceptions of gifted students towards research questioning and their attitudes towards research questioning.

Problem Statement

Do collaborative project activities have an impact on the perceptions of self-efficacy of gifted primary school students towards research and questioning and attitudes towards research towards questioning?

Sub-Problems

1. Do collaborative project activities contribute to students' self-efficacy perceptions towards research and questioning?
2. Do collaborative project activities contribute to students' attitudes towards research and questioning?
3. How do students think about collaborative project activities?



METHOD

Research Model

This study is designed using the converging parallel mixed method from mixed research patterns. In this context, both qualitative and quantitative data of the research have been collected in a body but analyzed separately. In the quantitative dimension of the study, a semi-experimental pattern is used in the pre-test-post-test without a control group. The semi-empirical settings shows similar characteristics to the experimental pattern, but the issue of unselected assignment of participants discerns the semi-experimental pattern from the actual experimental pattern (Balçı, 2018). A semi-experimental pattern in addition, is wielded to analysis the cause-and-effect related to research where empirical controls are not very possible (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2017). In this study, a semi-experimental pattern is utilised because it is not possible to control all of the variables. Semi-experimental pattern is often opted for in the field of educational researches. (Cohen, Manion, & Morrison, 2000).

The qualitative dimension of the research is a case study. The researcher performs in the educational environment that the application of experimental, experimental observation events by one-on-one throughout the process, facts in-depth examine and decide according to their own perspective that is to shape how they study, requires the execution of the scope of case study research (Ekiz, 2017). To Merriam (2013), the case study is defined as an in-depth description and a detailed examination of a situation by the researcher. The researcher in the case study, conducts in-depth investigations of the real environment with his observations, interviews, documents, reports and decides how to shape the study by collecting research data in the real environment (Creswel, 2007).

The research has an independent and two dependent variables. The independent variable of the research is “Collaborative Project Activities”, and the dependent variables are “Perceptions of Specially Gifted Students towards Research Questioning and Attitudes towards Research Questioning”.

The Study Group

This study is conducted to six gifted students in the Training Room of Gifted Students at Samsun Terme Atatürk Primary School, in the fall semester of the 2019-2020 academic year in Samsun R. K. Center for Science and Arts. Each of the students has taken an Individual Assessment Exam in one or more areas such as general mental ability, visual arts and music which are suitable for their abilities and as a result of the assessment gained the right to enroll into center, all of these students have been recognized as gifted in the field of general mental ability and have been accepted to Samsun R. K. Center for Science and Art. Three of the students taking part of the study group attend the third grade of primary school and are each 9 years old. Three other students attend the fourth grade of elementary school and two are 9 years old, and only one student is 10 years old. Two of the students are female and four are male students.

The Data Collection Tool

The "Self-efficacy Perception Scale for Research Inquiry of Secondary School Students" developed by Ebre Ozan, Korkmaz, and Karamustafaoglu (2016a) and "Research and Inquiry Attitude Scale of Secondary School Students" advanced by Ebre Ozan, Korkmaz, and Karamustafaoglu (2016b) are used as data collection tools in the study. A semi-structured interview form consisting of four questions has been used to determine the students' views on experimental practice. The scales are applied by giving the necessary explanations and instruction to each student and thus they are enabled to answer the questions. The characteristics of the data collection tools are described below.

Self-Proficiency Perception Scale for Research Inquiry of Secondary School Students

The Self-Proficiency Perception Scale for Research Inquiry was used to measure the self-efficacy perception of the participants for research and questioning (SPSRISSS). The scale was designed by Ebre Ozan, Korkmaz, and Karamustafaoglu (2016a). The validity and reliability analyses of the scale were performed with the data collected from a total of 233 students studying in the 5th and 8th



secondary schools classroom affiliated to the Directorate of National Education in Taşova county of Amasya. This scale, which is 5 point likert scale consists of 3 factors. The factor consists of a total of 14 items and the first factor is 7 items, the second factor is 4 items, the 3rd includes 3 items. For each item, a score was composed of the form of *I completely agree* (5), *I agree* (4), *I am undecided* (3), *I disagree* (2), *I don't agree at all* (1). As a result of Exploratory and Confirmatory Factor Analysis, it was calculated that the scale consists of three factors and the factors are 52.727% of the total variance. It was found that the contribution of the first factor to the total variance was 23.953%, for the contribution of the second was 14.836%, and the 3rd was 13.938%. The internal consistency and stability analyses were performed on the data for the reliability studies of the scale, determined as Cronbach's Alpha reliability coefficient of .835. The stability of the results obtained, which seems to be valid and reliable scale for the determination of the level of the calculated with the correlation coefficients of the three factors and the total score is the correlation coefficient between .793 and .821 for the scale to be a level of stability is .803 point.

Research and Inquiry Attitude Scale of Secondary School Students

The Research and Inquiry Attitude Scale of Secondary School Students (RIASSSS) was used to investigate the participants to measure research and questioning attitudes. The scale was formed by Ebrén Ozan, Korkmaz, and Karamustafaoglu (2016b). The validity and reliability analyses of the scale were performed with the data collected from a total of 233 students studying in the 5th and 8th secondary school's classroom affiliated to the Directorate of National Education in Amasya / Taşova. This scale, which is 5 point likert scale consists of 13 items. For each item, a score was composed of the form of *I completely agree* (5), *I agree* (4), *I am undecided* (3), *I disagree* (2), *I don't agree at all* (1). The first factor is 4 items, the second factor is 5 items, and the 3rd includes 4 items. It is observed that the scale consists of three factors and the factors mean 48.417% of the total variance as a result of Exploratory and Confirmatory Factor Analysis. It was found that the contribution amount of the first factor to the total variance was 18.011, the contribution of second factor was 17.683 and the third factor was 12.723. Cronbach's Alpha reliability coefficient was determined as .756 and the total correlation coefficient of the scale was measured as .821. The results obtained mean that the scale is valid and reliable.

The Semi-Structured Interview Form

A five-question semi-structured interview form was used to measure the students' thoughts about collaborative project activities that require research inquiry skills in the qualitative dimension of the study. The questions in the form are given in the findings section. The interview form was composed from questions that will measure students' attitudes towards collaborative project activities, research, and questioning when the empirical process was carried out. The students were asked questions by the researcher during an interview in the classroom environment, and the answers and opinions of the students were noted. All of the students, in addition were observed by the researcher during the empirical process and some were noted down.

The Empirical Process

This study is conducted in the training room of gifted students. Students worked in groups while implementing collaborative project activities in the support training room. Students are divided into two groups of three while studying in group activities. The collaborative project activities designed according to the project-based learning approach are planned as 8 group activities, with one activity per week to be performed according to the 8-week training plan. Sample research activities in the first 4 weeks of the training plan is designed in accordance with a project when students doing their research activities in the last 4 weeks students as a group by selecting topics designed to prepare their own projects. In the process of designed activities, the project-based learning approach steps were considered. The following project-based learning stages in this respect, have been applied:

- *Preparation and Planning Stage:* The project has determined the subjects with the help of the teacher. The studies that the students would do during the research have been scheduled and time scheduling function have been planned. The necessary lists of materials and which



stakeholders will benefit from them have been determined. The activities of the students have been planned and it is decided to form some posters and presentations as a product.

- *Application and Monitoring Stage:* The data about research subjects has been collected and the studies planned within the scope of the project have been carried out. The products of groups have been devised.
- *Conclusion and Evaluation:* The students have presented their projects, and the information, processes and products they acquired have been shared. The students have evaluated the project process with Presentation Evaluation Forms.

In practice, the educational contents consist of a total of 8 activities in 8 weeks, a project each week, and a total of 2 research projects in this process. Activities on a weekly basis are showed in table 1.

Table 1. Activities on a weekly

WEEK	ACTIVITY	DURATION	DESCRIPTION
1.	- Introduction - Identification of groups -Determination of the rules of group work.	40 min. + 40 min.	Students get acquainted with their group friends and determine the rules of group work, such as taking responsibility, cooperating, complying with working time, compliance, respect, distribution of tasks by making a joint decision by the group.
2.	- Group games (Who Am I-Color Hunt) -Introduction of the Research Project - Presentation, Sharing	40 min. + 40 min.	Playing a group game to warm up students, providing students with information about a research project and how to do a research project.
3.	- Sample Project Work -Determination of Questions related to the Project - Preparation and Sharing of the Project Summary	40 min. + 40 min.	Reminding the project stages to realize a sample project, identifying project topics and creating questions, preparing and sharing a project summary.
4.	- Sample project work (Endangered Animals) - Conducting research - Product creation	40 min. + 40 min.	Completion of research on a sample project, creation and presentation of a product.
5.	- A Game of Colorful Groups - Creation of Project Groups - Creating a Group Booklet - Determination of Project Topics of Groups	40 min. + 40 min.	As a result of the group game, new project groups are determined and a group booklet is formed in which new group members introduce themselves.
6.	- Creation of a Project Work Plan and Summary - Creating a Mental Map to the Project Topic	40 min. + 40 min.	Determining the project topics that the groups will explore, making a project plan, creating a mental map with questions about the project.
7.	- Continuation of Group Work and Preparation of Project Products - Creation of Project Products	40 min. + 40 min.	Researching on project topics, preparing the product to be created.
8.	-Performance of Group Presentations	40 min. + 40 min.+ 40 min.	Outputs of project products, group presentations and evaluation.

The Application of Activities

The Objectives of the First Week

1. He expresses himself appropriately in introduction games.
2. It forms the rules for working with the group.

The students played The game “Who am I”, which is one of the dating games, so that they could explore different aspects of their classmates and get warmed up, the students were then told that the school, the class, the games have their own rules as well as the rules to be followed in group work, and they were asked to establish group working rules on what to look out for when working with the group. Each student was asked to write down the study rules they wanted to be followed on the



blackboard and common group study rules were determined. Students were divided into two groups of three. Students understood what they needed to do first in order to carry out a research project as a group, the need to respect common decisions by creating group work rules in accordance with their own recommendations.

The Objectives of the Second Week

1. Students understand the purpose of the Research Workshop Program and the activities that they will do during the semester.
2. Student have knowledge about the concept of the project.

Students were played the game "Color Hunt". After giving instructions for the game, the group that found the most objects at the end of the period was asked to explain how they found more objects. Students were asked for ideas about the "research project" and then asked to ask about dreams and tell them what to do to realize their dreams. The students were reminded that our dreams can be projects for us and when we want to realize these projects, we need to plan, implement and evaluate whether we have achieved our dream or not, and were informed that there are steps for planning, implementing and evaluating the preparation of a project. The students watched the presentation prepared on the topic of "How to Make a Project" and they were provided with information about the concept and stages of the project. After the presentation was completed, it was informed that they would begin to conduct a sample research project on endangered animals in Turkey based on these concepts that they learned the next week.

The Objectives of the Third Week

1. Students apply the concepts they have learned about the project within the scope of a sample project.
2. They ask questions related to the predetermined project topic.
3. Students form project summary.

The students were divided into two groups, with three students forming the *Sea Turtle*, one of endangered animals group from and the other three students were member of the *Bald Ibis*. Each group was given letters of endangered animal and asked the students some questions such as "What can we do to help these animals? What can we do to introduce these animals to the people around us, to raise awareness that they are extinct? What measures can be taken to ensure that animals do not become extinct?" Then, the students were informed that they would develop a project on the topics discussed. The groups, after that were given a cardboard with a large circle drawn in the middle and three separate sections drawn around the circle, and each student was asked to write down the questions they were curious about in their own side. In the middle section, the groups were asked to write down the common questions they had agreed on, and it was stated to the students that they would shape their projects and plan their plans in accordance with these questions. Thus, the students prepared the cardboard of the sharing ideas. In order to make plan for the project easier for them, they distributed a working paper to each group, and all groups were asked to prepare a working paper on Endangered Animals – A Summary of the Project and submit it to their friends.

The Objectives of the Fourth Week

1. Students apply the concepts they have learned about the project within the scope of a sample project.
2. They design a product in accordance with the project topic and purpose.

The groups were given back the Sharing Tour Cardboard and Endangered Animals - Project Summary Papers that they used to ask their questions the previous week in accordance with the questions they asked the students and the plans they made, they were asked to create a product by conducting a study at the Application and Monitoring stage of the project. Then, flashcard was distributed to each group about the animal they had chosen and with the information obtained from this flashcards, the necessary materials were also provided and they were asked to prepare *Identity Card for Endangered Animals*. After sharing of the groups' Identity Card for Endangered Animals, they were wanted to



produce outputs of the project. For this stage, the groups were wished to choose one of the mask, finger puppet or model and prepare it. Through the sharing and presentation of products, the groups completed a sample research project one by one.

The Objectives of the Fifth Week

1. Students know the concept of social responsibility.
2. They realize that each person has a responsibility in the process of working within the group.
3. They improve feasible project ideas related to the problems around them or the issues they think should be developed.

New project groups of students were set off with the “colored groups” game. It was stated to the students that they would start their own project studies in these groups starting from the next week. Students were informed that they would work on their projects with this group and were asked to find a group title for themselves. After that, each group member was asked to prepare and decorate a card with his personal information, hobbies on a small cardboard. The group members were asked to create a group booklet with their cards and the group booklets were shared after completion.

The Objectives of the Sixth Week

1. Students make a study plan for a specific purpose.
2. Students discuss concepts that may be relevant to the selected topic.
3. Students summarize the basic information about the project.

The groups were asked the following questions and wished to brainstorm and list their ideas.

- Are there common needs/problems around you?
- What do you think should be done better around you?
- What problems would you like to have eliminated?

Cards with news about different problems were stick the board in order to support the groups during the idea-forming stage. Students were told that they could the news that interests them. As a result, students were supported to choose a research topic that could be put forward as a product, and various sources could be accessed. Thus, the groups determined the project topics. Then, students were reminded stages of the “How to Make a Project” when preparing their projects and asked to take into account the project stages. After the defining project topics, each groups created a summary of their projects together. The students were informed that they would create a mind map in order to determine the research questions related to the project topics. When preparing a mind map, students were asked to identify the topics/concepts flashing minds and the relationships of these topics/concepts with each other. The activity was completed with the presentation of mind maps.

The Objectives of the Seventh Week

1. Students decide which points of the selected topic should be investigated.
2. Students designs a product suitable for the project.

After the students created their own mind maps related to the project, they were asked to conduct research on project questions library, Internet, books, newspapers, magazines, online resources, etc. The groups were asked to review the project objectives, the mind map they created about the project topic, the information they gained about the topics, and other studies they plan to do within the scope of the project. At this stage, they were asked to decide how they could create products to promote their projects to others, announce them and share what they had learned and the experiences they had gained with others. In order to decide, the following product samples were shared with students.

Cartoon - Graphic - Slide Show - News Broadcast - Storytelling - Manual -Letter - Fairy Tale - Album - Catalog - Photo Brochure - Puppet - Poster - Booklet – Newspaper - Collage Work - Story Map.

After the group members determined the project products and materials, the students started to design and create their products.



The Objectives of the Eighth Week

1. Students create a product in accordance with the purpose of the project.
2. Students verbally express the works on the project and the result of the project.

Students created their products by deciding on the details of how the products they would create were as a group. Each group was asked to make their presentations by giving a period of 15 minutes. A general discussion environment was created about the presentation, and after all the presentations were completed, the groups were asked to answer the following questions by promising.

- How did this project you made contribute to you?
- How do you think this project you have done has contributed to society?

The group presentations were evaluated by Presentation Evaluation Forms. At the end of the project, the groups shared their prepared products with their classmates and also made a comment box, students wrote their opinions about this study, and their friends' projects and threw them in the box and the research project was completed.

Analysis of the Data:

Parametric analysis was used due to the fact that the data collected before and after the experimental application does not provide prerequisites for parametric analysis. Wilcoxon Signed Rank Test was used in line with this, in order to make the statistical analysis of non-parametric tests on research questioning of students' research attitudes and self-efficacy perceptions of competence pre-test and post-test scores. The content analysis method was preferred in the analysis of qualitative data. The accepted significance level in this study was determined as $p < .05$.

RESULTS

The results of the Wilcoxon Signed Rank Test regarding whether the applied collaborative project activities contribute to the students' attitudes towards research inquiry are summarized in Table 2.

Table 2. The effect of experimental practice on attitudes towards research inquiry

Dependent Variable	Group	Mean	Std.Dev.		N	Mean Rank	Sum of Ranks	z	p
Research Inquiry Attitude	Pre-test	3.4615	.3115	Negative Ranking	0	.00	.00	-2.201	.028
	Post-test	4.5641	.2157	Positive Ranking	6	3.50	21.00		
F1: Curiosity	Pre-test	3.2500	.4183	Negative Ranking	0	.00	.00	-2.207	.027
	Post-test	4.541	.3679	Positive Ranking	6	.50	21.00		
F2: Avoidance	Pre-test	3.7667	.4633	Negative Ranking	0	.00	.00	-2.226	.026
	Post-test	4.7333	.2732	Positive Ranking	6	3.50	21.00		
F3: Valuing	Pre-test	3.2917	.2922	Negative Ranking	0	.00	.00	-2.023	.043
	Post-test	4.3750	.4401	Positive Ranking	5	.00	15.00		

When Table 2 is examined, it is noted that the pre-test score averages of the students' research inquiry attitudes are $\bar{x}=3.461$ before the collaborative project activities application and that this average is $\bar{x}=4.564$ after the application. It is observed that there is an increase in the average score of students' attitudes towards research inquiry after the implementation of collaborative project activities. In addition, students' attitudes towards the research question examined; curiosity (pre-test $\bar{x}=3.250$ post-test $\bar{x}=4.541$), avoidance (pre-test $\bar{x}=3.766$; post-test $\bar{x}=4.733$) and valuing (pre-Test $\bar{x}=3.291$; post-test $\bar{x}=4.375$) sub-factors, it is observed that the average score increased after the application of the project. It can be said that after the implementation of collaborative project activities, the attitude scores of all students towards research inquiry increased in consequence of analyzing the results of the Wilcoxon signed rank test conducted on the significance of this increase. In addition, when the variables obtained in the table is significant, when the calculated test statistical value is examined, there are a significant difference between the students' pre-test and post-test scores of the research



questioning ($Z=-2.201$, $p<.05$). There is a significant difference between the pre-test and final, in the same way, test scores of students' attitudes towards the curiosity, avoidance, and valuing sub-dimensions of research inquiry (Z for curiosity; -2.207 , $p<.05$; avoidance $Z=-2.226$, $p<.05$; for the evaluation of $Z=-2.023$ ($p<.05$). Accordingly, it can be said that the application of collaborative project activities has a positive effect on students' attitudes towards research inquiry. Before and after the collaborative project activities applied to the students, a Wilcoxon rank test was performed to test whether there was a significant difference between the students' perceptions of self-efficacy dec research questioning and the results are summarized in Table 3.

Table 3. The effect of empirical application on self-efficacy perceptions of research inquiry

Dependent Variable	Group	Mean	Std.Dev.		N	Mean Rank	Sum of Ranks	z	p
Research Query Self-efficacy	Pre-test	3.3929	.1735	Negative Ranking	0	.00	.00	-2.207	.027
	Post-test	4.2857	.0903	Positive Ranking	6	3.50	21.00		
F1: Avoidance	Pre-test	3.7857	.4309	Negative Ranking	0	1.00	1.00	-1.997	.046
	Post-test	4.4048	.2772	Positive Ranking	6	4.00	20.00		
F2: Continuing the Research	Pre-test	2.8333	.5627	Negative Ranking	0	.00	.00	-2.214	.027
	Post-test	4.1667	.2041	Positive Ranking	6	3.50	21.00		
F3: Personal	Pre-test	3.2222	.4554	Negative Ranking	0	.00	.00	-2.226	.026
	Post-test	4.1667	.5055	Positive Ranking	6	3.50	21.00		

The average self-efficacy perceptions of the students for research questioning before the application of collaborative project activities are $\bar{x}=3.392$, and the average self-efficacy perceptions of the students for research questioning after the application are $\bar{x}=4.285$ when table 3 studied. Accordingly, it can be said that students' perceptions of self-efficacy towards research inquiry after collaborative project activities increased in their score averages. Along with this, sub-factors of questioning of student's research and qualifications of self-efficacy avoidance (pre-test $\bar{x}=3.785$ post-test $\bar{x}=4.404$), continuing the research (pre-test $\bar{x}=2.833$; post-test $\bar{x}=4.166$) and personal (pre-test $\bar{x}=3.222$; post-test $\bar{x}=4.166$) means that the average score increased after the application. As the results of the Wilcoxon signed rank test conducted regarding the significance of this increase interpreted, it comes out that all of the students had an increase in their self-efficacy scores for research questioning after the application of collaborative project activities. Whether the variables obtained in the calculated value of the test statistic is examined, it is understood that students research a questioning of self-efficacy score increase after the implementation of the cooperative project, and this increase differed significantly ($Z=-2.207$, $p<.05$). In the same way, students are observed that sub-dimensions such as research their questioning of avoidance, continuing the research and it's on the personal self-competencies significant difference between pretest post test scores (avoidance for Z ; -1.997 , $p< 0.05$; for continuing the research $Z=-2.214$, $p<.05$; for personal $Z=-2.226$, $p<.05$) Accordingly, it can be said that collaborative project activities contribute significantly to students' perceptions of self-efficacy towards research inquiry.

The answers of the students to the questions posed in order to determine their views on the collaborative project activities can be summarized as follows.

1. Do you like participating in collaborative project activities? Why? Answers to the question:

S1: "Yes, I liked it, because the research project work was fun."

S2: "Yes, I liked it, it was especially nice to work as a group, and I learned many new things."

S3: "I didn't really like it at first, but then I really enjoyed it because I thought I had developed different perspectives."



S4: *“Yes, I liked it because I both had fun and learned new things.”*

S5: *“Yes, because I learned new things and I liked studying as a group.”*

S6: *“Yes, I like it because I like research.”*

When the answers given by the students to the first question are viewed, we observe that they have gained new knowledge through collaborative project studies, gained different perspectives and found collaborative project studies to be fun. Accordingly, it can be said that students like to participate in collaborative project activities and find collaborative project activities useful.

2. How was it studying with your friends as a group while making a research project at collaborative project events? Why? Answers to the question:

S1: *“I think it was very nice, I could have been bored if I was the only one, it might have been difficult, but I had fun as a group. Also, my friends knew some things that I didn't know, so my deficiency was complete.”*

S2: *“It was very nice to work as a group because we had fun and we all learned new information by helping each other.”*

S3: *“I think it's different, there are some bad sides and good sides. As a group, sometimes when we make the wrong decisions, it's all our fault, I think it's bad. And sometimes because we question together, we can easily make the right decision, which is a good thing.”*

S4: *“It was very pretty to work together because it was nice to do the same event with my friends, to make decisions together.”*

S5: *“It was nice because my shortcomings can come out when I'm studying alone, but sometimes my other friends can overcome my shortcomings when I'm a group.”*

S6: *“I think it was nice to work as a group, because when we mix different thoughts of all of us, some good ideas come out as a result.”*

When the students' answers to the second question examined, it may mean that when they work together with their group mates, they learn new information by helping, complete their deficiencies together, can make the right decisions by exchanging ideas together. Accordingly, it can be said that students find group work useful in collaborative project activities.

3. How did this project that you did as a group contribute to you? Answers to the question:

S1: *“I found out at what point I would start research and where I would complete it. Sometimes I find out that everything I know is not true.”*

S2: *“The topic of the presentation I studied in the research project came across in the social studies course, so it helped me in other courses.”*

S3: *“Working as a group has improved my sense of togetherness. I found out that a study is done better by exchanging ideas as a team.”*

S4: *“This event allowed me to get new information.”*

S5: *“I have learned how to work as a group and how to do research.”*

S6: *“I have learned more about the issue I am researching. I never knew how to prepare a presentation, I also learned how to prepare a presentation when preparing a research project.”*

When the answers given by the students to the third question are examined, it is possible to say that the students have learned how to conduct research, exchanged ideas, gained new knowledge thanks to the research project they have prepared. According to the students' opinions, made an inference that collaborative project activities have a contribution on students' learning of new information.

4. How do you think this project that you are doing as a group can contribute to society? Answers to the question:

S1: *“I think it will make a positive contribution, our project will raise public awareness about children's rights.”*



- S2: *"I think people become more aware of the problems in society and become aware of them."*
S3: *"We will raise public awareness. We make people sensitive and more responsive."*
S4: *"Our project provides awareness of people in society."*
S5: *"It makes more people in society realize the problems in the world."*
S6: *"By our project, more people learn what we have learned, and so people are more careful to solve problems."*

It may be deduced that they will have a positive contribution to the fact that people will be more sensitive to world problems, awareness, and problems will be noticed by more people with the research projects they have prepared when the students' answers to the fourth question are examined. According to the opinions of students, it can be said that they think that students contribute to society with research projects prepared in collaborative project activities.

5. What would you pay more attention to if you had to prepare a research project on a new topic? Answers to the question:

- S1: *"I would do each step in the research project with more attention, without skipping in turn. I would like to add more of what I have learned in other courses to my research."*
S2: *"Our energy resources are running low, I would like to choose and investigate this issue. I would also like to prepare large posters in the square to create more awareness when the project is over."*
S3: *"I would have cared more about teamwork."*
S4: *"I would choose the topic, the places, the people I would be helped to investigate, more carefully."*
S5: *"I would have liked to gather with my friends outside the school and do more research."*
S6: *"I would have chosen the topic carefully. I would choose the topic that I am more interested in, that I would like to have information about."*

When the answers given by the students to the fifth question are examined, it is possible to say that they want to make a new research project by paying attention to the research project stages, choosing the topic they are interested in, paying attention to the group work and the dissemination of the project. Accordingly, the findings shows that students are actively learning through collaborative project activities and are learning how to do a research project.

6. Do you want to do new research projects as a group? Why? Answers to the question:

- S1: *"Yes, I would like to, because I'm learning new things. I'm learning better with what I've learned by discussing it as a group and researching and doing everything ourselves."*
S2: *"Yes, I would. I learned new information in my first research project, I would like to do new projects and learn more. And we'd learn new things as a group, and I really like that."*
S3: *"Yes, because it contributes more to me, and I liked to do everything ourselves."*
S4: *"I would have liked to, and I really liked to prepare the presentation and to learn new things."*
S5: *"Yes, because it's fun. And as a group, we learn better when we do everything ourselves."*
S6: *"I would like to because it's fun to do research and we did the research ourselves freely."*

Students when examining their answers to the sixth question, when preparing a research project, feel free to learn new information, they enjoy working as a group for better learning by doing everything themselves and it can be said that new research projects they want to do. Thus, it can be said that the students' thoughts about collaborative project activities are positive.

According to the answers given by the students to the questions asked about the activities, it can be said that the opinions of the students regarding the collaborative project studies are positive. According to the teacher observations in the classroom when the activities are being applied, in the research project studies; it can be said that the students are active, carry out the studies themselves,



even if there are occasional differences of opinion in the group studies, they can ultimately come to a common decision, respect the decisions of their friends, choose the subjects they are curious to investigate, use different sources when researching new information, use technology effectively and efficiently. That the students want to do other research projects after eight weeks of collaborative project activities completed, and as a group they think they learn better because they do all the work themselves, support that they find collaborative project activities fun, enjoyable and useful.

DISCUSSION and CONCLUSION

The results of this study show that after the collaborative project activities applied to the students, the students' attitude towards research inquiry scores increased on average. Collaborative project activities contribute significantly to students' attitudes towards research inquiry, and it is founded out that this contribution is also statistically significant. It's similarly, seen that there is a significant difference between the pre-test and post-test scores of the sub-factors of the research such as curiosity, avoidance and valuing inquiry-based attitude scale sub-factors in favor of the post-test. This reveals that the attitudes of gifted students towards research inquiry applied in collaborative project activities can develop in a positive way. It can be said that the collaborative project activities implemented in this research; planning them as project-based learning activities, continuing them over a long eight-week study period, and implementing them in a flexible work environment affect the positive development of students' attitudes towards research inquiry. When other studies in the field are examined, there are many related studies dealing with cooperative learning and the gifted, whereas it is very limited that the research in which the two parts of the research are combined.

As a result of a literature review, it is possible to find similar studies that support the results of this research. It is examined that while studying with students at the lower, middle and upper level of success and increasing student attitudes as a result of the study, it was seen that this increase was affected by the importance of tasks and responsibilities in the lower group, course success in the middle group and knowledge and learning in the upper group in the study of Durmuş (2020) revealing the impact of guided research inquiry approach activities on students' attitudes towards research inquiry. Similarly, it has been observed that there has been an increase in the attitudes of the students towards research inquiry and that there has been an improvement in the scientific process skills of the students at the higher level of success in the research of Koyunlu and Ünlü (2015) in which students examined how their views and perceptions of research and questioning changed with science courses based on technology-supported research inquiry. Kanter, and Konstantopoulos (2010) and Turkmen (2019)'s works have revealed that cooperative project activities also work with the students' concerns to be actively involved in the assessment process and discuss with members of the research group are important in terms of the provision of permanent learning. Çiçek's (2018) study also supports these findings. It is concluded that cooperative learning increases students' self-confidence and participation in the learning process, and that students learn better in a similar study (Gavali & Banu, 2020). A study conducted by Mentz and Van Zyl'in (2016) also revealed that cooperative learning has positive contributions to students' attitudes towards learning and self-learning. Another study found out that permanent and meaningful learning is achieved in students by assuming their own learning responsibility of each of the students with a project-based learning approach (Dobrin, 2020). These studies show that by using collaborative project activities in educational settings, students investigate the issues they are interested in themselves, thus providing persistent learning, and collaborative project activities positively increase students' attitudes towards research inquiry.

However, it may be encountered opposite results in the educational researching field. In Özer's (2019) study which measuring the attitudes of students towards research inquiry with educational technologies, no significant difference has been found between the scores of the pre-test and post-test of student attitudes. This situation has been interpreted as the fact that 3 weeks of study is not enough for research inquiry-based attitudes to develop and that students are encountering this method for the first time. Another different study, in which the effect of collaborative group studies on the students'



questioning skills was examined, has shown that there is no significant change in the students' attitude scores towards the course (Kaplan Parsa, 2016). That findings are interpreted as the fact that although the application lasted for two months, the 14 activities during this time decreased the motivation of the students. It is reported that Questioning of students' research of the attitude of increase in the positive way are derived from every week for a period of eight weeks event planning, research, questioning, curiosity about studying with gifted students, students in the selection of the topic to be researched given the opportunity to choose their topics of interest in this study.

The implemented collaborative project activities contribute significantly to the students' perceptions of self-efficacy towards research inquiry and is that this contribution means statistically significant. There is a significant difference between the pre-test and post-test scores of the self-efficacy perception scale sub-factors aimed at questioning the research; avoidance, continuing the research, and personal subfactors in favor of the post-test. This result shows that the self-efficacy perceptions of gifted students joining to collaborative project activities towards research inquiry can develop in a positive way.

One may find research that shows that collaborative project activities and project-based learning approach bring students skills such as problem solving, collaboration, decision making, research review, questioning and, discussion in when this field is research. The studies of Yaman and Yalçın (2004), Uysal (2009) and Yılmaz (2015) are noteworthy at this point. Wu and Hsieh's findings (2006) also revealed that research inquiry-based learning environments contribute to the development of students' inquiry skills. In other study, the effect of online learning on the development of students' critical thinking skills with the cooperative learning strategy was studied on and it was found out that the cooperative learning strategy positively affects the development of students' critical thinking skills (Sholikh, Sulisworo, & Maruto, 2019). It is emphasized that the importance of project-based learning approach contributes to the creative thinking, reflective thinking and problem solving skills of gifted students in a different paper (Kıran, 2018). In the study of Turkmen (2018), it was revealed that the project-based learning approach provides meaningful learning for students by searching for solutions to problems, discussing ideas, using scientific research skills and creating their own products. Chu, Tse and Chow (2011) also revealed that the project-based learning approach has a positive effect on the development of students' scientific research skills. As in similar studies in the field, it is possible to say that collaborative project activities in this study contribute to the development of students' self-efficacy towards research inquiry.

When their views on collaborative project activities are examined, it is seen that the students find the collaborative project activities fun, useful and are happy to learn new information. Yaman and Yalçın's study (2004) is also remarkable work at this point. It is seen that students can reach a common point by discussing their ideas in cooperation with their group mates, they can correct each other's failures by helping each other so that they can learn better, and they want to do a research project again. The studies of Çiçek (2018), Anderson (2019) and Durmuş (2020) also advocate these findings. Chu (2009)'s study also monitored those students find collaborative project-based learning approach easy and enjoyable. It is showed up those students who receive high marks prefer to learn collaboratively in a different study (Eijl, Pilot, & Voogd, 2005). It is possible to find findings in similar studies in the literature that students can investigate the topic they are interested in and curious about themselves, feel free in the working environment as a group, and have increased motivation in research inquiry-based collaborative learning (Demir, 2013; Ecevit, 2018; Yılar, Şimşek, Topkaya, & Balkaya, 2015). As in this study, similar studies in the field show that students find collaborative learning environments useful, learn better, and enjoy working collaboratively. In addition, in this study, observations of teachers in the classroom during the implementation of activities also support these results. In this regard, the research results are in parallel with the findings contained in the relevant field resources. Students in collaborative learning environments acquire many skills such as cooperation, assistance, exchange of ideas, research inquiry, new learning, and social skills as well as cognitive skills are developed.



Recommendations

It is recommended that the collaborative project activities discussed within the scope of the research should also be used in other courses such as science and social studies that require knowledge and skills in this context.

Within the scope of this research, the effect of collaborative project activities on the competence and attitudes of students towards research inquiry has been discussed. It is suggested to conduct different studies aimed at the effect of collaborative project activities on different psychometric characteristics of gifted students, such as critical thinking, problem solving, and creative thinking.

Limitations of the Research

This research is limited to six gifted students.

This research is limited to a total of 8 activities, once a week in the gifted support room.

Acknowledgments

The data of this research were collected in 2019-2020 academic year. As the authors of this study, we declare that we collected data in accordance with ethical rules during the research process and acted in accordance with all ethical rules. We also declare that there is no conflict between the authors.

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PRESCHOOL TEACHER OPINIONS ON ADAPTATION TO SCHOOL DURING THE COVID-19 PANDEMIC

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Abstract

This study aims to determine the opinions of preschool teachers on preschool adaptation during the Covid-19 pandemic process and to determine what can be done to facilitate the adaptation of children to school in such negative situations. The research was carried out as a multiple case study with 22 preschool teachers working at private and governmental institutions in seven different regions of Turkey. The data were collected by means of phone conversations using an interview form prepared by the researchers. The results of the research determined that children's adaptation was affected by masks and social distance requirements, necessitating teachers to prepare their activities accordingly. Teachers' opinions about the effect of gradual transition on the adaptation process to the school were found to differ. The findings and results of the research are detailed in the study.

Keywords: Pandemic, Covid-19, preschool education, adaptation to school, gradual transition.

INTRODUCTION

School is often the first place children spend long hours away from their families and where they may encounter novel difficulties. It is also where they encounter teachers and peers for the first time. An important factor in the positiveness of subsequent adaptation processes is a problem-free adaptation when initially starting school. Likewise, any difficulties encountered during this same period are important factors in the persistence of issues to adaptation in future situations. Therefore, adaptation to school can also affect children's development (Docket & Perry, 2016; Margetts 2009; Saribaş & Akduman, 2020).

Borbélyová (2017) stated that adaptation to school should be addressed from three perspectives: socially, psychologically, and biologically. Ladd and Burgess (2001), on the other hand, asserted that school adaptation is a concept covering school success and social behaviour towards school. Gennadevna (2012) also defines school adaptation as children's adaptation to new social institutions, where they develop new social relationships and accept new social roles (as cited in Borbélyová, 2017). Therefore, adaptation to school can be expressed as a broad concept that includes the academic, social, and psychological adaptation of children. Children with easy and early adaptation to school are considered to have a high level of readiness, positive social and emotional skills, the ability to establish healthy peer relationships, and high academic success (Betts & Rotenberg 2007; Bono, Sy, & Kopp, 2016; Estell, Jones, Pearl, Van Acker, Farmer, & Rodkin, 2008; Onder & Gülay, 2010). Children who have problems adapting to school may experience low academic success, psychological



problems, and negative peer relationships, with the possibility of these difficulties continuing in following years (Brown & Lan, 2015; Flouri & Sarmadi, 2016).

Bronfenbrenner's Theory of Ecological Systems is an approach that deals with the transition process between home and school. The ecological model states that children shape their own experiences of transition to school and that these experiences in turn shape them (Docket & Perry, 2016). Bronfenbrenner's theory also holds that the development of a child is best explained in the context of family, education, and society, and that this development process consists of intertwined circles. Within this context, the child is at the centre and the innermost circle is that child's experience. The microsystem, which is the innermost level of the environment, includes the personal development of the child and the closest environment the child is in, such as home, parents, school, teacher, and peers (McBlain, 2018). The mesosystem forming the outer circle emphasises communication between these microsystems. As the child starts school, the interaction between home and preschool education forms the mesosystem. The mesosystem includes every situation that does not directly involve the child but affects his or her experiences. The outermost level of Bronfenbrenner's model is called the macrosystem. It includes cultural values, laws, customs, and traditions. According to Bronfenbrenner, the environment has a variable power that affects the child and is known as the chronosystem. Situations such as starting school affect the development of the child and these effects vary depending on environmental opportunities, personal, physical, and mental characteristics. Situations such as conflict, tension, and indecision can turn school adaptation into a negative experience (Docket & Perry, 2016; Hertler, Figueredo, Peñaherrera-Aguirre, & Fernandes, 2018). Ratelle, Duchesne, Litalien, and Plamondon (2021) state that family has a significant effect on a child's adaptation to school. Other research also emphasises the child-teacher relationship (Lan & Moscardino, 2019) and teacher-child dependency (Lifshin, Kleinerman, Shaver, & Mikulincer, 2019). Teachers and families are the child's microsystem and thus have an important effect on the child's adaptation to school. Bronfenbrenner also emphasised the importance of the microsystem in which the child is located.

In Turkey, preschool education is optional and covers children who are 36 months to 5 years of age. The net rate of 3- to 5-year-olds in preschool education in this country is 39.11%, with participation rates of 50.79% and 68.30% for 4- to 5-year-olds and 5-year-olds, respectively (National Education Statistics, 2019). In this case, there are children starting preschool at the age of 3 and others at the age of 5. Studies have shown that children who have received preschool education for a few years have an easier adaptation process to school, while those who start school for the first time and receive preschool education for the first time at the age of 5 experience more adaptation problems (Başaran, Gökmen, & Akdağ, 2014; Datar, 2006; Kahraman, 2018). The Ministry of National Education (MoNE) developed a five-day programme covering the week before schools open in order to facilitate the adaptation process of preschool children to school (MoNE, 2013). This programme was implemented for two days (September 5-6th School Adaptation Programme-Preschool) in the 2019 academic year: however, the school adaptation process changed in the 2020 academic year due to the Covid 19 pandemic.

The Covid 19 pandemic, which emerged in China in December 2019, was detected for the first time in Turkey on March 11th, 2020 (Ministry of Health, 2020; World Health Organization, 2020). Alongside this global pandemic and health crisis (United Nations Development Programme, 2020), a challenging era of quarantine processes in which many places with close human contact like schools have been shut down, affecting the whole world in terms of health, policies, economics, and education. This pandemic has also created a new culture of remote work and education, which many countries around the world have turned to (Bozkurt & Sharma, 2020; Gupta & Goplani, 2020; Reimers, 2020).

With the start of 2020 academic year on September 21st, children were provided a one-day integration programme before the first week of school, with parental consent. In the following weeks, children were permitted to attend in-person classes for two days per week with parental consent. It was then decided to allow preschool institutions to allow students to attend five days per week effective October 12th. This differed in private preschool institutions as they allowed their students to attend classes five



days per week effective July 1st, 2020. This process ended after public schools re-opened and continued for a week as of November 16th, and then closed completely. When schools finally reopen, the adaptation process of children will need to be restored. Understanding what happened as of September is important in terms of determining what can be done during the new period. It is also important to understand the adaptation process of children who start school for the first time or who get education in different regions and institutions and whose education has been interrupted by the Covid 19 pandemic in order to help reduce future risks for school children. Can (2020) believes that implementations for preschool children should be prepared. However, little research has been conducted to examine how teachers generally view children's school adaptation in preschool education in Turkey (Bağçeli Kahraman, 2018; Bağçeli Kahraman, Şen, Alataş, & Tütüncü, 2018; Başaran, Gökmen, & Akdağ, 2014). In addition, only one study was found examining the school adaptation process after Covid 19. Ogelman, Güngör, and Göktaş (2021) conducted research to determine teachers' views on the school adaptation process after the initiation of measures designed to prevent the spread of Covid 19. This research is different in terms of evaluating how teachers in both public and private schools view preschool adaptation during the opening and closing processes of schools in seven different regions of Turkey. Understanding the school adaptation processes of children who started preschool with the opening of schools during Covid 19 is important in determining what methods should be used in preschool education for any subsequent difficult situations such as pandemics. Therefore, using preschool teacher evaluations about the school adaptation process during an extraordinary situation that they themselves have likely experienced for the first time as well can be helpful in preparing for such incidents in the future. For this purpose, the present study aims to determine the opinions of preschool teachers on preschool adaptation during the implementation of Covid 19 measures and aims to determine what can be done in order to facilitate adaptation of children to school in case of such pandemics or diseases or in negative environments, considering the experience of teachers. In line with this purpose, answers to the following questions were sought:

1. How do teachers view the school adaptation process?
2. According to teachers, how has the pandemic process affected children's adaptation to school?
3. How has the pandemic process been managed in schools?

METHOD

The research was carried out using the qualitative research method of the multiple case study, which aims to examine an event or phenomenon deeply in a limited system that cannot be controlled by the researcher (Akar, 2017; Merriam, 2018). Through this method, the researcher reveals experiences and processes in their natural environment (Yin, 2014). Individual interviews were conducted in this study to determine the opinions of teachers based on their experiences during the school adaptation process over the course of measures implemented to slow the spread of Covid 19. Since the research included teachers working in schools from different regions and from different socio-economic levels, it was planned as a multi-case design. There are sub-units or sub-cases in the multi-case design from which data are collected and analyses are carried out (Merriam, 2018).

The Study Group

Maximum diversity sampling was used to examine the differences or similarities between private and public schools from seven different regions in Turkey. This sampling method allows researchers to use a small sample size which reflects the diversity of a particular situation to the greatest extent (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2012). This study sampled public and private schools based on region and teachers employed in these schools were determined through the use of the snowball sampling method. In this sampling method, volunteer participants are asked to identify one or two others who would be willing to participate, thus growing the sample size (Christensen, 2014). Being employed at a preschool education institution, having at least an undergraduate degree in preschool education, as well as having a minimum of two years teaching experience were determined



as criteria. An attempt was made to ensure maximum diversity during participant selection by snowball sampling. Phone interviews were carried out with the participants and the interviews were recorded as digital audio files upon their consent. The records were later transcribed. Demographic information of the teachers participating in the study is given in Table 1.

Table 1. Demographic information of participants

Teacher	Age	Years of Service	Type of Institution	Region	Province	Time spent with the current class	Class Size	Age Group (in months)
ID1	37	15	Public	CA	Nevşehir	0-4 months	14	61-72
ID2	34	11	Public	CA	Nevşehir	0-4 months	16	36 - 48
IID3	48	26	Public	CA	Eskişehir	0-4 months	10	49-60
IID4	30	3	Public	CA	Sivas	2 years and above	8	49-60
II01	25	3	Private	CA	Eskişehir	2 years and above	13	49-60
ED1	37	14	Public	A	Muğla	0-4 months	15	61-72
ED2	37	15	Public	A	Muğla	0-4 months	11	61-72
EO1	29	8	Private	A	Izmir	4 months and above	8	54-78
MD1	25	4	Public	M	Istanbul	0-4 months	14	49-68
MO1	27	4	Private	M	Bursa	2 years and above	6	49-60
MO2	29	5	Private	M	Yalova	2 years and above	11	61-72
KD1	28	4	Public	BS	Amasya	0-4 months	13	61-72
KD2	39	16	Public	BS	Giresun	2 years and above	18	61-72
KO1	28	5	Private	BS	Samsun	4 months and above	8	61-72
DD1	27	4	Public	EA	Ağrı	0-4 months	8	49-60
DO1	25	3	Private	EA	Malatya	0-4 months	11	49-60
DO2	37	17	Private	EA	Erzurum	0-4 months	16	61-72
AO1	24	3	Private	Med	Mersin	0-4 months	11	36 - 48
AO2	23	2	Private	Med	Mersin	2 years and above	14	49-60
AD1	28	6	Public	Med	Antalya	0-4 months	8	61-72
GDO1	24	2	Private	SEA	Gaziantep	2 years and above	11	61-72
GDD1	27	5	Public	SEA	Kilis	0-4 months	22	49-60

CA: Central Anatolia, A: Aegean, M: Marmara, BS: Black Sea, EA: Eastern Anatolia, Med.: Mediterranean, SEA: South-Eastern Anatolia

Of the sample of 22 volunteers, 10 work in private preschool institutions and 12 in public. Five of the teachers included in the study are from Central Anatolia, three each from the Aegean, Marmara, Eastern Anatolia, and the Mediterranean, while two are from South Eastern Anatolia.

Data Collection Tool

An interview questionnaire consisting of semi-structured questions was prepared in order to determine opinions of teachers on school adaptation processes of children during Covid-19. After an extensive literature review, the form was designed and semi-structured interview questions were created in accordance with the scope of this research. In order to ensure validity, two teachers experienced in the school adaptation process were consulted, and the questions were put into final form after revisions were made regarding questions to be added, eliminated, or changed. Eight open-ended semi-structured questions were thus prepared for teachers. The questionnaire was tested on two other teachers who were not part of the study in any way and it was determined at the end of the analysis that the questions were understood. Finally, the opinions of two further experts were taken and the questionnaire was put into its final form. The final version of the questionnaire has two sections. The first deals with questions about experience, demographic information, class sizes, and age groups among other information. The second part contains eight semi-structured interview questions to determine opinions on the school adaptation process. The following questions were asked regarding school adaptation: “In your opinion, what makes a child adapt to school?”, “Are there differences in the traits of children who had difficulty compared to before the pandemic?”, and “As you know, it is



said that there are differences in the attitudes and behaviours of families with the pandemic process. What do you think about it?” In order to determine how the pandemic process affected children's adaptation to school, the following questions were asked: “Do you think there is a difference between a child who received online education last year and one who did not? Could you compare?”, “What do you think about the adaptation process of children to school after the pandemic process?”, “Some children may have been affected more by the pandemic process compared to other children. Are there children in your class that you think are affected much? Why do you think these children are affected more?” and “What kind of studies have you carried out with children this year during the adaptation process? Has the pandemic affected your activities? Can you explain?” Finally, to determine how the pandemic process was managed in schools, the following questions were asked: “Last year, schools were closed due to the pandemic process. What did you do during this process?”, “As you know, the Ministry of National Education implemented a gradual transition during the pandemic process by ensuring that children come to school first one day per week, then two days in the following weeks, until finally they were attending five days per week again. What do you think about this process? How did it affect their adaptation to school?”

Validity and Reliability

Lincoln and Guba (1986) stated that the concepts of credibility, transferability, reliability, and verifiability are used in qualitative research to ensure validity and reliability. However, reliability is not necessary per se in qualitative research. In order to ensure credibility in this study, it was carried out using known participants and the group was expanded with the suggestions of these participants, thus establishing a friendly atmosphere. The use of a semi-structured interview questionnaire allowed for a more genuine collection of data. Participant interviews were all recorded and opinions were confirmed at the end of each question, and participants were asked if they wanted to add anything further.. Diversity was ensured by conducting research in different schools and using participants having a variety of demographic differences. Creating questionnaires utilizing expert and teacher opinions also supports credibility.

Recording the research data and revealing the data without comment support the transferability. The storage and coding methods for the data show the verifiability of the research. Data were encoded separately to ensure the verification of the study, and the coefficient of concordance between encoders was determined to be .73. A coefficient of concordance over .70 between encoders indicates consistency (Miles & Huberman, 1994). Finally, during the creation of themes, two researchers discussed and reviewed the codes together and finalised the themes.

Data Collection Process

Before starting the research process, ethical permission was obtained from the Ethics Committee of the Bursa Uludag University (dated 02/10/2020 and numbered 2020/07). After obtaining permission, the first volunteer teachers were determined, and then the teachers recommended by these volunteers were determined considering maximum diversity. Telephone interviews were held between November 1 and December 1, 2020, with teachers who consented to be interviewed. Participants were first informed about the scope and purpose of the research and the content of the interview and advised that they could terminate the interview at any time if they so choose. They were informed that the interviews would be recorded and that these records would be kept confidential. Each interview started with informal small talk to ensure a friendly environment so that participants would feel comfortable answering the questionnaire items. At the conclusion of the questionnaire, the opinions obtained were read back to the participant and confirmation of the opinion was requested. Participants were then asked if there was anything further they wished to add or remove from the record. Throughout this process, no guidance was given to the participants. The interviews lasted for about 20 minutes, excluding conversations and confirmations.

Data Analysis

Content analysis was used in the study as the stages of data preparation, encoding, theming, organisation of codes and themes, identification, and interpretation of the findings were followed



(Creswell, 2013). During the preparation of the data obtained from the interviews with the participants, the audio recordings were transcribed to paper. Two researchers collaborated to determine codes for each individual question y and then the questions were grouped into themes. During the process of interpreting the data, codes were given to the teachers and direct quotations were included. Institutions were classified as “O” for private and “D” for public school. Regions were coded similarly with Marmara as by “M”, Black Sea as “K”, Aegean as “E”, Mediterranean as “A”, Eastern Anatolia as “D”, Central Anatolia as “II”, and South-eastern Anatolia by “G”. Thus, for example, a preschool teacher working in a private school in Eastern Anatolia would be encoded with the number 1 and would be indicated as “DO1”, while another teacher working in a state-affiliated public school would be encoded as “DD1”.

RESULTS

The Opinions of Teachers on the School Adaptation Process

In this section, teacher’s opinions on the first sub-problem of the study, the process of adaptation to school, were examined. Table 2 provides the opinions of teachers on the factors affecting a child's adaptation arranged in themes and codes.

Table 2. The factors affecting a child's school adaptation according to teachers

Theme	Code	Participants
Family	Parental Attitudes	ID3, DD1, MD1, DO1, IO1
	Communication of Family with Child	ID1, MO2, AD1, DO2
School	School Environment	ID3, KD2, DO1, ED2, AO1, ID2
	Stimuli in the Classroom Environment	ID3, DD1, EO1, DO1
	Trust in the School	MO2, ID2, ID1
Teacher	Trust in the Teacher	ED1, MO2, ID4
	Teacher's Support	ID1, GDO1, ID4, MO1
	To Endear themselves	ID4, IO1, MO1, KD1
	Teacher's Attitude	AO2, KD2, DO1, GDD1
	Communication of teacher	KD1, ID3, ID4, AD1, DD1, MD1, MO2
Child's Personal Traits	Readiness Level	ID4, DO1, GDD1
	Communication with Friends	ED1, MO1, AO2, KO1
	Child's Character, Temperament	IO1

As seen in Table 2, teachers’ opinions regarding the factors affecting adaptation to school are classified under four main headings. Under the theme of “Family”, teachers emphasised the attitudes of parents and the communication of family with child. It was determined that among the responses of the teachers towards the family theme, they mostly emphasised the parental attitude code (n=5). Opinions about parental attitudes are as follows:

The family pressure on the child. Let me give an example, I personally witnessed it. In the hallway, the parents were telling the child to go into the class immediately or else they would beat him and that they wanted the child to get used to the school, but when you approach children with such an attitude, the child will inevitably dislike school (DD1).

MD1, on the other hand, stated their opinion emphasising the communication of the teacher under the teacher theme together with the parent attitude, saying *“the attitude of the family, and then communication with the teacher when the child enters the social environment... Before starting school, for example, some promises are made to children, but they are not kept. Children lose their trust in their parents and likewise when they start school... it is difficult due to parents' attitudes. Then, the teacher's approach is also important. When teachers are involved for the first time, they should ensure that the child is in contact with other friends as much as possible, and the rules should be softened a little, not strictly. They should make the school loved”*.



DO2, emphasising the communication of family with child, said, *“Because parents share their concerns in the first place while they are preparing their child for school. If they do not share these, the child sees the environment s/he is in as insecure and it would be difficult to adapt that child to school, but if parents make the child understand that they trust the teacher... that child would be advantaged. S/he would listen to everything that teacher says and trust him/her”*.

The second theme was determined as “School” in which teachers emphasised the school environment, stimuli in the classroom, and trust in school. It is seen that the most emphasised code within this theme was the school environment (n = 6). Participant DO1 expressed the school environment and stimuli in classroom as follows: *“Children having attention catching toys such as pictures that draw their attention visually or other materials, whether inside or outside the classroom”*. ED2 discussed environment by saying: *“Child believing in the environment because it is often the first time that children are separated from parents. Feeling safe when they are in the environment. When a child feels safe, s/he gets used to the process”*. ID2, emphasising trust in school, said, *“It is the feeling of trust. It is the trust of the child in school, and the fact that there is nothing that might cause phobia”*.

Participants emphasised the concepts of trust in the teacher, teacher support, endearing themselves, teacher’s attitude, and teacher’s communication within the third main theme of “Teacher”. Most participants focused on the idea of communication within this theme (n = 7). MO2 discussed trust in teacher and teacher's communication by saying, *“For example, let us assume that a child came to class and I said that when the lesson finished, I would call the mother of that child. So, if I do not call, that child will lose trust in me. The next day that child will not want to come to school because s/he will know that I lied to him/her”*. Another participant, GDO, believes that *“If the communication between teacher and child is good, you will have difficulty for maximum 2 weeks”*.

The final theme was that of “Personal Traits” where the concepts of basic sense of trust, readiness level, communication with friends, and temperament were determined. Communication with friends was seen as the most significant within this theme (n=4). In this scope, AO2 said, *“... when the child sees a friend, s/he adapts by seeing what they do. At least this is how the process in our school starts. It progresses with gaining social skills”*. MO1 said, *“When child starts to get along with his/her friends, a healthier process continued to progress.”*

In terms of readiness level, DO1 said *“I could not make some children adapt to school psychologically, even though I exerted effort for some children for 2 to 3 weeks, the age of the child is the age of separation from the mother. For example, there was a child who could not adapt and then had to disenroll”*. Regarding temperament, IO1 said, *“If expectations from the school match the child's character, this also is very effective”*.

The Opinion of Teachers on the Effect of the Pandemic Process on Children’s School Adaptation

According to the second sub-problem of the study, teachers were asked what they thought about the ability of children to adapt to school after the implementation of pandemic measures in schools. Their opinions are collated in Table 3.

As seen in Table 3, two main themes emerged from teacher responses on school adaptation after the pandemic process: factors that facilitate adaptation and factors that make it difficult to adapt. Longing for school, classification, not letting parents into school, and family sensitivity to pandemic rules were stated as factors that facilitate adaptation after the pandemic, with longing for school seen as the most significant (n = 9). ID2 exemplified longing by saying, *“I think they adapt more quickly because they miss their friends, playing, and being part of society”*. Similarly, MO2 said, *“Children did not have difficulty when they first came to school because children miss school, their friends and me so much... They were so happy”*.

ED1 referred to classification and not letting parents into school codes by saying, *“I did not have problems with masks, face shields, or sitting separately but classification was good. It was good to not let parents into school. This year we realised that they were different when they looked through the*



door and saw them. You know, there was no such situation before, mothers used to come to classrooms and take photos, when one of them cried, the others used to want their mothers. It happens that way, with the parents withdrawing, I think we got through this process well”.

Table 3. Teachers’ opinions on adaptation of children to school after the pandemic process

Theme	Code	Participants
Factors that facilitate adaptation to school	Longing for school	AO2, ID2, ID1, DO2, MO2, GDO1, IO1, EO1, KO1
	Classification	ED1
	Not letting parents into the school	ED1, ED2
	Family's sensitivity to pandemic rules	KD1
	Developing self-care skills	MO1
	Fear and Anxiety	ID1, ID4, MD1, GDO1, KO1, IO1
Factors that make it difficult to adapt to school	Activities being distant	ID1, KD1
	Social emotional difficulty	MO1, AO2, IO1
	Distractibility	DD1
	Rules	ID3, MD1, KD2, AD1, DO1, IO1, GDD1, AO1
	Academic skills	AO2
	Technology exposure at home	AO2, KD2, DD1
	School transfer	GDO1

In regard to factors making school adaptation difficult, responses were grouped into the following codes: activities being distant, fear and anxiety, social emotional difficulty, distractibility, rules, academic skills, technology exposure at home, and school transfer. The most significant factor in this sub-theme was rules (n = 8) with opinion such as:

I think the use of masks also affected the adaptation process. And as for hygiene rules, we have to use disinfectants, and we have to have cologne constantly. We have to wash our hands frequently. The pandemic process made the adaptation process long (IO1).

We had to constantly warn (the children) by saying do not take off your masks, do not let your noses appear (AD1).

KD2 felt that the most significant factors making it difficult to adapt to school were rules and technology exposure at home and stated that *"Since children are at home, they do not follow certain rules... even if we talk to parents every day and tell them to wake their children up within the framework of the schedule, home comfort is not like school. Children become addicted to the internet because they can engage in things like computers and tablets and phones because they stay with the caregiver or because they are in different places from their parents. Since this process is not in school, there is a little adaptation problem"*.

KO1, on the other hand, combined opinions regarding the school adaptation process within the themes of facilitating adaptation to school and making it difficult to adapt to school and emphasised longing for school and fear and anxiety by saying, *"I saw they were more enthusiastic. They were a bit shy because of the mask, because they also had fear, but I did not see any dislike of school ... They missed school"*.

Participants were also asked to expand on the reasons for the problems that were experienced in the school adaptation process pre-pandemic and whether there were any differences in the traits of children who had difficulties before the pandemic. These reasons were categorised into problems arising from family, problems arising from school, and problems arising from children. Under the theme of problems arising for family, the following issues were identified: family’s attitude towards school (ID1, ED2, MO2, ID2, GDO1, KD2), change of residence and school transfer (KO1), divorce of parents (ID1), grandparent caring for child (ID2), family commitment (KD1, KD2, GDO1, AD1,



IO1, GDD1), parental attitude (ID2, ID4, DD1, MD1, KD2, AD1, ID1, ED1), and the readiness of family (ID2, MO2, ID3, IO1). Problems arising from school were identified as communication with family (MO1, MO2, KO1, DO2), intraclass conflicts (AO2), not having an adaptation process (DO2), and the class being crowded (MD1, EO1). Finally, problems arising from children were expressed as excessive use of technological devices (ID2, KD2), behavioural disorders (ID1), sibling factor (KD1, ID1), children with special needs (KD1), children with no self-confidence (ID3, KD2), and the readiness of the child (ID4, DD1, AO1, KD2, AO2).

Teacher opinions about the post-pandemic process were gathered under the themes of rules and problems arising from children. Participants stated that they saw differences due to masks and distance (KD1, MD1, MO2, DO1, GDD1) regarding the theme of rules after the pandemic, and stated that they saw differences in speech disorder (AO2) and commitment (D1, IO1, DO1, GDD1) regarding the problems arising from child.

DD1, in discussing problems arising from the child and family, stated that there was not much difference after the pandemic. *"The child not being ready for school and family pressure on the child. Let me give an example I personally witnessed. In the hallway, the parents were telling the child to go into the class immediately or else they would get a beating. They wanted the child to get used to school, but when you approach children with such an attitude, the child will inevitably dislike school"*.

ID1, addressing family problems pre-pandemic and emphasising commitment after the pandemic stated *"Children have behavioural disorders, families are inconsistent, so there are problems, divorce of parents and sibling jealousy were problems before and they still are problems, but the pandemic got ahead of these problems. The fact that a child does not want to leave, overprotective families, etc. are difficult for the teacher and for adaptation to school as well, these problems exist right now too but children subconsciously put them in second place because now there is a word called pandemic in their lives"*.

IO1 stated: *"They got very attached to their families, so it was difficult for them to leave their parents and start school again. Even the children who normally did not have trouble with the adaptation process left their parents crying in the first week in the morning, the issue of fear became even more challenging, it was not that difficult when they started school for the first time last year. Wearing masks at school also affected children, they cannot attribute a meaning as to why they have to wear masks... We cannot touch, we cannot hug, they cannot share their toys, everyone plays with their own toy, but they get curious and want to touch. But they could not, therefore it was very challenging for them"*.

EO1 believed that there were problems arising from school before the pandemic but no new problems after the pandemic: *"I mean in general, even before the pandemic, there were many problems, because classrooms are too crowded. One child sees more children and they cannot adapt to each other. In the post-pandemic period, I did not start with 8 students one came and one went, one came and one went, now I have 8 students, I did not have problems because children started gradually and got to know me"*.

In order to evaluate the school adaptation process after the pandemic, teachers whether they believed some children had been more affected by the pandemic than others, and whether there were in their classes that were greatly affected. Interestingly, some stated that the children had been affected by the pandemic, while others stated that they had not. The opinions of the teachers who stated that children were affected by the pandemic were evaluated under two themes: traits and reasons. The opinions of the teachers who stated that children were not affected by the pandemic were examined under the theme of reasons for not experiencing any problems.



Teachers who believed that children were affected by the pandemic stated characteristics such as child of a strict family (ID1, GDO1, EO1), having negligent parents (MO1), and anxious children (ID1, KD1, DD1, AO2, KO1).

Teachers believed the reasons why children were affected included concepts such as exposure to coronavirus news at home (ID1, DD1, ID4, KO1, KD2, DO2), overexposure to technology (ID2, MO1), due to experience (parents who are doctors or working in this sector) (MO2, DO1, IO1, DO2) and the inability of children to perceive the virus concretely (ID4). Some of the teachers' opinion on this regard are as follows:

DD1 emphasised anxious children and exposure to the news: *"Parents do not use media consciously. Children are constantly exposed to the news. There was an inevitable reaction from the children. Honestly, I thought that one of my students would not even come to school because the child said 'what if there is corona at school, I do not want to go to school then'. As soon as they enter the classroom, there are constant warnings like wash your hands, wear your mask, cover your nose. Even in children's drawings, we see covid, corona, microbe, and many others"*.

DO2 discussed experience and the news by saying, *"Children of healthcare professionals have adopted this situation in their lives a little more because it is mentioned a lot at home, they listen to the news as well, but children whose parents work outside the health sector or are professors at university and teach from home have routinised this situation"*.

The characteristics of children who were not affected by the pandemic were identified as environmental (place of residence, socio-economic level, etc.) factors (ED1, IO1, GDD1), becoming used to the process (ED2, ID3, AO1, MD1, AD1), and the sibling factor (IO1).

In this regard, ED stated that *"They were very good, as I said, they adopted this situation. So, I did not have to make them adopt it. Family gave that awareness to the child, so they were ready when they came"*. Similarly, GDD1 said that *"Children who have experienced the Syrian war environment have gone through a lot and are not affected by the pandemic that much. They have already come out of a war and come to another country. They have gone through a lot before, so they got used to this pandemic as well"*.

In terms of environmental factors, ED1 stated that children were not affected by the pandemic. *"There was no pandemic in the city where I live or the village where I work. Schools were closed, but no one wore masks, or nothing prevented them from travelling, so there was no change"*.

In order to determine how the pandemic process affected children's adaptation to school, participants were asked whether they thought there were any differences between children who had received online education in the previous academic year and those who did not. Opinions on this situation are given in Table 4.

Table 4. Teacher opinions regarding the adaptation of children who received previous online education and those who did not during the pandemic process

Theme	Category	Code	Participants
Positive opinions	Prior School Experience	Knowing Some Subjects	ID3, GDD1, MO2, DO2, ID4, GDO1, DO1
		No Adaptation Problem	KD1, ID4, KO1, EO1, KD2, AD1, ED2
	Contribution of the Child to Academic, Motor, and Social Domains	Stimulus Difference	ID2
		Motor Skills	MO1, MO2
		Social emotional domain	MO1, KD2, AO2, MO2,
Negative opinions	Communication with the child	Academic skills	ID2, ID4, AO2, EO1, KD2, ED1, DO2
		One to One Communication	DD1, MD1



Educational Perspective

Technology exposure
Academic Education

DD1
MD1

According to Table 4, teacher opinions on this situation fall under two themes: positive and negative opinions. The positive opinion theme is sub-divided into two categories: prior school experience and contribution of the child to academic, motor, and social domains. The most significant points under the prior experience category are having some knowledge (n=7) and no adaptation problem (n=4). Some opinions regarding the code of "no adaptation problem" are as follows:

... even if we weren't face to face, we spent time together and fulfilled our longing for each other. Otherwise, we observe shyness even if the child is very used to class. But that did not happen. I think there is a huge difference (KO1).

... at least they have an idea about their teacher. Even if not as much as face-to-face education, the child at least sees their teacher... Because the other ones come without knowing their teacher... It makes a difference (ID3).

In terms of having some knowledge, ID3 stated that "...a child who has received online education at least has some knowledge in some things, but how can a child who has never received online education have knowledge". Similarly, EO1 said, "Children receiving online education were the children who were together with me at least for 4 to 5 months. Of course, they were very ready, while the others were not. There is absolutely a difference". In the same vein, regarding the stimulus difference concept, ID2 said "Of course there will be a difference between those who received (online education) and those who did not. There is a difference in stimuli, after all".

Under the category contribution to academic, motor, and social domains of the child, the most significant factor was academic skills (n=7). One participant, KD2, said "Some of them had been taught the concepts but others had not, when I asked them if they remembered what we did, children that received online education remembered. There was a difference between the two".

Another code under the same category is social emotional domain. AO2 stated that "As for social skills, since they continued to communicate and see each other, they could share some things in front of the camera even for 5-10 minutes a day. Children who did not attend, forgot. There is something we shouldn't miss in that social skill, the social skill with the group, they lost it to such an extent...". Another participant, MO1, discussed social emotional domain and motor skills by saying, "Of course there are serious differences in their motor skills and pencil holding skills. And I see very serious differences in the social emotional domain... I can say that (the ones with prior experience) are one or maybe a few steps ahead".

The theme of negative opinions is again sub-divided into two categories: communication with the child and educational perspective. Regarding one-to-one communication under the category of communication with the child and academic education under the category of educational perspective, MD1 stated the following:

I can say there is no difference. As you know, preschool education, which should be handled face to face, is a type of education where the child is taken from the family environment and put into the social environment, but it has now been eliminated ... We used to teach our students how to be a good child and a good person, to have harmony with the community, and what good behaviours are rather than 1-2-3-4-5. During this time, of course, we could not provide these in remote education. We just tried to give something academically. Many children were already learning that too.

Regarding the code of one-to-one communication under the category of communication with the child and the code of exposure to technology under the category of educational perspective, DD1 said:

"There is no difference... one-to-one communication is another thing when it comes to children. We do not want to expose children to too much media, to those tablets. There is a problem between the communication channels there too, so nothing happened, no effect".



In terms of individual difference, IO1 believe that *"It depends on the individual characteristics of the child. Not only on whether a child receives online education or not, because in both situations there were children who had difficulties or for whom it was easy"*.

In order to determine teacher opinions on the adaptation process to school, participants were asked what they thought about potential differences between the attitudes and approaches of families related to the pandemic process. Responses regarding this issue were classified under three themes: insensitive, cautious, and overprotective. Teachers stated their opinions regarding families that are insensitive to the pandemic process as insensitive/disobedient parents (ID2, AO2, GDO1, EO1, KD2, AD1, GDD1, ID4, MO1) and parents that are of the opinion that everyone will have the disease (EO1). In terms of insensitive/disobedient parents, AO2, stated that *"Some of them did not use masks to such an extent that (the children) did not know what a mask was...The difference between children originates here. Children are shocked while telling each other"*. MO1 similarly said, *"I have observed that they do not make any sacrifices from their social life and they do not abide by the flexible rules we have at school... I have observed that they do not show the sufficient sensitivity outside, as well"*.

Under the same theme, regarding parents that are of the opinion that everyone will have the disease, EO1 regarding the code of "parents that are of the opinion that everyone will have the disease" under the same theme, said "There are parents who think that this virus will infect everyone, some parents do not believe in the pandemic." said, *"There are parents who think that this virus will infect everyone, some parents do not believe in the pandemic"*. Under the theme of cautious, parents were perceived as belonging to three different groups: understanding parents (IO1), parents who accepted the pandemic process (AO1, KO1, AD1, DO1, DO2), and parents who think that their children are bored (ID2, EO1). In this regard, IO viewed understanding parents in this way: *"...there were parents that were more understanding that listened to me and asked what else we can do for child"*. EO1, on the other hand, said of parents who thought their children were bored: *"Some of them say that their child is too bored. The pandemic has bored us, it is not psychologically good, therefore they are sending their child to school... there are parents that are rigorous and send their child to school but always warn them by saying 'wear your mask, never take it off'"*. Similarly, ID said *"There are conscious parents that think their children are bored"*. Parents who accept the pandemic process was the most significant factor (n = 5) with the following opinions:

Later they enrolled in school and schools started, yes, they were always saying 'Teacher, do not let them take off their masks and make them disinfect their hands constantly'. As I said, those sending their children to school were not that rigorous. Inevitably, people relax a little. They have to be comfortable. We will catch [Covid-19] from outside, it is safer for child to be at school. In terms of trust, in terms of education (DO1).

Those who let it go and think that eventually all of us will have the disease... they are cautious, but they let it go. They are calm in terms of whether they will catch [Covid-19] or not, they just let it go (DO2).

Most participants were of the opinion that the most significant characteristic under the overprotective theme was rigorous/anxious/self-focused parents (ID1, KD1, ID3, DD1, MD1, AO1, GDO1, EO1, KD2, IO1, DO2) (n = 11). Some of the teacher opinions on this are as follows:

The more families care about this, the more fear problematic children will have. Fear develops in children...For example, a child spat in class last week. Another started to cry because of the spitting thinking that we would all be infected. Some children do not care much, while others care a lot. It is reflected in children (GDO1).

Some families act as if they were the only ones experiencing the problem. For example, we are experiencing most of the stress compared to what they are experiencing at the moment. They say that they are working and that their child is more problematic and needs more. Due to this point of view and this anxiety, they were stressed ... (IO1).



Another significant code was that of parents who do not send their children to school (EO1, KD2, TP1, GDD1) under the same theme. EO1 stated that *"When I talked to 18 parents, most of them said that they would disenroll [their children] due to the pandemic. There are also parents who do not send their children to school. That's why we had a lot of trouble enrolling"*. Similarly, GDD1 said *"Some of them were overprotective, they said that they could not risk it under any circumstances and they could not send their children to school"*.

Continuing under the overprotective theme and the code parents biased towards school (ED2, MO2), ED2 stated the following opinion: *Parents are worried when sending their child to school now, they are worried that something might happen at school or that their child might get infected from others but the same parents take their child to parks or shopping centres. I mean they let their child into the community, but they are biased when it comes to school. They are more worried thinking that their child will get infected with corona. I can say that they reflect this concern to the school and to the teacher more. But they may not be that careful outside"*.

In addition, ID2 said that they did not see a difference in the attitudes and behaviours of families regarding the pandemic process by indicating that *"...there are not very obvious differences"*. ED1 also said *"When comparing parents pre- and post-pandemic, I haven't seen any. I mean there was no difference. None of the parents have taken it seriously so far"*.

In order to determine how the pandemic process affects children's adaptation to school, participants were asked what kind of activities they had used in their classrooms related to the pandemic measures, and how the pandemic had affected their classroom activities. The teacher opinion on this situation are provided in Table 5.

When Table 5 is examined, it is seen that the activities of teachers in the process of adaptation to school are gathered under the themes of adaptation activities regarding the pandemic and activities affected by the pandemic. Participants evaluated adaptation activities regarding the pandemic as activities suitable for transmission prevention, activities suitable for social distance, activities provided by the Ministry, musical games, online acquaintance, and familiarisation letters. It was determined that teachers mostly coded activities adaptable to masks, distance, and hygiene rules (n = 11) and activities suitable for social distance (n = 10). The opinions regarding these codes are as follows:

In general, we went through social distance, mask, and pandemic rules by recalling their favourite games we implemented last year (AO2).

Our favourite is the ring game. We played ring games by adjusting our distance and we did not hug in the mornings. Because the mask covered the teacher's mouth and hid his/her gestures, the teacher looked like a robot to [the children]. From time to time, I showed them that I also have teeth and lips by wearing a face shield. Today, they play by paying attention to social distance, before, they used to sit side by side and wrestle over and over (DO2).

One participant, GDD1 discussed gift giving and stated that *"Normally we used to play games. We were not able to play much this year. We were able to play name learning games ... Apart from that, we tried to attract them to school with small gifts such as balloons or pencils. We let them do the things they loved most from day one. You know, they played with the toys they wanted, painted the pictures they wanted"*.

On adaptability, DD1 stated that the process was initiated with activities suitable for social distance: *"We started with songs and games that are more active for a while, games of getting to know each other, and if there were activities that involved touching, we adapted them"*.

KD1 incorporated family participation with studies regarding hygiene rules: *"First of all, on the first day I did a microbe experiment. I explained that microbes do not appear, but somehow, they do and showed them pictures and told them to what extent they need to wash their hands. Then I supported it"*



with videos and then I sent them home with paintings with masked animal figures for 1 or 2 weeks. After that, I provided information through a parent information booklet".

Table 5. The activities of teachers in the process of school adaptation this year

Theme	Code	Participants
Adaptation activities regarding the pandemic	Adaptability to mask, distance, & hygiene rules	ID1, ED1, KD1, ID4, AO2, EO1, KD2, DO1, IO1, DO2, GDD1
	Activities suitable for social distance	ED2, DD1, AO1, AO1, MO2, GDO1, AD1, IO1, DO2, GDD1
	Activities provided by the Ministry	MD1, AO1
	Musical games	MO1, DD1, MO2
	Online acquaintance	ID3
	Familiarisation letter	ID3, KD2
	Gifts	KO1, KD2, GDD1
	Free Events	GDD1
	Family participation studies	ID3, IO1
	Orientation	MO1, ED2
Activities Affected by the Pandemic	Intraclass activities	AD1
	Family participation / parent visits	AO1
	Field trips	AO1, KD2
	Large group activities	ED2, MO1, KD1, AO2, MO2, EO1, KD2
	Games	ID1, ID2, ED1, ED2, MO1, ID4, MD1, MO2, GDO1, KD2, AD1, DO1, IO1, DO2, GDD1
	Having to intervene in the activity processes	KD1, AO2, DO1, IO1
	Involving families in the process more	KO1
	Directing to academic activities	MO1
	Values education / sharing	ID3, ID4, DD1
	Science and nature activities	AO2, AD1
Culinary activities	ID4, MD1, AD1	
Art activities	ID3, AD1, IO1	
Turkish language activities	AD1, GDD1, ID2	
All activities without a desk	ID1, AO2, KO1	
Starting the day / centre / free time	ID3, KO1	
Stage (cultural) activities	KO1	

Under the theme of activities affected by pandemics, participants clearly felt that games were the most affected (n = 15). Regarding this code, ED2 said, “[The pandemic] affected games a lot. I can say that it has also affected a lot of activities. Since we are required to seat children using social distance, we do not do group activities, we try to spend time in individual activities and mostly table activities”.

Opinions on the activities affected by the pandemic process were given as follows:

Now, there is definitely a mask in front of our mouths in Turkish Language activities. When I read with a mask, they can get distracted easily. For example, we cannot carry out many types of games in game activities because they have to be together. We can organise one-to-one activities and one-to-one game activities. I used outdoor game activities which required children to be more independent. Apart from that, as I mentioned, we showed them art activities from a distance... Apart from that, in other science experiment activities, for example, there were tasting and smelling activities, we could not do



them in any way, or for example, we could not make sandwiches or make cakes, or we could not pretend as if we were cooks in culinary activities (AD1).

As for the field trips, we used to go to the library or post office or the seaside or collect tangerines from gardens We used to do all of these trips but we cannot not do any of them [now], this also was affected (KD2).

We could not organise game activities, we were only able to do activities with pencil and paper because it used their personal belongings ... We could not do breathing exercises in Turkish Language activities. I mean, [the pandemic] caused problems for many of our activities (GDD1).

Teacher Opinions Regarding the Management of the Pandemic Process in Schools

Regarding the sub-problem of how the pandemic had been managed in schools, participants were asked what they did during the periods when schools were closed. Teachers working in private schools stated that “online education was started” (MO2, GDO1, KO1, IO1, DO2). Teachers stated activities during this period as follows: sending activities via social media (ID2, ED1, KD2, DO1, MD1), having video calls (ED1, AO2, KO1, KD2, DO1, GDD1), activities with family participation (ED2, ID4, DD1, AD1, IO1, GDD1), sending videos (ID2, ID4, DD1, AO2, KO1), receiving feedback from activities (ED2, DD1, AD1, DO1), sending classroom activities to home (ID1, ED2, ID4, AO1), communicating (ID2, DD1, GDD1), and graduation with social distance (ID2). Some comments related to these activities include: *At first, we did not give anything to the children because we did not know that the process was going to be that long. Later, when we stayed that far, we switched directly to online education...In education, we paid attention to contents of activities so that children would not be sitting in front of computer constantly (MO2).*

After the schools were closed, I sent activities to parents via EBA or WhatsApp. We told the children that this process would pass by making video calls (ED1).

In this process, I first sent activities that they could do at home and other activities that they could do with their families that do require paper. I sent stories and we had phone calls together. We were in contact with all of them (DD1).

I created a weekly schedule by adapting classroom activities to home. I wrote them in an explanatory way daily and sent it to parents. They also applied as much as they could at home. Actually, of course, I followed it with visual feedback (ED2).

I shot videos for them for several times a week. I sent those videos to them. We shared it on the school page... I shot it for children to do activities. We also shared so that they participate in the activities. So, I'm experimenting, I want them to experiment as well (KO1).

I sent the daily education flow to parents through social media. They tried to have it done at home, but it lost its naturalness after a while. Parent took pictures and made their children do the activities just to send them to me. They could not have a natural process with the child because of taking pictures ... I read their books. I shot videos. I sent them... But of course, I talked to my students privately, I texted them... Then, when the curfews started to be cancelled, I organised graduation outdoors, in a hotel garden suitable for social distance and said goodbye to them for the last time. I did not want anything negative to remain in their minds due to such a pandemic. I wanted something positive to remain (ID2).

Also, one of the teachers, ID4 said that they could not have online education: “*Unfortunately, my communication is not online or anything since it is a village school*”. Similarly, ED2 said, “*The electronic equipment of parents is very insufficient. Their phones are very insufficient*”.

Regarding the same sub-problem, a question was asked about the gradual transition back to in-class teaching implemented at schools after the pandemic. Some teachers stated that they approved of this, while others stated that they do not. Teachers validated their approval with reason such as easy adaptation (ED1, ED2, ID3, ID4, IO1, KD1, MD1), small number (ED1, ID3), advantage to see their



teacher (ID1), chance to do exercises (ID1) and schools being ready (DO1). Teachers not approving of the gradual opening of schools expressed their reasons for this to be a prolongation of adaptation process (DO1, DO2, KD2, AD1, DO2, GDD1, DD1, ID2, GDO1), face-to-face education (ED2, KD2), not different (AO1, AO2) and decreased socialisation (KD1). In addition, there were teachers (MO1, AO1, AO2, MO2, GDO1, DO2, KO1, IO1) who stated that different implementations were being carried out in their schools. The views of the teachers who approved of gradual transition process are as follows:

Some teachers stated that slower or gradual adaptation was better. . For example, ED1 said, *"Rather than taking a child out of a game and introducing that child to unknown children and bringing them all together, it is better to gradually and slowly adapt to the school environment"*. ED2 shared that in their institution *"[The children] stayed for about two and a half hours. During these two and a half hours, we played games or introduced our school. The next week, the children came to school for two days, for example, so they knew that they would be separated from their mothers for two days and came with the comfort of that"*.

BC1 stated that *"We did not implement this because we were in a private school...In the transition, they increased from one day to 3 days then to 5 days. But in our school, our first day they started with their mothers and it took half a day and after it was full days. I think it was an implication that their mother was outside, waiting for her child. It may have made it easier for them to adapt"*.

KD2, one of the participants who did not of the gradual opening of schools, stated that the adaptation process is prolonged this way and face-to-face education is a necessity: *"I got really tired of teaching the same things...If schools are opened, I prefer it to be 5 days, not gradual, and prefer them to be together for a shorter period of time. It affects their adaptation, so we come one day and then we do not come for five days. It is like a vacation for 5 days. We find it difficult to explain abstract things to children in this age group. When I say their other friends will come the next day, they say things like 'why can they come but we can't?' and 'I miss my friends', etc."*.

GDD1 also disapproved of the gradual transition process because it prolonged school adaptation and emphasised that *"A child who comes for one day takes a break before they can adapt again until they come for a week. They come for two days and there is a break for five days, so when children come again, they feel like they are starting all over again. We had that problem in terms of adaptation"*.

DO2, whose institution did not implement the gradual transition process, was another participant who did not approve of the process: *"Children come for one day and that is for 2-3 hours, then they the rules until next week"*. GDO1, similarly did not approve of the process and stated *"In my own observations, when the children took a break, even on Saturday and Sunday for two days, they could come back with a change of behaviour. There could be an alienation to the school. So, in my opinion, one day is not enough for the child to love and adapt to school. Unfortunately, this was implemented because the situation required it. Let's say it is better than nothing, but I do not think it is good and efficient"*.

DISCUSSION and CONCLUSION

This study aimed to determine preschool teachers' opinions regarding preschool adaptation during the Covid-19 pandemic process. As such interviews were carried out with teachers employed at private and public preschools from seven different regions in Turkey. After conclusion of the research, it was determined that teachers evaluated the factors affecting school adaptation in terms of family, teacher, and the child's personal traits and generally experienced problems in these areas before the pandemic. In parallel with this conclusion, teachers believed that adaptation to school was affected by factors such as the gender of the child, temperament, the number of siblings, peer relationships, the socio-economic status of the family, the educational status of the parents, and the relationship between the child's parents, teachers and peers, and parent-teacher interactions (Ato, Fernández-Vilar, & Galián, 2020; Bağçeli Kahraman, 2018; Chi, Kim, & Kim, 2018; Durmuşoğlu Saltalı & Erbay, 2020; Erbay,



2019; Jarrett, Coba- Rodriguez, 2018; Lifshin, Kleinerman, Shaver, & Mikulincer 2019; Nur, Aktaş Arnas, Abbak, & Kale, 2018; Ratelle, Duchense, Litalien, & Plamodon, 2021; Roorda, Zee, & Koomen, 2020; Topçu & Nazlı, 2018). O'Farrelly, Booth, Tatlow-Golden, and Barker (2020) stated that children's priorities for their school adaptation are family and school relationships, supportive environments, successful peer relations, and willingness to attend school.

It was found that children's adaptation to school was easier in terms of longing for school, dividing them into groups, not letting parents into school, and family sensitivity to pandemic rules; however, rules and differences arising from children made adaptation difficult after the pandemic process. In a study examining the pandemic process in preschool education institutions in Sweden, Norway, and the United States, it was determined that mask, distance, and hygiene rules as well as reducing the number of students in classes and keeping parents away from schools were applied (Samuelsson, Wagner, & Ødegaard, 2020). In a study conducted by Ogelman, Gungor and Goktaş (2021), teachers stated that they would organise cleaning, personal care activities, and meet parents alone after schools re-opened. Similarly, in this study, teachers stated that they attached importance to mask, distance and hygiene rules, they carried out activities in accordance with these rules, and the number of students in the classroom was reduced. With the closures of schools in Turkey, the Ministry of National Education and many private education institutions started remote education practices. However, these implementations mostly covered primary school and higher levels. However, in this study it was determined some private preschool institutions switched to online education. The teachers in institutions that did not implement online education carried out activities such as sending activities via social media, having video calls with students and parents, and organising activities that could be done with family participation. There were also some teachers who stated that they could not carry out any practices at all due to lack of educational and technical infrastructure. In this case, technological facilities at home have gained importance and those who do not have these opportunities have become removed from education. In addition, this study showed that teachers who provided online education or tried to support their students through online activities felt the families were bored and tired of the activities. Similarly, in a study conducted with primary and secondary school teachers; it was determined that teachers did supportive activities during the pandemic process and attempted to make students feel as though school continued, but parents did not show much support (Çakın & Akyavuz, 2020). Göl, Güven, Şeker, Erbil, Ozgünlü, Alvan, and Uzunkök (2020) determined in their study with parents of 4 to 12-year-old children that teachers offered suggestions for education to be continued at home. Hapsari, Sugito, and Fauziah (2020) also found that families play an important role in education for their children during the pandemic process. UNICEF (2020) stated that students living in disadvantaged areas are in riskier positions during the pandemic process, and are likely not to adapt to school or return to school. As well, there are children who do not have the opportunity to access remote education all over the world and therefore inequality in education has increased (Horowitz, 2020; Moreno & Gortazar, 2020). When assessing implementations in Turkey, it can be said that families provide an important contribution to the education of their children, and that there are important differences between institutions and even teacher practices. Garbe, Ogurlu, Logan, and Cook (2020) investigated the experiences of parents with children of all levels during the pandemic process and determined that parents were trying to do their best for their children, but that they needed support. Similarly, Drane, Vernon, and O'Shea (2020) stated in their study that expecting families to become educators at home during this process made the current difficult situation even more difficult. As is seen, in this study, teachers stated that families were tired. It is thought that the reason for this situation arises from the fact that preschool children need more support.

Another conclusion of this research is that the adaptation of children who receive online education during the pandemic process has contributed to the academic, motor, and social domains of the child, especially with prior knowledge; however, it was determined that it created problems in terms of communication with child and educational perspective. While some of the participants in this study emphasised that online education is especially academic-oriented, others stated that children see each other and themselves and socialise in this environment. As a matter of fact, Korkmaz and Toraman



(2020) found that during the online education process, teachers experienced problems such as the student internet connectivity issues, inability to support skills education, difficulty in providing feedback to students, inability to educate according to individual interests, and inability to motivate students. Therefore, it can be said that there are problems in communication with the child and in educational perspective. Kim (2020) stated that the effective use of technology by preschool teachers is an important issue in the effectiveness of remote education and in ensuring children's motivation and learning. Although the effective use of technology by teachers is not evaluated within the scope of this research, it is thought that teachers may be incapable of improving themselves as the pandemic is a developing process. Kruszewska, Nazaruk, and Szewczyk (2020) stated that during the pandemic process in Poland, all preschool education institutions started remote education, but during this process, preschool children experienced loss in effective learning, spent less time in remote learning compared to school learning, and that most children had stress, anxiety, and concentration problems during the learning process. They concluded that the closure of schools caused a lack of communication with their peers and that their teachers had difficulties in motivating children to participate in activities. Research has also shown that, due to Covid-19, children stay away from social environments such as school, and experience negative psychological situations such as anxiety, depression, fear, crying for no reason, irritability, tantrums, and sudden changes in mood (Alisinoğlu, Karabulut, & Türksöy, 2020; Ozer, 2020; Orgilés, Morales, Delvecchio, Mazzeschi, & Espada, P, 2020; Xia Wu, Zhou, Zang, Pu, & Li, 2020). Howes (2020) also stated that peer relationships are important in keeping children away from such negative situations. In addition, Erbay and Durmuşoğlu Saltalı (2020) emphasised the relationship between the teacher and the child in the process of adaptation to the school, and found that children with positive relationships with their teachers had higher participation in the school adaptation process and activities. For this reason, it is also important that children do not stay away from school and their friends for their psychological health. However, when schools cannot remain open in an epidemic situation, it is important to ensure that children do not stay away from their friends and teachers through the use of online applications, even if they do not replace school activities. At the end of this process, when schools re-open, it is thought that children will have a better psychological state and they will not have any problems in adapting to the school. In the present study, teachers stated that children may be exposed to too much technology at home. Teachers also stated that using technology negatively affected children's social development and mentioned that peer relationships are important as they aid in facilitating school adaptation. Studies have indicated that unmonitored television time and over-use of tablets and phones harm children's cognitive, behavioural, and emotional development (Drouin, McDaniel, Pater & Toscos, 2020; Hosokawa & Katsura, 2018). King, Delfabbro, Billieux, and Potenza (2020) also state that online gaming and technology-based activities increased during Covid 19 pandemic as many families could not adequately monitor or control technology use in their children. Families have played a great role in the increase of the use of these technologies during the pandemic process. In addition, directing children to technology has long been a method of keeping children quiet and occupied, especially for working parents. Teacher participants within the present study stated that children affected by the pandemic were mostly children of strict families, children with negligent parents, anxious children, and children who were exposed to coronavirus news, especially in the home. They also stated that families' attitudes and behaviours were more insensitive, cautious, and overprotective during this period. Studies have shown that positive parenting behaviours facilitate children's adaptation to school, while negative attitudes make it difficult (Bağçeli-Kahraman et al., 2018; Becerra, Sánchez, & Méndez, 2020; Ogelman, Onder, Seçer, & Erten, 2013; Özen, Altinkaynak, & Akman, 2019). Teachers in this present study also emphasised the importance of the environment in which the child lives and stated that the child's exposure to excessive coronavirus conversation increased anxiety. These situations are affected by family members and family relationships during the Covid-19 process as well as the adaptation process to school (Prime, Wade, & Browne, 2020; Romero, López-Romero, Domínguez-Álvarez, Villar, & Gómez-Fraguela, 2020).



Adaptation activities for the pandemic during the school adaptation process were determined as mask, distance, and hygiene rule activities, activities suitable for social distance, activities provided by the Ministry, musical games, online acquaintance, and familiarisation letters. Culinary activities, stage productions, and activities involving family participation that are frequently carried out in preschool education were among the activities affected by the pandemic. Teachers stated that they had to intervene more in activity processes and tended to prefer academic activities, especially considering social distance during this process. At the same time, they stated that they had difficulties in transmitting their facial expressions and emotions, especially in Turkish-language activities, due to mask use. The activity most affected by the pandemic was games. Play is an important factor for children to develop positive relationships with their peers and to have healthy school adaptation processes. In this respect, the teacher should create learning environments that will improve social interaction (Gülay Ogelman & Güngör, 2020). According to the results obtained from this study, while the pandemic mostly affected game activities, it also affected when the day started, activities with large groups, and various game-based preschool educational activities. The contribution of games to the cognitive, motor, and social emotional development domains of a child is great (Gözüm & Kandır, 2020), which is supported by the fact that the 2013 MEB Preschool Education Programme is also game based (MoNE, 2013). Moreover, children spend most of their time playing games and can learn more permanently through games. The pandemic has affected game activities mostly due to mask, distancing, and hygiene rules and has resulted in the reduction of game activities or the adaptation of games in different ways to be more 'pandemic-friendly'. Considering that games take have a significant role in the education of children at school, the effect of this change on children will also be great. Furthermore, due to the measures taken in schools and due to the pandemic rules, common materials such as tools and toys have become individualised. Teachers have stated that "sharing", one of the most important values gained in preschool education, was highly affected by the social distance that entered our lives with the pandemic process. As a matter of fact, teachers stated that during this process, children question situations such as not being able to play, not being able to access toys and not sharing their toys, and that they are not satisfied with this situation. As Kozikoğlu (2018) stated, learning values such as responsibility, cooperation, and sharing during the preschool period is of great importance for the personality development of children. During this period when the foundations of personality are laid, the healthy acquisition of values affects the coming years.

In conclusion, there are many factors that affect the adaptation of children to school due to the child's personal traits, family, and environment. This year, the pandemic process has isolated children, whose only jobs are to play and socialise, from the environments where they can best achieve these tasks and has forced them to stay in their homes for long periods of time. Although some children continued their online education during the pandemic, others could not take advantage of this opportunity due to lack of technological resources or other reasons. During this process, a great deal of responsibility fell on families in terms of meeting their children's needs for both education and play. It is not possible for a preschool child to participate in online education alone; they need the support of their families. Some families can fulfil this responsibility to the fullest, while others have difficulty after a while. Remembering that families are the first educators of children and that children have become more intertwined with their families due to the pandemic process, it is important that families are supported with education, information, and psychological support. It is thought that the inequalities of opportunity in education should be eliminated as much as possible, and orientation studies should be conducted for the families of children who continue online education. While it is important to support children online while they are at home, due to their young age and their need for movement and play, their interests as well as their needs should be considered during the education process, activities based on learning by doing and experiencing should not be burdened on them. Thus, different methods supported by the use of technology should be employed to bring teachers, families and children together, and to find solutions to the psychological and social difficulties that may arise.

Children returning to school at the end of the pandemic process have shown some differences in adaptation. Some children adapted more easily because they missed school and their friends, while



others had difficulty because they were overly attached to their home and family. Some were negatively affected by this process and showed various behaviours such as crying, irritability, and self-isolation during the adaptation process. In this case, the biggest job falls on families and teachers. Families should provide accurate information about the pandemic process in a way that is simple for their children to understand so that negative, adverse attitudes are prevented and cooperation with schools is achieved. Teachers, on the other hand, should protect children from the negative environment as much as possible and create a positive atmosphere at school, which is the best place children can express themselves, play games, and socialise. How the child is approached is particularly important in this respect. Appropriate language should be used to indicate that the process is temporary and that there is nothing to be afraid of when the rules are followed. In this context, although activities to aid with adaptation were implemented in line with pandemic rules, in particular social distancing requirements, it was observed that some children had difficulty from time to time while others quickly became accustomed to school. In preschool education, the comfort of the child is a critical factor, thus when situations arise in which the child feels uncomfortable, participation in activities and self-expression can become problematic. Game-based learning and socially distanced games are important here as too much desk work at the preschool age can also affect school adaptation.

Regarding the gradual transition applied during the adaptation process, some teachers found it negative on the grounds that it prolonged the adaptation process, while most stated that dividing children into groups and having them come for a certain period of time facilitated adaptation. Only one teacher working in a private school stated that they carried out an implementation similar to this process and it was effective. Therefore, considering that the adaptation process is affected by many independent factors, it is necessary to repeat the implementation and to receive feedback in order to evaluate whether it provides a positive or negative effect on the adaptation process.

With this research, the adaptation of children to school during the pandemic process was examined and conclusions and suggestions were presented. However, there are some limitations in this study. Firstly, the research was planned qualitatively. It is necessary to conduct both quantitative and qualitative studies on how this process is carried out to determine its effectiveness. The adaptation process of children to school can be evaluated through different methods such as observation. Therefore, new studies should be conducted to examine the adaptation process to school with the opening of schools using both quantitative and qualitative methods. Secondly, the data was obtained exclusively from teachers in this study. In future research, the school adaptation process may be evaluated from the child's perspective. Parent perspectives should also be included as parents have a great impact on the school adjustment process. Experimental studies can be carried out with family education programs to facilitate the adaptation of children to school, especially during epidemic periods. Despite the limitations of this study, it is believed that this research serves to guide both preschool teachers and families of preschool-aged children and can aid in supporting schools to manage this adaptation process.

Ethical Approval

An ethical approval was obtained from Bursa Uludag University Social and Human Sciences Research and Publication Ethics Committee (dated 02/10/2020 and numbered 2020/07).

Conflict of Interests

The authors declare that they have no potential conflict of interest.

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DEVELOPMENT OF THE GOAL SETTING SKILLS SCALE FOR PRIMARY SCHOOL STUDENTS: ITS VALIDITY AND RELIABILITY ACROSS TIME

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Abstract

This study is a scale development study aimed at determining the goal setting skills of primary school students. The scale, which was developed to determine the goal setting skills of the students who are studying at the 4th and 5th grade levels of primary education, consists of items in a way that students can make self-evaluation about their goal setting skills. This scale development study was conducted with two study groups. The validity and reliability analysis of the first study data in 2014 showed that the scale has a two-factorial structure. Validity and reliability analyses performed on the data collected in 2019 once again revealed that this structure was valid and reliable, independent of time. The two structures revealed by the scale were determined to measure the goal decision making skills and the goal-directed process management skills, and the reliability coefficient is .78 and .80 (workgroup 1) and .67 and .78 (workgroup 2), respectively.

Keywords: Goal setting, goal setting skills, primary school, scale development.

INTRODUCTION

Apart from being motivation tools that lead people to success, goals are like road maps and signs that enable people to add value and meaning to their lives. People who have achieved socially accepted accomplishments in the world demonstrate common characteristics, namely the act of setting a predetermined goal and making the necessary efforts to achieve this goal (Adair, 2017; Baltas, 2020; Covey, 2014; Goleman, 2008; Lent, 2019; Locke & Latham, 2018; Schunk, 1985). According to Eric Fromm, the most important of the strengths that individuals consider while living their lives and making plans for their future is to have an interest area and goal acquisition. Therefore, each goal helps people work toward a greater connectivity with others and motivation for life. According to Maslow, the individual wants to realize himself and achieve psychological satisfaction after meeting his basic needs. Self-realization is defined as the desire and effort of an individual to reach a certain point and attain his goals by using his own talents and skills (Cloninger, 1993, as cited in Erden & Akman, 1995).

Goals express the wishes and desires of people: they represent what they want to achieve in life. Besides, the goals point out the expectations for the future, but also the expectations that express the results one tries to reach or maintain, that guide one's behavior and choices, and that is closely related to the personality. In this respect, personal goals are one of the distinctive features that distinguish the individual from others (Diener & Lucas, 2000). From this point of view, it is understood that goals also express the meaning that the person attributes to the goal and how this meaning affects the life of the person.



When examining the studies in the field of goal setting, it is striking that there are different theories in this field. The theory that has the most comprehensive explanation of the definition, selection, and organization of the goal is the Goal Setting Theory (Locke & Latham, 1979) developed by Locke and Latham in 1979. The Goal Setting Theory was developed based on empirical research that lasted for nearly 40 years. This research, which includes about 40 laboratory and field studies, was based on the simplest observations of inner processes by assuming that conscious human behavior is purposeful (Locke & Latham, 1990; 2004; 2006). In other words, Goal Setting Theory describes a conscious goal selection and regulation process. Latham and Locke (1979) found goal setting to be the main mechanism among various others that affects one's internal and external motivation.

Research on goal setting shows that it affects performance and increases individual's success (Conrad, Doering, Rief, W. & Exner, 2010; Klung & Maier, 2015; Koestner, 2008; Lent & Souverijn, 2020; Moeller et al., 2012; Schunk, 2001). Goals direct one's efforts and emotions; in other words, the difficulty and value of a goal affect one's intensity of efforts put forth to achieve it. Therefore, when one attains the goal, the following success will be more (Locke & Latham, 2006). Moreover, the level of one's goal-setting skill is highly related to one's social, economic, and professional achievements. In this respect, Schunk (1985) found that one's involvement in goal setting encouraged one to find new strategies in order to attain the goal. Additionally, studies showed that the compliance of the individual's personal goals with their psychological needs and inner motives affects their subjective wellbeing (Job et al., 2009). Thus, having meaningful and important goals and moving towards these goals have an essential role in maintaining and enhancing the subjective wellbeing of the individual.

Each goal is an integration of cognitive, emotional, and behavioral elements. The cognitive element of the goal is related to the mental representation of the goal, the creation of the goal hierarchy, and the determination of the paths to the goal. The emotional element of the goal is the emotional responses that integrate with the goal. The behavior matter includes actions that integrate with the plan to achieve the goal (Locke & Latham, 2018). An individual's awareness of these different aspects of goals, which actually helps to form goal-setting skills, affects the processes of setting, regulating, and attaining goals. Locke and Latham (2004) state that goals set by using goal-setting skills lead to higher task performance than an uncertain goal, such as a particularly challenging one. Research shows that it is much more possible to attain the intended goals if they are realistic, specific, measurable, and challenging, but do not exceed the individual's capacity (Conrad et al., 2010; Dornyei, 2001; Pintrich & Schunk, 2002).

The development of goal-setting skills at an early age is almost a prerequisite for individuals to have a healthy wellbeing and a successful, high-saturated life. In a study conducted at Yale University in 1953, the students were asked whether they had a clear and written goal to achieve and whether they determined how to achieve this goal step by step. Only 3% of the students pointed out their goals clearly, while the other 97% did not specify a clear goal. Approximately 20 years later, the same participants were compared in terms of social and economic status and profession. It was revealed that the 3% group, who had clarified their goals in their minds and could write them down on paper, were more successful socially and economically than the 97% group (Robbins, 2007). The results of this study show how individuals whose goal-setting skills are developed at an early age can have a significant impact on their future lives. From this point of view, for individuals to add meaning to their lives, they must have some personal goals and prepare themselves for all the difficulties they may encounter in reaching their goals. Moreover, there are studies that support the claim that setting goals increases student performance (Clark, 2020; Lent, 2019; Travers et al., 2015; Umashankar, 2020). In conclusion, it is very important for individuals to acquire this skill at an early age in their lives.

Primary education is not only important for children's cognitive, social, emotional, and personal development, but also for attaining the goal-setting skills they will continue to need in their own life adventures. This is because goal-setting skills are related to students' ability to plan their own learning, set their own learning responsibilities, and determine their own learning goals as well as



their performance goals. However, when the curriculum at primary education is examined, it is obvious that the development of these skills is not given much importance in basic education (MEB, 2005). In a research study conducted to examine the goal-setting level of students in elementary school (Erişen et al., 2014), the teachers stated that the majority of students could not acquire these skills at the primary school level.

The number of related studies in Turkey is limited. In this respect, it is necessary to carry out studies about goal-setting skills in order to see the needs and requirements of students regarding these skills. In addition, concerning the goal-setting scale development or scale adaptation to Turkish, a few studies exist, but they are generally limited to higher education, business life, and sports (Ağbuğa 2014; Arslan et al., 2018; Aslan & Gelişli, 2015; Bakioğlu & Eraslan-Çapan, 2015; Doğan et al., 2017; Kahleoğulları, 2017; Korkmaz & Kırdök 2019; Şenel & Yıldız, 2016). Most importantly, a scale development or adaptation that measures the goal-setting skills of primary school students has not been encountered in the literature. In order to evaluate and monitor students' progress regarding goal-setting skills and to develop training programs accordingly, a scale development study for measuring these skills is crucial. In light of this information, this study aimed to develop a scale that will determine the goal-setting skills of primary school students and to examine its validity and reliability across time.

METHOD

Study Groups

The research consists of two study groups. The data in the first study group were collected from 125 4th grade students attending a primary school in Üsküdar District National Education Directorate in the 2014-2015 academic year. However, the data of 120 students who filled the scale were included in the analysis. In the second study group, data were collected from 232 students who were studying in different districts of Istanbul in the primary school in 2019 academic year, but analyses were made on the data of 226 students. Of the students in the second group, 110 were 4th grade students and 122 were 5th grade students. Convenience sampling method was used to select the participants in both study groups. Convenience sampling method is one of the non-probability sampling methods that includes people who can be reached in the conditions and situations that exist for the study to be conducted and is preferred when there is not enough time and facilities (Cohen, Manion, & Morrison, 2007; Lodico, Spaulding, & Voegtler, 2010). In this regard, due to the difficulty of using probable sampling methods in all schools in Istanbul, convenience sampling was used in the research.

Scale Development Process

1-Creating the item pool. A questionnaire form has been prepared in order to create the items of the scale in order to measure students' goal setting skills. This form, which consists of open-ended questions, is a form consisting of 10 questions that students can convey their opinions about goal setting. The survey was applied to a 16th grade students. In addition, six teachers were interviewed about the students' goal setting skills and the development of these skills. The data from the survey and interviews were analysed through content analysis and interpreted within the context of students' goal setting skills. In addition, while creating an item pool, periodicals, books, and various scales applied abroad related to goal setting skills were also examined. As a result of the literature review and content analysis of the data arising from the survey, a total of 44 positive and negative items related to the skill to be measured were written. The scale is rated according to 4-point likert. The students were asked to read each item on the scale and make self-assessment according to the four degrees. The four degrees specified are as follows: (1) Doesn't Similar to Me, (2) A Little Similar to Me, (3) Similar to Me, (4) Very Similar to Me.

2-Evaluation of the items by experts. For the content validity of the scale, expert opinion was consulted to evaluate to what extent the items were suitable for the aim of the scale and representative of goal setting skills. Accordingly, the scale was sent to 12 classroom teachers, 8 experts in guidance



and psychological counselling, 4 experts in curriculum development and 2 experts in assessment and evaluation, and. In order to evaluate the items in terms of spelling and grammar rules and expression disorder, experts working in the field of Turkish Language and Literature were also consulted. In this process, all experts were asked to make a score between 1 and 3 (1 = absolutely not suitable, 2 = appropriate but needs to be changed, 3 = exactly appropriate) in order to evaluate items. An expert evaluation form was prepared by leaving an appropriate space for comments and suggestions next to each item, and the forms were sent to the experts via e-mail. The necessary adjustments were made in line with the feedback received from the experts, and 4 items were removed from the scale.

3-Pilot implementation. After the draft form of the scale was formed, a pilot study was carried out in order to ensure that students can understand the items clearly and to determine the average duration of administration. This implementation was conducted with a group of 35 students by an educator. According to the feedback from the participants and the educator, necessary arrangements were made. Finally, the draft form of the scale has become ready to be applied as a paper and pencil scale with a total of 40 items, 21 of which were negative and 19 were positive.

4-Implementation. The implementation was carried out in two ways. The first implementation was carried out in 2014, and the second in 2019. The aim was to ensure the validity of the scale across time. The necessary information was given to the students to fill the scale before the implementation and their participation in the study was provided on a voluntary basis. The implementation was made by giving a lesson time to each class, and it was ensured that the students were not affected by each other as much as possible. In the analysis of the data, the scales that seemed to be filled carelessly or mostly left blank were determined and removed from the data set.

Study group 1: First study was conducted with the permission from the Primary School Directorate in Üsküdar District Directorate of National Education in 2014-2015 Spring Semester. The scale was administered to 125 4th grade students in the school. Then, the completed forms were examined, 5 forms that were filled incorrectly and incompletely were removed, and data belonging to 120 forms were analysed.

Study group 2: It was conducted in 2019-2020 Fall Semester with the permission of the Primary School Directorate in Üsküdar District National Education Directorate. A total of 232 4th and 5th grade students were participated in the Study Group 2. After the implementation, the completed forms were examined. 8 forms that were filled in incorrectly and incompletely were removed, and the analysis was made by entering the data of 226 forms in total.

Data Analysis

Validity Analysis

Explanatory and confirmatory factor analysis was performed for construct validity. According to Explanatory Factor Analysis (EFA) results for the Study Group 1, the factorial structure of the scale was determined. Confirmatory Factor Analysis (CFA) was carried out with in order to test the validity of the structure revealed by EFA. LISREL 8.54 program was used for CFA. In CFA, many fit index values are used to evaluate the harmony between the theoretical model and raw data: Chi-Square Goodness Test, Goodness of Fit Index (GFI), and Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Normed Fit Index (NFI), Root Mean Square Residuals (RMR or RMS) and Root Mean Square Error (Root Mean) Square Error of Approximation, RMSEA) (Büyüköztürk, Akgün, Özkahveci, & Demirel, 2004). In order to reveal the validity of the model across time, CFA was carried with the data obtained from Study Group 2. For this purpose, fit indices obtained from CFA were taken into account.

Reliability Analysis

For this purpose, the Cronbach- α reliability coefficients and item-total correlation values of item for each dimension of the model created by EFA and CFA were examined. In addition, lower-upper group t-test results were analysed for the discrimination of each item.



RESULTS

Explanatory Factor Analysis (EFA)

EFA was performed for the construct validity of the scale. EFA is a statistical analysis of data used for reducing large number of variables into fewer factors underlying these variables. It aims to determine minimum number of factors that account for covariation among variables. In factor analysis, the conceptual structure measured by variables collected from a certain group was defined based on the factor loading values (Büyüköztürk et al., 2011). For this purpose, Principal Component Analysis, one of the factor analysis techniques, was used in this study. KMO coefficient and Bartlett Sphericity Test results obtained from EFA are given in Table 1, and KMO coefficient (.707) value higher than .60 and significant Bartlett Test result ($p < .05$) showed that the data are suitable for factor analysis.

Table 1. KMO Coefficient, and Bartlett Test results

KMO Coefficient		.707
Bartlett Test Results	X^2	524.398
	df	136
	Sig.	.000

EFA results yielded two factors. In order to decide on which factors the items were loaded and which items would remain in the scale, the magnitude of the factor loading values were initially taken into account. It is stated that the factor loading between .30, .59 indicates medium and above .60 indicates a high level relationship (Büyüköztürk et al., 2011). The lowest acceptable level for each variable is .32 (Tabachnick & Fidell, 2001). In the study, the value of .32 was determined as the lower limit and items with a load below this value were excluded from the analysis. Then, it was checked if there were variables loaded on both factors. For these overlapping variables, the difference between the highest two factor loading values should be at least .10 (Büyüköztürk et al., 2011). Such items were also removed from the scale. As a result, items no 1, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 18, 22, 23, 25, 26, 28, 30, 31, 32, 35 and 39 were removed from the scale. Analyzes were repeated after each item removal, and the factor eigenvalues of the final form of the 17-item scale are presented in Table 2.

Table 2. Eigenvalues of the formed factors and explained variance ratios

Factor	Eigenvalues	Explained Variance %	Cumulative %
1	3.709	21.819	21.819
2	3.187	18.746	40.565

The variance rate explained by the final 2-factor scale is 41%. 22% of this variance was explained by the first factor and 19% by the second factor. Items and factor loadings of the obtained factors are presented in Table 3.

As seen from Table 3, factor loads vary between .38-.77. Factor 1 consists of 7 items, factor 2 consists of 10 items. When the items that make up the first factor were examined, it was found that these items were related to “Deciding on the Goal” and the items in the other factor were about “Managing the Goal-Oriented Process” skills.

Table 3. Item factor loads

Item Number	Factor 1	Factor 2
	Deciding on the Goal	Managing the Goal-Oriented Process
I 20	.756	.030
I 19	.725	.113
I 37	.671	-.133
I 24	.670	.045
I 21	.652	.123
I 36	.580	-.103
I 17	.526	-.030



I33	-.121	.774
I34	-.086	.715
I39	-.054	.684
I12	-.010	.682
I40	-.182	.597
I2	.039	.578
I29	.276	.550
I27	.048	.496
I3	.118	.472
I5	.011	.378

Confirmatory Factor Analysis (CFA)

DFA was conducted with the data obtained from both Study Group 1 and Study Group 2 in order to test the construct validity of the two-factor model resulting from EFA. The two-factor model shown in Figure 1 has been tested for both groups through the LISREL 8.54 program, and the fit indices obtained for Study Group 1 are given in Table 4, and the values obtained for Study Group 2 are given in Table 5.

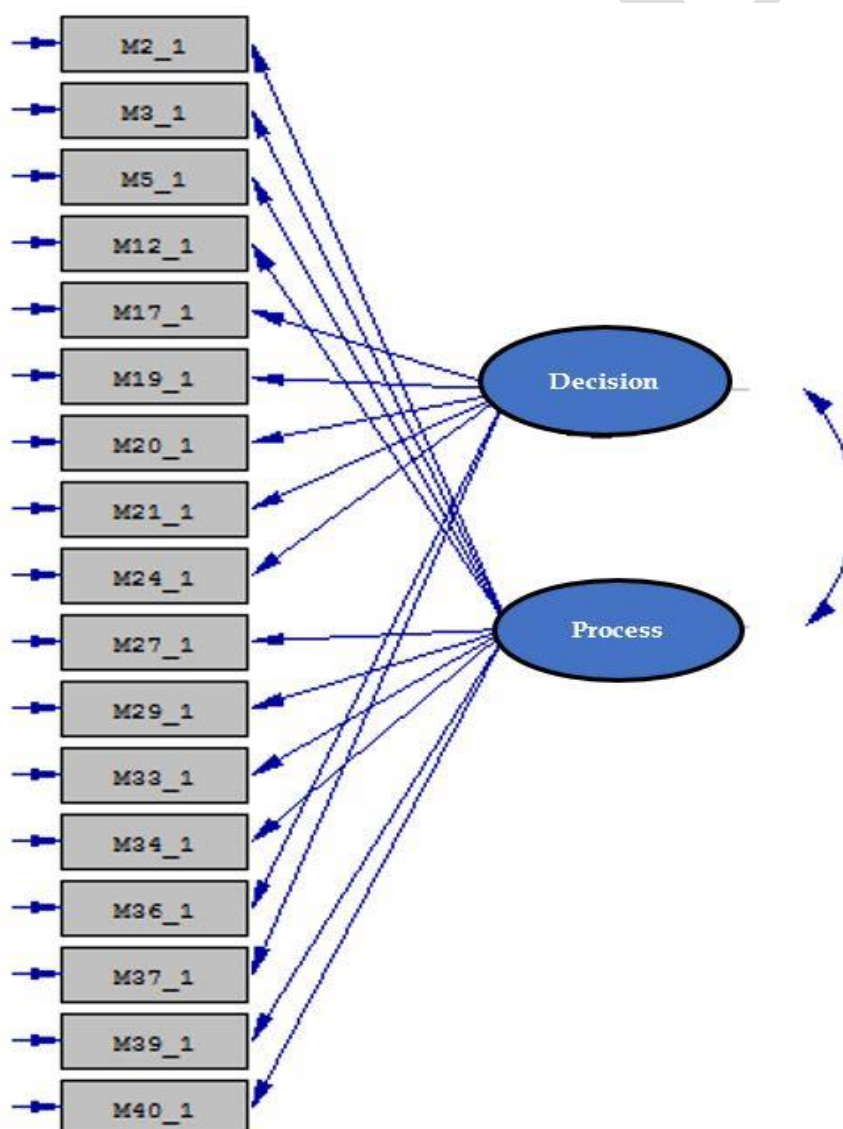


Figure 1. Goal setting scale measurement model

**Table 4.** Acceptance limits of CFA fit index values and fit indices of Study Group 1 data

Fit Indices	Perfect Fit Values	Acceptable Fit Values ¹	Fit Value Obtained from the Scale	Degree of fit
χ^2 (p)	-	-	175.50 (p<.05)	-
sd	-	-	115	-
χ^2 /sd	$0 \leq \chi^2 / df \leq 2$	$\leq 5^a$	1.526	Perfect Fit
RMSEA	$.00 \leq RMSEA \leq .05$	$\leq .08^b$	.061	Good Fit
SRMR	$.00 \leq SRMR \leq .05$	$\leq .08^b$	.083	Poor Fit
GFI	$.95 \leq GFI \leq 1.00$	$\geq .90^c$	.86	Acceptable Fit
AGFI	$.95 \leq AGFI \leq 1.00$	$\geq .90^c$	.81	Poor Fit
CFI	$.95 \leq CFI \leq 1.00$	$\geq .90^b$	.92	Good Fit
IFI	$.95 \leq IFI \leq 1.00$	$\geq .90^b$	.92	Good Fit
NNFI	$.95 \leq NNFI \leq 1.00$	$\geq .90^b$	.90	Good Fit

¹ a Bollen (1989), Sümer (2000); b Byrne (1998), Hu & Bentler (1999), Sümer (2000), Tabachnick and Fidell (2001); c Hooper, Coughlan and Mullen (2008), Sümer (2000)

When the fit indices obtained from Study Group 1 data were examined, it was seen that except for AGFI and SRMR, the other indices supported the perfect or good fit of two-factor scale structure to data. Since AGFI and SRMR values are sensitive to sampling, it is recommended not to be used alone in evaluating the fit of the model (Hooper, Coughlan, & Mullen, 2008). Accordingly, the value obtained from the ratio of the chi-square value to the degrees of freedom is less than 2, the RMSEA = .061 value is less than .08, the CFI = .92, IFI = .92 and NNFI = .90 values are greater than .90, and the GFI if the value of = .86 is close to the .90 value. These values indicate that the model has a good fit. As a result, when the index values are considered together, it is confirmed that the model fits well with the 2-factorial structure, in other words, the 2-factor scale is acceptable.

Table 5. The acceptance limits of CFA fit index values and fit indices of Study Group 2 data

Fit Indices	Perfect Fit Values	Acceptable Fit Values ¹	Fit Value Obtained from the Scale	Degree of fit
χ^2 (p)	-	-	181.77 (p < .05)	-
sd	-	-	113	-
χ^2 /sd	$0 \leq \chi^2 / df \leq 2$	$\leq 5^a$	1.609	Perfect Fit
RMSEA	$.00 \leq RMSEA \leq .05$	$\leq .08^b$	.048	Perfect Fit
SRMR	$.00 \leq SRMR \leq .05$	$\leq .08^b$	.062	Good Fit
GFI	$.95 \leq GFI \leq 1.00$	$\geq .90^c$	.92	Good Fit
AGFI	$.95 \leq AGFI \leq 1.00$	$\geq .90^c$	.89	Good Fit
CFI	$.95 \leq CFI \leq 1.00$	$\geq .90^b$	.95	Perfect Fit
IFI	$.95 \leq IFI \leq 1.00$	$\geq .90^b$	.95	Perfect Fit
NNFI	$.95 \leq NNFI \leq 1.00$	$\geq .90^b$	.94	Good Fit

¹ a Bollen (1989), Sümer (2000); b Byrne (1998), Hu & Bentler (1999), Sümer (2000), Tabachnick & Fidell (2001); c Hooper, Coughlan & Mullen (2008), Sümer (2000)

Moreover, according to the CFA fit index values given in Table 5, the data obtained from the Study Group 2 fit the model better. The ratio of the chi-square value to the degree of freedom, RMSEA, CFI and IFI values indicate perfect fit of data to the two-factor model while SRMR, GFI, AGFI and NNFI values showed a good fit.

Reliability Analysis of the Scale

In order for the internal consistency of the scale, first of all, item total correlations, which indicates whether each skill item is related to the dimension desired to be measured, were examined. In this regard, the correlation between the students' responses in each item and the total score obtained by excluding the relevant item was examined. Afterwards, the mean scores obtained by the lower and upper groups were compared for each item. For this purpose, the total score students received from each subscale was ranked in descending order, and the first 27% constituted the upper group and the lower 27% formed the lower group. The mean scores of the upper group and the mean scores of the lower group for each item were compared by independent samples t-test. The item analysis results are given in Table 6.

**Table 6.** The corrected item-total correlations of the factors and the uncorrelated T-test results between the upper 27% and lower 27% scores

Factor Name	Item Number	Corrected Item-Total Correlation	t (upper%27-lower%27)
Deciding on the Goal	I 20	.614	7.892
	I 19	.586	13.754
	I 21	.548	10.095
	I 37	.508	8.286
	I 24	.503	8.907
	I 36	.453	6.894
	I 17	.366	7.267
Managing the Goal-Oriented Process	I 33	.645	8.519
	I 34	.615	7.070
	I 12	.567	7.723
	I 39	.537	10.146
	I 40	.493	7.243
	I 2	.480	6.889
	I 29	.437	7.744
	I 27	.400	5.304
	I 3	.392	6.280
	I 5	.284	3.681

Accordingly, the corrected item-total correlation values range from .57 to .23. The criterion for item-total correlation is to be greater than .30. If it is between .20 and .30, item can be kept by revising it but if it is below .20, item should be removed from the scale. When the table was examined, only the item total correlation for Item 5 (.28) was less than .30. Since this item is a theoretically important item, it was revised and kept in the scale. The results of the independent sample t-test in Table 6 showed that there is a significant difference between the mean scores of the upper 27% and the lower 27% group. This situation showed that the items of the scale are distinctive in terms of having the relevant skill. After these processes, the Cronbach's Alpha coefficient was calculated. This value is expected to be greater than .70. The reliability coefficients calculated for the entire scale and its sub-scales and for both Study Group 1 and Study Group 2 data are shown in Table 7.

Table 7. Reliability coefficients of the scale and its sub-dimensions

	Cronbach Alpha Coefficient Working Group 1	Cronbach Alpha Coefficient Working Group 2
Deciding on the Goal	.79	.68
Managing the Goal-Oriented Process	.81	.78
Full Scale	.73	.78

Reliability coefficients of each sub-scale obtained from Study Group 1 data vary between .79 and .81. The reliability coefficient of the entire scale is .73. Reliability coefficients obtained as a result of the analysis of Study Group 2 data are .68 and .78 for each sub-scale, while this value is .78 for the entire scale. These values obtained from both study groups indicate that the scale is reliable.

DISCUSSION, CONCLUSION and RECOMMENDATIONS

Humans, having a mental capacity and metacognitive skills, have a superior goal orientation capacity than primitive creatures and has the power to conceptualize goals and set long-term goals for the future (Locke, 1969). Therefore, people should identify what is beneficial for life wellbeing, set goals to achieve this, and determine strategies and tools to achieve them and act accordingly. The most important finding that emerged from hundreds of studies on goal setting is that individuals with



specific, difficult but attainable goals perform better than individuals having easy, not specific goal or no goals and have higher life satisfaction (Latham and Locke, 1991). Considering the importance of setting goals for human life, it can be said that the development of these skills in childhood is extremely important.

Children can develop many metacognitive skills, especially through the formal and informal learning experiences in primary school. In order to carry out studies aimed at developing a skill that children will need in all areas of their lives such as goal setting skills, one would be in need of measuring the level of children's skills in order to determine their development. In this context, the scale developed in this study to evaluate the goal setting levels of children, especially in primary education period will serve this purpose.

During the scale development process, data was obtained from two study groups. Data from the first group were collected in 2015 and from the other group in 2019. Validity and reliability analyses of the scale started with the first group and were repeated in the second study group. The initial results revealed that the scale supports the 2-factor structure. When the items in these structures were analysed, it was seen that one construct was related to deciding on goal and the other was related to managing the goal-oriented process. Analyses on data collected from the second study group in 2019 also showed that the scale preserves its two-factorial structure. Consequently, this study revealed that a "Goal Setting Skills Scale for Primary School Students (GSSS-PSS)", which consists of two subscales measuring skills related to "Deciding on the Goal" and "Managing the Goal Oriented Process", is a valid and reliable independent of time.

These dimensions in the scale are similar to the goal setting skills scale developed by Hansen and Larson (2002) for young people. This scale consists of two dimensions as decision making and following the goal process. In the goal setting questionnaire created by Gaumer Erickson, Soukup, Noonan McGurn (2016), it is striking that there are items for personal emotions, attitudes or characteristic behaviours as in the GSSS-PSS. However, in their questionnaire, there are five constructs, which are loyalty to goal, self-efficacy, goal specificity, goal conflict and autonomy. In the current study, it can be said that items in these five constructs seem to be placed under the two constructs of the GSSS-PSS. In addition, Goal Type Scale developed by Meenashki et al. (2013) to examine athletes' performance goals has two dimensions: "time-based goals" and "combination of mixed goals". These constructs include process, performance and outcome goals and short- and long-term goals sub-dimensions. When these dimensions and the items are examined, it can be observed that there are similarities in terms of the contents of the items of the GSSS-PSS.

The scale was created by considering the Goal Setting Theory developed by Locke and Latham in 1979 and the goal setting process introduced in this theory. However, there are theories each of which explains goal setting process differently. But all of them seem to describe a goal setting process as setting a goal, taking action, directing attention and action, evaluating the performance and gains that have arisen, and measuring satisfaction attained at the end of the process (Mavisu, 2010). In terms of this scope of goal setting theories, the two dimensions in the GSSS-PSS, "Deciding on the Goal" and "Managing the Goal-Oriented Process", correspond to determining a goal, taking action, directing action and attention dimensions. The scale's "Deciding on the Goal" dimension includes setting the goal, while the "Managing the Goal-Based Process" dimension includes the areas of taking action, directing action and attention. The evaluation of performance, gains and satisfaction is not included in the scale since it is related to the result part. In this regard, it can be said that when considering purpose and age range of the scale, the GSSS-PSS is limited to the first two steps of goal setting theory and the processes of setting the goal and managing the goal setting.

In the literature review, it has not been yet encountered a specific scale for goal orientation and goal-setting skills within the scope of Turkey. On the other hand, it is noticeable that the scale development studies on this subject are generally created for the academic goals in the school and classroom environment (Anderman & Midgley, 1997; Anderman & Young, 1994; Hicks, 1997; Iliot &



McGregor, 2001; Kaplan & Maehr, 1999; Midgley & Urdan, 1995; Midgley et al., 1998; Ryan, Gheen, & Midgley, 1998) rather than the goal setting skills that cover the entire life of children. The dimensions of these scales are generally related to performance goals, learning goals, mastering goals, avoiding the goal.

The “Goal Setting Skills Scale for Primary School Students”, developed in terms of the importance of the goals for human life, is capable of closing a gap in the field for determining and developing the goal setting skills of primary school students. Validity and reliability analyses results demonstrated that this scale is a valid and reliable tool regardless of time. The scale can be used for different purposes by teachers, school administrators and psychological counseling and guidance units. In particular, this scale can be used in further research investigating the relationship between students' academic achievement performance and goal setting skills. The scale can guide teachers in evaluating development of children as a whole in terms of academic, social and emotional aspects. Furthermore, guidance and psychological counselling units in schools can use this scale for determining the level of goal setting skills of students and offer practices to develop these skills through individual and group guidance activities. At the same time, teachers can develop strategies, methods and techniques so as to improve the goal setting skills of students in classroom by collaborating with teachers from different branches. Since the goal setting skills should be gained and evaluated at all educational levels, adaptation studies can be conducted for different grade levels. In addition, this scale can assist researchers in developing different assessment tools that can be administered to teachers and parents in order to evaluate children's goal-setting skills from different perspectives. Furthermore, researchers can use the scale to evaluate the effectiveness of programs designed to improve students' goal setting skills. In this way, the scale will serve one of its main goals.

Limitation of the study

The data collected in this study were limited to 120 people in the first participant group and 223 people in the second group of participants. The levels of the students participating in the study are from primary school 4th and 5th grades. If this scale is claimed to be used in different studies, after validity and reliability studies are performed, it can be used with the participants from higher or lower grades or from different socio-economic levels.

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PRIMARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN SOCIAL STUDIES: A STRUCTURAL EQUATION MODELING ANALYSIS

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Abstract

The aim of this study is to determine the learner characteristics that have a significant effect on academic achievement in social studies lessons. For this purpose, the study process was modeled as relational scanning as a quantitative research approach. Relevant literature and observations were used and a research model was created based on the variables that were thought to affect the academic achievement of students in a social studies course. In order to test the created model, data were obtained from 145 students in the 4th grade by using different measurement tools. The data obtained were analyzed using confirmatory factor analysis and path analysis techniques. According to the results obtained in this study, the variables in the research model explained 63% of the academic achievement of the students in this social studies course. In addition, it was determined that students' attitudes toward social studies lessons, their interest, and the importance they attached to the course were the most important variables that affected their achievement, while a teacher-centered teaching environment directly and negatively influenced students' achievement. Suggestions that can be used in the design and preparation of an effective and efficient learning environment for social studies courses are presented.

Keywords: Academic achievement, Primary school, Social studies, Structural equation model.

INTRODUCTION

The quantitative dimension of the knowledge acquired by students in a learning environment can be defined as academic achievement. In this context, it can be said that academic achievement is the potential success achieved by students as a result of learning. Academic achievement is considered very important by teachers and families as it enables students to prepare for their future professional and social lives and it shapes their futures (Bahçetepe & Giorgetti, 2015; Sarier, 2015). On the other hand, academic achievement is also accepted as an indicator of the effectiveness of education systems (Moss & Moss-Racusin, 2021; Rodríguez, Tinajero, & Páramo, 2017; Uzun & Çokluk-Bökeoğlu, 2019). Therefore, it is very important to determine how to increase the academic achievement of students and how to eliminate their failures in terms of improving education systems, increasing the efficiency of education, and ensuring the satisfaction of teachers, students, and parents.

Theoretical Background of the Study

Academic achievement is the level of performance reached by a student in the learning environment (Moss & Moss-Racusin, 2021). However, although academic achievement is a basic indicator in the learning environment, it is affected by the student, who is the owner of success, and by the environment and many variables originating from the environment that shape this success. Researchers have stated that a student's academic achievement is related to three main factors: school, family, and student characteristics (Akbaba, 2006; Bahçetepe & Giorgetti, 2015; Engin-Demir, 2009;



Rozan, 1987; Sarier, 2015). The characteristics of the school and its environment, which are among these main factors, constitute the formal environment in which the student realizes his or her learning experiences. In this context, the quality of the learning-teaching process is related to the school and its environment. Therefore, it is expected that the characteristics of the school and its environment will affect the academic achievement of the students because the quality of the school is an important factor that determines the experiences students will have in the learning process. The school atmosphere (Bahçetepe & Giorgetti, 2015; Zysberg & Schwabsky, 2020), interpersonal relationships and the sense of belonging at school (Zysberg & Schwabsky, 2020), school culture, teacher behaviors, and school principal leadership (Idris, Hussain, & Ghaffar, 2021; Sarier, 2015) were seen to be directly related to the success of students and affect their success. However, different characteristics such as the environment in which the school is located and the teaching opportunities it provides, the teacher's professional competencies, and the number of students in the classroom also affect student achievement (Benbenishty et al., 2016; Cheema & Kitsantas, 2014; Engin-Demir, 2009; Kalemoglu-Varol & İmamoğlu, 2014; Özkan, 2020; Sakiz, 2017). It can be said that the teacher, the teaching opportunities, the school, and the administrative structure of the school and its environment affect the quality of the education that the student will receive and his or her academic achievement.

The socioeconomic status, sociocultural characteristics, and educational expectations of families shape the entire educational life of students. In this context, the opportunities and educational support provided to students by their families may vary according to their socioeconomic and cultural characteristics. Therefore, it is expected that the socioeconomic status and expectations of the family will affect the academic achievement of students. The economic situation of the family (Pinquart & Ebeling, 2020; Sarier, 2015; Turan & Koldere-Akın, 2019; Liu, Peng, & Luo, 2020; Uzun & Çokluk-Bökeoğlu, 2019), parents' expectations of their children (Pinquart & Ebeling, 2020), parenting styles (Garg, Levin, & Tremblay, 2016), the mother and/or father's educational status (Rodríguez, Tinajero, & Páramo, 2017; Sarier, 2015; Suphi & Yaratana, 2012; Waters et al., 2021), the educational support provided by the family (Bayramdurdyeva, 2019), and the number of children in the family (Turan & Koldere Akın, 2019) were seen to be directly related to students' achievement. In short, it can be said that the physical, economic, and cultural structure of the family affects the educational process of the student and his or her academic success throughout that educational process.

Although it is affected by different features such as the academic achievement of students, the school, and families, the learning process is largely a result of student performance (Moss & Moss-Racusin, 2021). Therefore, the individual characteristics that determine a student's performance are related to his or her academic achievement. Walberg (1981) classified the individual characteristics that affect a student's performance on psychological grounds as cognitive, affective, and behavioral and stated that these characteristics were related to academic achievement. Students' studying styles (Bahar & Okur, 2018), studying habits (Bayramdurdyeva, 2019; Sarier, 2015; Sayın & Gelbal, 2014), experiences in the learning environment and approaches to learning (Karagiannopoulou & Milienos, 2015), perceptions of self-competence (Sarier, 2015; Suphi & Yaratana, 2012; Zysberg & Schwabsky, 2020), emotional status, gender, prior knowledge level (Rodríguez, Tinajero, & Páramo, 2017), motivation, self-esteem and attitude toward the lesson (Sarier, 2015), self-confidence and time management (Bayramdurdyeva, 2019), academic risk-taking and fear of negative evaluations (Uzun & Çokluk-Bökeoğlu, 2019), in-class participation (Sayın & Gelbal, 2014), and emotional intelligence (Garg, Levin, & Tremblay, 2016) were all seen to be directly related to success and have an effect on academic achievement. On the other hand, it is emphasized that students' intelligence, interests, learning and cognitive styles, learning speeds, and personality traits also affect their academic achievement (Cevher & Yıldırım, 2020; Krapp, 2002; Lin, Hong, & Chen, 2013; Sarier, 2015; Sujito & Muttaqin, 2020; Şevik, 2014; Şimşek, 2017; Wang, 2004). In light of these studies, it is seen that the characteristics that affect the academic achievement of students generally include cognitive aspects such as intelligence, prior knowledge level, learning style, and cognitive style; affective aspects such as interest, attitude, importance given to learning, and motivation; and behavioral aspects



such as participation in the lesson, study habits, and participation in out-of-school learning environments.

Although it is stated that academic achievement is generally affected by three basic sets of variables, originating from the school, family, and student, it is emphasized that the most important factors determining a student's academic achievement are the individual characteristics originating from the student (Hattie, 2009; Sarier, 2015). Each student has a different genetic structure and different life experiences. This means that each student participates in the learning environment as an individual with different characteristics and the cognitive, affective, and behavioral characteristics originating from students are the main variables that enable us to understand why some students have no difficulties during the teaching process while some students have difficulties and fail (Bempeni & Vamvakoussi, 2015; Jonassen & Grabowski, 1993). Therefore, knowing the cognitive, affective, and behavioral characteristics of students and the relation of those characteristics with academic achievement may allow us to eliminate the reasons for failure and support the success of students. At this point, it can be said that individual characteristics that can be controlled in the learning-teaching process and be used in the preparation of that process are more important than factors that also affect the academic achievement of students but are difficult to change, such as school or family.

The main cognitive features that affect academic achievement are prior knowledge, which encompasses students' previous learning; cognitive styles, which are defined as individual differences in the strategies used in processing information and transferring it to the learning environment (Plass & Pawar, 2020; Sujito & Muttaqin, 2020); and learning styles, defined as the preferred ways of receiving and processing information (Cevher & Yıldırım, 2020). Cognitive features such as prior knowledge, cognitive styles, and learning styles can be understood as variables that can be used concretely in the preparation and control of learning environments. On the other hand, the main affective characteristics that affect academic achievement are the attention given to lessons, which is defined as a student's attachment to and establishment of a relationship with the learning environment (Tekin & Eltiöglu, 2019); the importance given to lessons, defined as valuing and caring about the subject to be learned (Ceylan & Berberoöglu, 2007; Yilmazer & Demir, 2014); and attitude, or affective tendencies toward lessons (Kelley, 2021; Sarier, 2015). Affective characteristics such as the importance given to lessons and the interest and attitude displayed do not change rapidly in the learning environment; in this respect, they can be used effectively in the preparation and control of learning environments, which is a process. Student-based features that affect academic achievement are affected by behavioral features as well as cognitive and affective features. The behavioral habits of students, such as their participation in activities in and out of the classroom, the way they study, the quantitative dimension of the time they allocate to the course, and their preferences in using resources to support the course all also affect academic achievement (Anderson, 2021; Bayramdurdyeva, 2019; Ceylan & Berberoöglu, 2007). The behavioral characteristics of students are variables that can be configured more easily compared to cognitive and affective characteristics. In this respect, they can be used effectively in the preparation and control of learning environments.

The characteristics that affect the academic achievement of students may differ according to their cognitive, affective, and behavioral characteristics, and the effects of these variables may also vary for different courses and subjects. Each course or subject has its own characteristics and students' approaches and tendencies for each lesson may also differ. For this reason, it is normal for the academic achievement of students to differ according to courses. Therefore, analyzing the characteristics related to the specific academic achievements of students, rather than general academic achievement, can give more meaningful results. For example, some studies in the literature have explored the characteristics that affect the academic achievement of students in science and mathematics courses (Ceylan & Berberoöglu, 2007; Ertürk & Erdiñ-Akan, 2018; House, 2006; Koballa & Glynn, 2004; Ölçüoöglu & Çetin, 2011; Savaş, Taş, & Duru, 2010). However, many lessons are conducted in teaching and each lesson has its own features. It can accordingly be said that there is



a need for studies that analyze the characteristics that affect the academic achievement of students in courses other than science and mathematics.

While the characteristics that affect students' academic achievement may vary according to courses, different learner characteristics at different education levels will also affect their academic achievement. In the literature, some studies were conducted to analyze the variables that affected the academic achievement of students in primary school (Ertürk & Erdiñ-Akan, 2018), middle school (Ceylan & Berberođlu, 2007; Engin-Demir, 2009; Ertürk & Erdiñ-Akan, 2018; Ölcüođlu & Çetin, 2011; Savař, Tař, & Duru, 2010; Uzun & Çokluk-Bökeođlu, 2019; Zysberg & Schwabsky, 2020), secondary school (Zysberg & Schwabsky, 2020), and the undergraduate level (Bahar & Okur, 2018; Bayramdurdyeva, 2015; Garg, Levin, & Tremblay, 2016; Karagiannopoulou & Milienos, 2015; Sayın & Gelbal, 2014; Suphi & Yaratán, 2012; Rodríguez, Tinajero, & Páramo, 2017; Turan & Koldere-Akın, 2019) from different perspectives. In this context, it is seen that limited studies have been performed, particularly at primary and secondary education levels. Primary school has a special place in the educational process because the knowledge, skills, and attitudes acquired in primary school largely affect the success of students in their later learning life (Yařar, Sözer, & Gültekin, 2000) and form the basis for preparing them for the tasks they will be responsible for in adulthood (Ersoy, 2006).

Therefore, analyzing the characteristics of primary school students that affect their academic achievement is very important for both their future education and their success in adulthood. It is necessary to design lessons that reflect the nature of primary school while analyzing the student characteristics that affect the academic achievement of primary school students. In primary school, lessons and life itself are integrated in accordance with the principle of collective education (Kaya, 2018). Primary school social studies lessons have a very important role here. Social studies is one of the few subjects that include the principle of collective education, which is the basic teaching approach of primary school (Gültekin & Burak, 2019). Therefore, analyzing the features that affect the academic achievement of students in social studies courses can also allow inferences about other teaching processes in primary school.

Aim and Importance of the Study

In this study, it was aimed to determine the learner characteristics that have a significant effect on academic achievement in social studies lessons. In studies on student achievement, factors affecting success should not be considered independently of each other (Uzun & Çokluk-Bökeođlu, 2019). Thus, based on the literature and observations, a conceptual research model was created in which the variables thought to be effective on the academic achievement of students in primary school social studies lessons were associated with each other and with academic achievements. The created conceptual research model was analyzed with structural equation modeling techniques. The variables that affect the academic achievement of students in social studies lessons were accordingly discovered and evaluated, and cause-and-effect relationships were established in a holistic manner. In this study, in general, answers were sought to the following research question: "What are the characteristics of the learner that significantly affect academic achievement in social studies teaching?" This study is considered to be important for being conducted at the primary school level for social studies lessons in the context of learner characteristics, which are thought to be important for academic achievement, and the results of the study are expected to help primary school and social studies teachers prepare more effective and efficient learning environments.

METHOD

Research Model

In this study, it was aimed to determine the variables that affect the academic achievement of primary school 4th grade students in a social studies course. In line with this purpose, it was necessary to analyze the relationship between academic achievement and the variables affecting it from multiple perspectives. The study was carried out in the form of a relational scanning model as a quantitative



research approach. Relational scanning models are correlational research conducted to determine the relationships between two or more variables and to obtain clues about cause and effect (Büyüköztürk et al., 2014). In this study, based on the literature, a conceptual research model was created in which variables thought to be effective on academic achievement in the social studies course were associated with each other. The conceptual research model is illustrated in **Figure 1** below. In addition, research hypotheses were determined to test the effects of the learner characteristics predicted in the conceptual research model on success. The determined hypotheses are provided below.

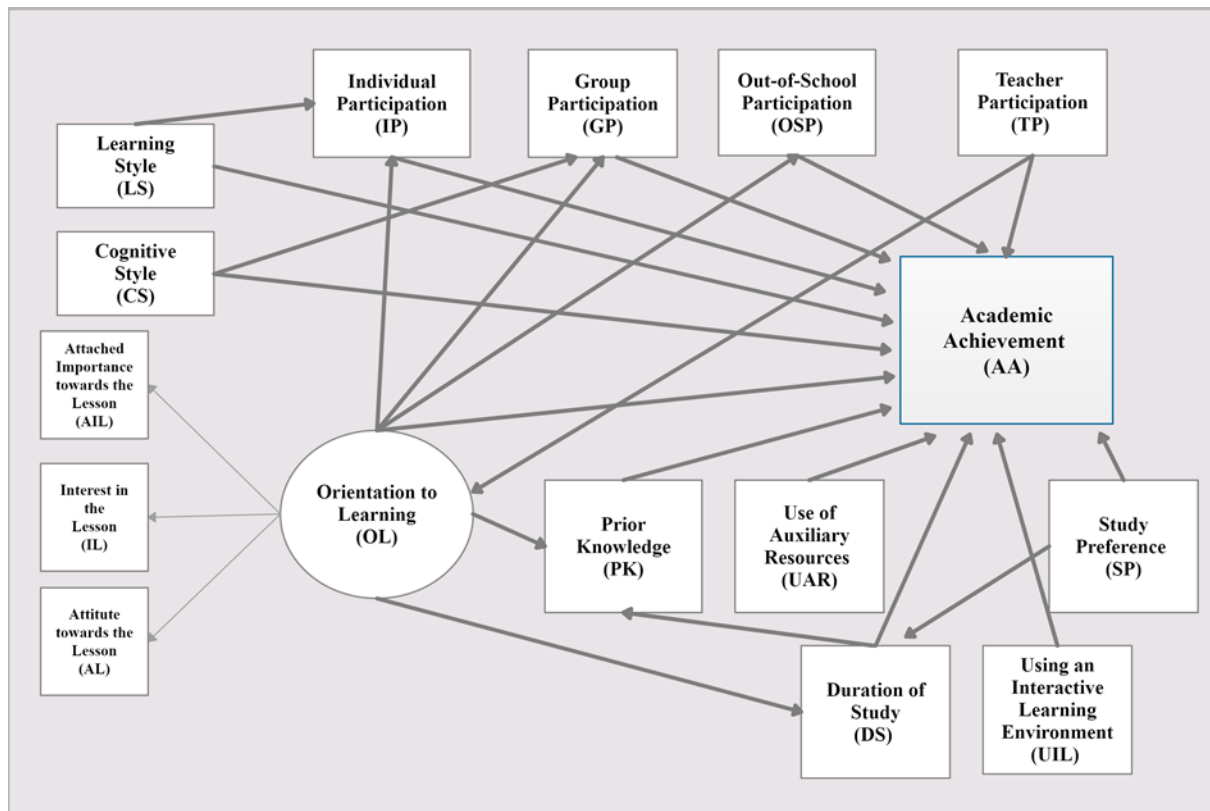


Figure 1. Conceptual research model

In previous studies in the literature, the learner's cognitive styles (Chrysafiadi & Virvou, 2013), learning style (Güngören, 2015; Özyurt, 2013), interest in the lesson (Ceylan & Berberoğlu, 2007), pre-knowledge level (Abulla-Ahmet, 2017; Güngören, 2015), attitude toward learning the subjects of the lesson and importance attached to the lesson, and participation in classroom and out-of-class learning activities (Webster & Fisher, 2000), as well as the teacher's participation in the learning process (Ceylan & Berberoğlu, 2007), were determined as variables effective on achievement. The variables specified in the literature are directly associated with academic achievement in the structural and conceptual research model presented in Figure 1 (PK → AA, TP → AA, LS → AA, and CS → AA). In this model, the variable of learner participation in in-class and out-of-class learning activities was defined as the three different specific variables of individual, group, and out-of-school participation (IP, GP, and OSP). This is because the variable of participation in the learning process as typically defined in the literature is a very general and abstract variable shaped by variables of participation in individual, group, and out-of-school learning environments. Thus, efforts were made to test the effect of variables on achievement at lower dimensions that define students' participation in the learning process. The subdimensions of the learning process participation variable were defined and directly associated with academic achievement (IP → AA, GP → AA, and OSP → AA). On the other hand, since the variables of interest, attitude, and importance attached to the learning process include affective processes, it was not thought possible to use them in the design and preparation of



learning environments alone. For this reason, a new latent variable was defined as orientation to learning by combining the relevant variables (OL → AIL, IL, AL). Thus, a general variable was defined and associated with academic achievement (OL → AA). In addition, based on observations made in the learning-teaching process, variables such as the use of auxiliary resources, duration of study (weekly estimated course hours), study preferences (planned or flexible), and use of an interactive learning environment were thought to have a direct effect on academic achievement. For this reason, the stated variables were directly associated with academic achievement in the conceptual research model (UAR → AA, DS → AA, SP → AA, and UIL → AA).

The preferences of students with different cognitive styles for independent or group work may change and may affect participation in individual learning environments together with learning style (Erden & Akman, 2001). In this context, the variables specified may affect academic achievement indirectly. For this reason, cognitive styles were associated with individual and group participation variables in the learning process, whereas learning styles were associated with the individual participation variable in the learning process (CS → IP, CS → GP, and LS → IP). In addition, since the learning orientation variable includes affective features that can mobilize the learner, it was thought that it could affect academic achievement through the variables of individual and group participation in the learning process, participation in out-of-school learning environments, and study duration. The learning orientation variable was therefore associated with these stated variables (OL → IP, OL → GP, OL → OSP, OL → PK, and OL → DS). From another point of view, it was thought that study preference (planned or flexible) could affect academic achievement through the course study duration variable and study duration through the prior knowledge variable. Study preference and duration of study were therefore associated in the conceptual research model, as were the duration of study and prior knowledge variables (SP → DS and DS → PK). In order to test the conceptual research model, hypotheses were created based on the model and the literature, as follows:

- H₁: In social studies lessons, individual participation in the learning process has a significant effect on academic achievement.
- H₂: In social studies lessons, participation in the learning process with the group has a significant effect on academic achievement.
- H₃: In social studies lessons, participation in the out-of-school learning process has a significant effect on academic achievement.
- H₄: In social studies lessons, the teacher's participation in the learning process has a significant effect on academic achievement.
- H₅: In social studies lessons, orientation to the learning process has a significant effect on academic achievement
- H₆: In social studies lessons, prior knowledge has a significant effect on academic achievement.
- H₇: In social studies lessons, cognitive styles have a significant effect on academic achievement.
- H₈: In social studies lessons, learning styles have a significant effect on academic achievement.
- H₉: In social studies lessons, study preference has a significant effect on academic achievement.
- H₁₀: In social studies lessons, study duration has a significant effect on academic achievement.
- H₁₁: In social studies lessons, the use of auxiliary resources has a significant effect on academic achievement.
- H₁₂: In social studies lessons, the use of an interactive learning environment has a significant effect on academic achievement.



Sample

A sampling technique was used to determine the school and the students from which data would be collected. In this phase, criterion sampling, one of the purposeful sampling techniques, was used to determine the school and the students for the sample. Criterion sampling takes the study of all situations that meet a predetermined set of criteria as its basic understanding. The criteria can be determined by the researcher or according to a previously prepared list (Yıldırım & Şimşek, 2013). In this context, the criteria were that the school represent the general environment in terms of sociocultural and socioeconomic aspects and that there be 150-200 students in the 4th grade at the school. In the literature, it is stated that the sample size should include 150-200 participants in order to test the model proposed at this stage (Özdamar, 2016). Thus, the criterion sampling technique was used in determining the school where data would be collected; however, rather than taking samples of students in the school, an effort was made to reach the whole universe.

A school that met the criteria was identified and data were obtained from 161 students in the 4th grade of this school, who were studying in five different classes. However, as data were collected from these students at different points of time, it was possible for participants with data loss to directly affect the analysis. Therefore, the participants with missing data were excluded from the study. In addition, some participants were excluded from the sample to fill the assumptions required by the analysis (missing data, single and multiple outliers). As a result, 145 of the students whose data had been collected constituted the sample of this study. Information about these students who formed the sample in the design phase of the study is given in Table 1 below.

Table 1. Information about the students forming the sample

Dimensions	n	Subdimensions	f	%
Class	145	4/A	28	19.3
		4/B	29	20.0
		4/C	29	20.0
		4/D	32	22.1
		4/E	27	18.6
Study Preference for Social Studies Lessons	145	Planned	104	71.7
		Flexible	41	28.3
Study Duration for Social Studies Lessons (Weekly)	145	Never	10	6.9
		1-3 hours	83	57.2
		4-6 hours	44	30.3
		7+ hours	8	5.5
Taking Private Courses in Social Studies	145	Yes	5	3.4
		No	140	96.6
Use of Auxiliary Resources (test books, lectures, training sets, etc.)	145	Yes	112	77.2
		No	33	22.8
Use of Interactive Learning Environments (Morpa Kampüs, Vitamin, training CDs, etc.)	145	Yes	78	53.8
		No	67	46.2
Dominant Learning Style of the Student (measured by the Verbal-Visual Learning Styles Scale)	145	Verbal	48	33.1
		Visual	97	66.9
Cognitive Style of the Student (measured by the Group Embedded Figures Test)	145	Field-dependent	74	51.0
		Field-independent	71	49.0
Social Studies 2018-2019 Fall Semester Grade	145	Average of 88.9, ranging from 55 to 100		
Social Studies Academic Achievement Level (measured by Academic Achievement Test)	145	Average of 19.1, ranging from 6 to 30		
Age group	145	8-11 years old		



Data Collection Process and Tools

In this study, quantitative data were obtained by using different measurement tools. The data collection process was carried out periodically and gradually under the supervision of the researcher. In order to match the data collected at different times during the data collection process with their sources, students were asked to write their name and surname, number, and class information on the relevant forms; it was explained that this information would not be shared. The data collection tools with which the study data were obtained are explained below, respectively.

Academic Achievement Test (AAT)

In order to measure the achievement of 4th grade students in a social studies course, the AAT developed by Burak (2020) was used. Data were obtained in the fall semester of the 2018-2019 academic year using the AAT. It contains 30 items, 27 of which are multiple-choice and 3 of which are open-ended, for the five outcomes of the “Science, Technology, and Society” unit of the primary school social studies curriculum. The item discrimination index (r_j) of the items of the AAT ranges from .30 to .74, while the item difficulty index (p_j) ranges between .20 and .83. In addition, the average discrimination (r) of the test was found to be .47 and the difficulty (p) was calculated as .61. The KR-20 value for the reliability of the test was calculated as .86 and the correlation value of the scores obtained after the test-retest application was calculated as .81. In the present study, the KR-20 value was found to be .83. In the scoring of the AAT, correct answers are scored with 1 point and wrong answers with 0 points. The scoring key prepared by Burak (2020) was used to score the open-ended questions. The academic achievements of the students were determined with the scores obtained using the AAT, and these academic achievement scores were used as dependent (internal) variables in the conceptual research model.

Verbal-Visual Learning Styles Scale

The Verbal-Visual Learning Styles Scale developed by Burak (2020), whose validity and reliability were previously analyzed, was used to determine the learning styles of these primary school students. The scale is a 4-point Likert-type measurement tool (“completely not suitable,” “not suitable,” “suitable,” “completely suitable”) consisting of 12 items, with 6 for verbal and 6 for visual learning styles. The scale has a two-dimensional and two-factor structure with no reverse-scored items. The alpha coefficient of the visual learning dimension is .74 and that of the verbal learning dimension is .76. The correlation value of the scores obtained in the test-retest application to determine the reliability of the scale over time was calculated as .83 for the visual learning dimension and .74 for the verbal learning dimension. In this study, the alpha coefficient of the scale’s verbal learning dimension was calculated as .77 and that of the visual learning dimension as .79.

In the scoring of the scale, items related to visual learning style and items related to verbal learning style are summed separately. The lowest score is 6 and the highest is 24 points for both visual learning style and verbal learning style. A higher score in one dimension means that style and its related items are dominant. Thus, the dominant learning styles of primary school students are determined. Using the Verbal-Visual Learning Styles Scale, the learning styles of the participating students were determined, and the determined styles were then used as an independent (external) variable in the conceptual research model.

Group Embedded Figures Test (GEFT)

In this study, the GEFT developed by Witkin et al (1977) and adapted to Turkish by Okman-Fişek (1979) was used to determine the cognitive styles of 4th grade students. First, written permission to use the tool was obtained from Okman-Fişek (1979), who had developed the Turkish form of the test, via email. This measurement tool consists of 25 shape questions presented in three sections. The first seven questions serve as exercises and are excluded from the evaluation. The remaining 18 questions are divided into two sections consisting of nine questions each. In the application of the measurement tool, 11 minutes are given for the second and third parts. Answers are scored by giving 1 point for each correct answer and 0 points for each mistake. A total of 18 points can be obtained from this tool. If the score is higher than the relevant group average, it is evaluated as field-independent, while a



lower score is considered to reflect the field-dependent cognitive style. In score calculation, the average of each class was evaluated alone and the field-dependent/field-independent grouping was performed alone accordingly. In order to ensure better separation of students in terms of class dynamics and to evaluate students in their own contexts, the class average was used instead of a general average. The KR-20 value was calculated to estimate the reliability of the data obtained with the GEFT. As a result of those calculations, the KR-20 value was .83. The cognitive styles of the students were determined with the data collected by the GEFT. The determined cognitive styles were used as independent (external) variables in the conceptual research model.

Social Studies Active Learning Scale

The Social Studies Active Learning Scale, which was developed by Burak (2020) and the validity and reliability of which were tested, was used to determine the attitudes of primary school students toward social studies lessons. The scale consists of two dimensions and seven factors. The first dimension of the scale is “Active Learning,” while the second dimension entails “Orientation to Learning-OL” and “Participation in Learning-PL.” The dimensions of the scale include the following subfactors: “Individual Participation in the Learning Process-IP,” “Group Participation in the Learning Process-GP,” “Participation in the Out-of-School Learning Process-OSP,” “Teacher Participation in the Learning Process-TP,” “Interest in the Lesson-IL,” “Attached Importance towards the Lesson-AIL,” and “Attitude towards the Lesson-AL.” This measurement tool is a 4-point Likert-type scale (“Never,” “Sometimes,” “Often,” and “Always”) and it consists of 30 items. One item is reverse-scored.

The alpha coefficient was calculated to determine the reliability of the subdimensions and the whole of the Social Studies Active Learning Scale. According to those calculations, the dimensions that form the scale have coefficient values as follows: “Individual Participation in the Learning Process,” .63; “Group Participation in the Learning Process,” .77; “Participation in the Out-of-School Learning Process,” .77; and “Teacher Participation in the Learning Process,” .66. A new dimension was formed by these dimensions. “Participation in Learning” had an alpha value of .84. The alpha coefficients of the other dimensions of the scale were calculated as .80 for “Interest in the Lesson,” .78 for “Attached Importance towards the Lesson,” .75 for “Attitude towards the Lesson,” and .86 for “Orientation to Learning,” the latter being formed by the combination of the former dimensions. The alpha coefficient of the whole scale was calculated as .88. With this scale, the latent variables thought to be effective on academic achievement in social studies lessons were defined and the effects of those latent variables on achievement were tested. The subdimensions of the developed scale were accordingly used as external (independent) and moderator variables in the created and tested conceptual research model.

Personal Information Form

In order to analyze the personal features that have significant effects on academic achievement in social studies lessons, study habits that can affect students’ achievement were determined. An information form was prepared by the researcher to be used in the current study. This form included questions about the use of auxiliary resources and interactive learning environments in social studies lessons, students’ study preferences for social studies, and the average study time devoted by students to this course. In addition, students’ social studies grades from the fall semester of the 2018-2019 academic year were used as a data source to determine their prior knowledge levels. The data obtained in this process were added to the Personal Information Form.

Data Analysis

Structural equation modeling (SEM) analysis techniques were used to analyze the conceptual research model created in this study. SEM is a multivariate statistical technique that enables the establishment of cause-and-effect relationships between large numbers of latent and observable variables (Karagöz, 2017; Özdamar, 2016). For the analysis of the data obtained in the study, the dataset was first reviewed and prepared. In the preparation phase of analysis, first of all, missing data and outliers should be taken into account to increase the efficiency of the analysis results of quantitative data (Çokluk, Şekercioğlu, & Büyüköztürk, 2016). This is because missing data and outliers have



increasing effects on error variance and statistically decrease the power of analysis (Osborne & Overbay, 2004). For this reason, in the first stage, the average assignment technique was used to eliminate missing data so that they would have less effect on the variances. One-way and multidirectional outliers were then determined. Standard Z values were calculated by using the total scores of each measurement obtained from the data collection tools to determine one-way outliers. All scores analyzed in terms of one-sided extreme values should be within a distance of ± 3 standard deviations from the mean (Karagöz, 2017). It was seen that the scores for each measurement were in the range of ± 3 . Accordingly, it was decided that there were no one-way outliers. Moreover, multiple outliers were controlled by Mahalanobis distance ($p < .001$). In preparation for the analysis, 16 participants who were determined to have generated one-way and multiple outliers with excessive lost data were removed from the dataset and the analyses began with the data obtained from 145 participants.

In the analysis phase, the dataset was first analyzed in terms of univariate and multivariate normal distribution. In order to analyze univariate normal distribution, the skewness and kurtosis coefficients of each variable in the conceptual model were calculated. According to these calculations, the coefficient of skewness varied between -1.67 and 1.65 and the kurtosis coefficient varied between -1.99 and 2.23. Kline (2010) stated that the skewness and kurtosis coefficients should respectively not exceed values of $|3.0|$ and $|10.0|$. Accordingly, it can be said that the dataset satisfied the univariate normality assumption. For the multivariate normality assumption, Mardia's normalized multivariate kurtosis coefficient was calculated. This Mardia coefficient was between -6.668 and 5.372 for the subvariables and 12.234 for all variables (multivariate). Karagöz (2017) stated that kurtosis values greater than 5, 10, or 20 are critical values for multiple normal distribution. Kline (2010), on the other hand, suggested that values above 8 do not satisfy the assumption of multiple normal distribution, values larger than 10 are problematic, and values above 20 are serious problems for multiple normal distribution. Raykov and Marcoulides (2008), however, stated that the number of variables in a model is a determining criterion for multiple normal distribution and suggested that the critical value be calculated with the formula $p \times (p+2)$ (p : number of observed variables) to analyze the Mardia coefficient in terms of multiple normal distribution. Considering that there are 13 observed variables in the conceptual model in this study, it can be said that the calculated kurtosis coefficient is acceptable in terms of critical values for multiple normal distribution.

A conceptual hybrid model was created to be tested in the study. In other words, in this model, a large number of external and internal variables are used together. Therefore, the data were analyzed using confirmatory factor analysis (CFA) and path analysis together. With CFA, the fit of observable variables explaining some latent variables in the model was analyzed and, according to the obtained results, modifications were made to the model in accordance with the theoretical framework. In these modifications, the relationship paths that were not predicted in the conceptual model were defined and their significance in the model was analyzed. In addition, the path coefficient (regression value, β) and the t value expressing the significance of this correlation coefficient were taken into consideration in determining the variables that affect achievement ($p < .05$). The variables that did not have a significant relationship in the research model were excluded from the analysis hierarchically according to the degree of meaningfulness and the model was analyzed repeatedly.

In order to confirm the fit of the model, root mean square error of approximation (RMSEA) and standard mean square root of residuals (SRMR) functions were used. These indicators are based on the structural similarity function and they should be used for an effective evaluation; all other criteria are auxiliary (Özdamar, 2016). In addition, the ratio of chi-square to degrees of freedom (χ^2/df) was used as another criterion to determine the fit of the model. In the evaluation of the model, the incremental fit index (IFI) and comparative fit index (CFI), which are widely used in the literature, were also taken into consideration. The criteria and value ranges taken into consideration while determining the fit of the model are given in Table 2.

**Table 2.** Model fit criteria and value ranges (Özdamar, 2016, pp. 185-186)

Fit Criterion	Ideal Fit	Good Fit	Acceptable Fit
χ^2	$p > .10$	$.05 < p < .10$	$p < .05$
χ^2/df	≤ 2.00	2.00-5.00	-----
RMSEA	0-.05	.05-.08	-----
SRMR	0-.05	.05-.08	-----
CFI	1.00	.95-1.00	.90-.94
IFI	1.00	.95-1.00	.90-.94

The path coefficient was used to determine the significance levels of variables that were significant for achievement in the research model. The path coefficient (β) was determined using the standardized values of the coefficients that directly or indirectly predicted academic achievement, which is the internal variable in the model, and the sum of these values. In addition, in the evaluation of the effect of the path coefficient, the criteria specified by Kline (1998) were taken into consideration (values of .10 and below indicate small effect, values around .30 show medium effect, and values of .50 and above indicate a large effect). According to these criteria, inferences were made about the total effect level of the significant variables that predict achievement. The SPSS and AMOS package programs were used for the analyses conducted in this phase.

Validity-Reliability

During the study process, quantitative research was carried out with the relational screening model. The degree of explainability of the changes observed in the dependent variable in quantitative studies with independent variables is defined as internal validity while the degree of generalizability of the results to the universe is defined as external validity and there are generally factors that threaten both internal and external validity (Büyüköztürk et al., 2014). The following procedures were carried out to ensure the validity of the results obtained during the design phase:

- A conceptual research model was created to determine the learner characteristics that affect the academic achievement of students in this social studies course. While creating a conceptual model, previous studies in the literature were taken into consideration and the independent variables whose relationships would be tested were determined accordingly. Thus, it was sought to increase the internal validity of the quantitative research carried out in this stage.
- In quantitative studies, sample size and selection are very important dimensions for validity (Büyüköztürk et al., 2014). In the design phase of the study, the sample was determined according to certain criteria by considering the next stages of the research (application and evaluation). In addition, in this process, the sample size was determined by considering the number of participants specified in the literature. Thus, it was sought to increase the internal and external validity of the quantitative research conducted in this stage.
- During the data collection process, data were collected by giving the same scale forms to the participants at the same time. Distribution of the scale forms and the data collection process were completely carried out by the researcher. The researcher made the necessary explanations to participants during the data collection process and informed them.

In this study, quantitative data were obtained using different measurement tools. The validity of quantitative data can be expressed as the ability of the data obtained with the measurement tool to be used for the intended purpose (Özdamar, 2016). The most important factor ensuring the validity of quantitative data is the validity of the quantitative data collection tools. The validity of the quantitative data collection tools used in this study was demonstrated statistically in previous studies.

Reliability of quantitative data is the accurate and complete measurement of what is intended to be measured, free from accidental errors (Özdamar, 2016). In this context, it can be said that the most important factors ensuring the reliability of quantitative data are the measures taken during the data collection process. During the data collection process, the researcher accompanied the participants; thus, efforts were made to minimize the errors that may arise from the environment, data collection



time, and data collection tools. In addition, the researcher paid attention to collecting data from all of the participants at the same time and within the same period. Efforts were also made to gather gradually collected data from different groups at the same time and in the same period.

The reliability of the data obtained with the quantitative data collection tools used in this study was also demonstrated statistically; the Cronbach alpha and KR-20 coefficients were calculated according to the type of measurement tool for these operations. The lower limit for reliability in calculations was set as .60 (Özdamar, 2016). In this context, it was observed that the reliability of the data collected by the quantitative measurement tools was high.

Three short-answer open-ended questions are included in the AAT, one of the measurement tools with which quantitative data were collected. The quantitative data collected in this stage were scored according to the answer key prepared by Burak (2020). In the evaluation of the data obtained by this test, it was ensured that two experts, apart from the researcher, scored the results independently. The researcher and experts analyzed the open-ended questions according to the scoring key and completed the scoring by giving 1 point for correct answers and 0 points for wrong answers. The agreement between the raters was then tested with the Kendall W test (Özdamar, 2016). It was observed that the scores calculated in different stages of the research process showed high consistency ($n=145$, $W=.903$, $p<.01$). A pluralistic approach was used in the scoring and a score given by two of the three raters was accepted as final.

RESULTS

In this study, answers to the following question were sought: “What are the characteristics of the learner that significantly affect academic achievement in social studies teaching?” In order to find answers to this research question, research hypotheses that defined the conceptual model based on the literature were tested. These hypotheses were tested by hierarchical analysis of the quantitative data obtained during the research process (the tested hypotheses are presented in Table 3). After these tests, a research model was obtained in which variables that had a significant effect on academic achievement in social studies lessons were determined, which generally met the compliance criteria. This model is given in Figure 2 below ($\chi^2/SD=1.31$, $RMSEA=.044$, $SRMR=.071$, $CFI=.91$, $IFI=.92$, $R^2=.63$).

Table 3. Results of the relationships between research model variables

Research Hypothesis	Relationship*	Direct Relationship (β)*	Indirect Relationship (β)*	Total Relationship (β)*	Decision
H ₁ : In social studies lessons, individual participation in the learning process has a significant effect on academic achievement.	IP → AA	.40	.30	.70	ACCEPT
H ₂ : In social studies lessons, participation in the learning process with the group has a significant effect on academic achievement.	GP → AA	.36	-	.36	ACCEPT
H ₃ : In social studies lessons, participation in the out-of-school learning process has a significant effect on academic achievement.	OSP → AA	-	.26	.26	ACCEPT
H ₄ : In social studies lessons, the teacher’s participation in the learning process has a significant effect on academic achievement.	TP → AA	-.32	.60	.28	ACCEPT
H ₅ : In social studies lessons, orientation to the learning process has a significant effect on academic achievement.	OL → AA	-	.71	.71	ACCEPT



H ₆ : In social studies lessons, prior knowledge has a significant effect on academic achievement.	PK → AA	.42	-	.42	ACCEPT
H ₇ : In social studies lessons, cognitive styles have a significant effect on academic achievement.	CS → AA	-	.24	.24	ACCEPT
H ₈ : In social studies lessons, learning styles have a significant effect on academic achievement.	LS → AA	-	.19	.19	ACCEPT
H ₉ : In social studies lessons, study preference has a significant effect on academic achievement.	SP → AA	-	-	-	REJECT
H ₁₀ : In social studies lessons, study duration has a significant effect on academic achievement.	DS → AA	-	-	-	REJECT
H ₁₁ : In social studies lessons, the use of auxiliary resources has a significant effect on academic achievement.	UAR → AA	-	-	-	REJECT
H ₁₂ : In social studies lessons, the use of an interactive learning environment has a significant effect on academic achievement.	UIL → AA	-	-	-	REJECT

* $p < .05$

As a result of the analysis, 8 of the research hypotheses that defined the relationships of other variables with academic achievement in the conceptual research model were accepted. It can be said that 63% of primary school 4th grade students' academic achievement in social studies lessons can be explained by the variables of individual participation in the learning process, group participation, out-of-school participation, teacher participation in the learning process, orientation to learning, prior knowledge, learning style, and cognitive styles.

When the results in Table 3 and the diagram in Figure 2 are analyzed together, the variables that affect academic achievement (AA) directly and positively are demonstrated, according to the effect value, to be prior knowledge (PK, $\beta=.42$, $t=4.43$), individual participation in the learning process (IP, $\beta=.40$, $t=2.66$), and group participation in the learning process (GP, $\beta=.36$, $t=3.06$). On the other hand, it was determined that the participation of the teacher in the learning process has a direct and negative effect on academic achievement (AA) (TP, $\beta=-.32$, $t=-2.43$). According to these results, the prior knowledge of the students and their individual and group participation in the learning process has a direct, positive, and moderate effect on their academic achievement in social studies lessons. In the same context, it was determined that teacher participation in the learning process negatively and moderately affects the academic achievement of students.

According to the results given in Table 3 and the diagram in Figure 2, it was seen that the out-of-school participation (OSP) variable indirectly affected academic achievement (AA) through the learning orientation (OL) variable ($\beta=.26$, $t=2.89$). In addition, the learning orientation (OL) variable indirectly affected academic achievement (AA) through the variables of individual participation in the learning process (IP) and group participation (GP) ($\beta=.71$, $t_1=4.81$, $t_2=4.38$). On the other hand, cognitive styles (CS), an external variable, indirectly affected academic achievement (AA) through the variables of individual (IP) and group participation (GP) in the learning process (in favor of the domain-independent style; $\beta=.24$, $t_1=3.10$, $t_2=2.07$). Another external variable, learning styles (LS), was seen to indirectly affect academic achievement (AA) through the variable of individual participation in the learning process (IP) (in favor of visual learning style; $\beta=.19$, $t=4.81$). At the same time, individual participation in the learning process (IP), one of the variables directly affecting academic achievement (AA), also indirectly affected academic achievement through the variable of prior knowledge (PK) ($\beta=.30$, $t=5.52$). The variable of teacher participation in the learning process (TP) also affected academic achievement (AA) indirectly through other variables that mediated the



learning orientation (OL) and out-of-school participation (OSP) variables ($\beta=.26$; $t_1=3.31$, $t_2=3.29$). According to these results, it was seen that students' learning styles, cognitive styles, participation in the out-of-school learning process, and orientation to the learning process had indirect, positive, and moderate effects on academic achievement in social studies lessons. In addition, it was observed that individual participation in the learning process, which directly and positively affects the academic achievement of students in social studies lessons, also positively and indirectly affects their academic achievement. On the other hand, teacher participation in the learning process, which directly and negatively affected the academic achievement of students in these social studies lessons, had a positive effect indirectly.

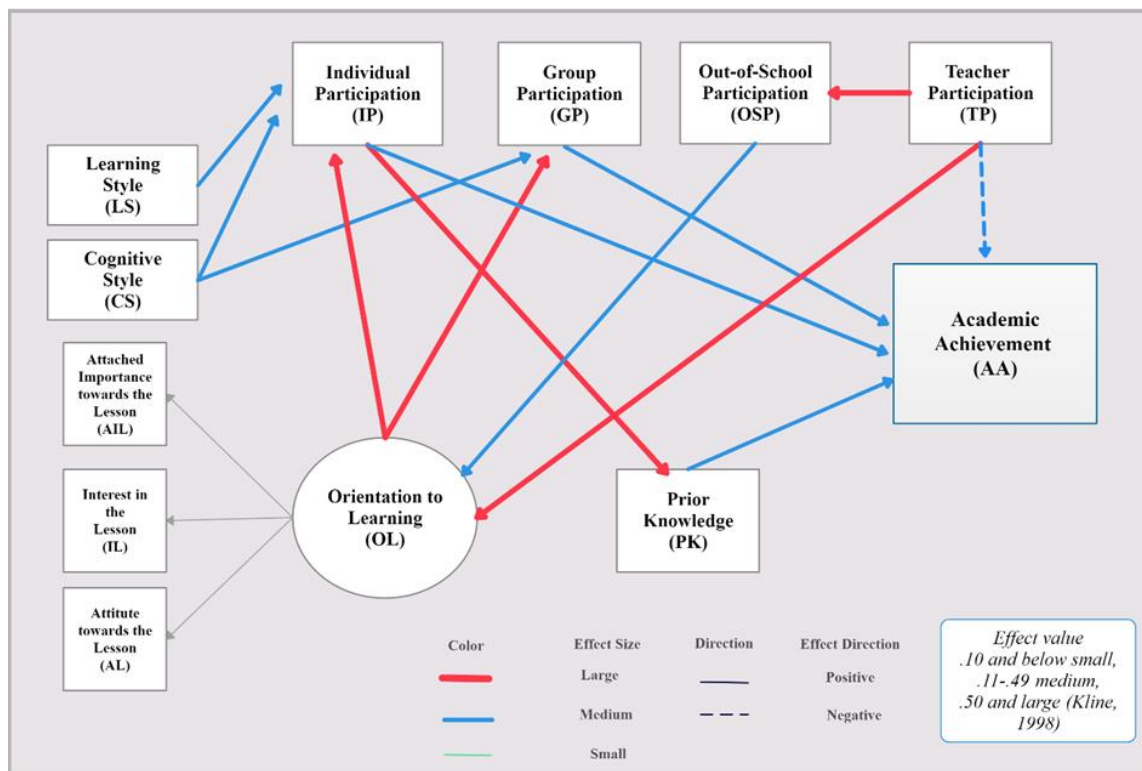


Figure 2. The accepted research model

When the results of the total effect value standardized on academic achievement as given in Table 3 are analyzed, it is seen that learning orientation (OL, $\beta=.71$) and individual participation in the learning process (IP, $\beta=.70$) are the variables with the highest effect value on academic achievement. It was thus determined that these variables are the most important variables that affect academic achievement in social studies lessons. When the direct and indirect effects were standardized and collected, the other variables affecting academic achievement (AA) were found to be prior knowledge (PK, $\beta=.42$), group participation in the learning environment (GP, $\beta=.36$), teacher participation in the learning process (TP, $\beta=.29$), participation in the out-of-school learning process (OSP, $\beta=.26$), cognitive styles (CS, $\beta=.24$), and learning styles (LS, $\beta=.19$). These listed variables affected academic achievement positively and moderately. Again, according to these results, it was found that students' orientation to the learning process was the most important factor affecting their academic achievement in social studies lessons; likewise, students' participation in the learning process had a high effect on their academic achievement in the relevant lesson. On the other hand, it was seen that students' prior knowledge, participation in the learning environment with the group, participation in the out-of-school learning process, cognitive styles, and learning styles and teachers' participation in the learning process in social studies lessons positively and moderately affected students' academic achievement.



DISCUSSION and CONCLUSION

According to the results obtained in this study, it was seen that in social studies lessons, the factors affecting academic achievement were affective states of the students, including their orientation to the lesson; their prior knowledge; their participation in the lesson individually, in groups, or in out-of-school learning environments; the role of the teacher in the learning-teaching process; and the students' learning styles. In this context, it was found that students' orientation to the lesson is the most important variable affecting their academic achievement.

The lesson orientation variable was defined in this study as the combination of the variables of interest in, attitude toward, and importance given to the course. In the literature, no studies were found testing the effects of variables defined as the combination of interest, attitude, and importance on academic achievement. In addition, there are no studies in the literature in which the interest and importance given to the course predict academic achievement in social studies. However, there are studies showing that students' attitudes in social studies lessons affect their academic achievement (Altıntaş, 2005; Ergin, 2006; Oğur, 2009, Öztürk, 1999; Tay & Akyürek-Tay, 2006; Yılmazzer & Demir, 2014). The phenomenon of "importance" in the course orientation variable was associated with criteria such as giving priority to social studies lessons and paying attention in lessons. In the literature, Yılmazzer and Demir (2014) concluded that students' prioritizing of and paying attention in social studies lessons positively affected their academic achievement. For the resultant lesson orientation variable, the phenomenon of "interest" was associated with criteria such as being curious about the subjects of social studies lessons and their interest to the subjects. In the literature, it is stated that interest and academic achievement are directly related (Kuzgun, 2017). As Laçın-Şimşek and Nuhoglu (2009) explained, this may be due to the fact that students learn the topics they are interested in faster and more permanently and thus they become more successful. In this study, orientation to the lesson was defined as an affective learner characteristic. It is stated in the literature that affective characteristics are important variables that affect academic achievement (Duit & Treagust, 2003; Tuan, Chin, & Sheh, 2005). Therefore, the present study's finding that the lesson orientation variable is the most effective learner feature for academic achievement overlaps with the conclusions of some other studies in the literature on the effect of the components of this composite factor. However, the fact that the course orientation variable and its components are the most effective variables for academic achievement is a unique result of this study.

In this study, it was observed that students' participation in lessons individually, in groups, and in out-of-school learning environments positively affected their academic achievement. Students' participation in lessons individually, in groups, or in out-of-school learning environments can be defined as being active in the learning environment, and being active in the learning environment can be defined as engaging in learning activities. One of the most important prerequisites for the success of the student in social studies lessons is the active participation of the student in the learning process (Sartepeci & Çakır, 2015). The finding that students' participation in social studies lessons individually, in groups, or in out-of-school learning environments has a positive effect on their academic achievement can be explained by some previous studies in the literature. In the present study, it was seen that students' individual participation in the lesson has a more positive effect on academic achievement than participating in group or out-of-school learning environments. Academic achievement is an indicator reached at the end of the learning process. Learning is a process that the individual realizes in his or her own life via individual participation, in a group, with a group, or outside of formal settings. Therefore, it can be said that the student's participation in group or out-of-school learning environments is a situation that first requires individual participation. In this context, the individual participation of students in lessons includes participation in group or out-of-school learning environments. Therefore, individual participation is thought to be more effective on academic achievement. In the literature, there are no studies in which students' participation in individual, group, or out-of-school learning environments was found to predict their academic achievement in social studies lessons. However, Şahin-Yanpar (1994) revealed that students'



participation in out-of-school learning environments in 4th grade social studies lessons positively affected their academic achievement. Thus, the result of the present study showing that students' participation in out-of-school learning environments positively affects their academic achievement overlaps with the findings of other studies in the literature.

In this study, students' participation in lessons with a group was associated with processes that require cooperation, such as performing tasks in group work, helping friends in the group, and demonstrating a democratic approach in group work. In this context, students' participation in the learning process with the group can be associated with their participation in cooperative learning environments. In the literature, in the studies of Çelebi (2006) and Kuş and Karatekin (2009), it was found that the participation of students in cooperative learning groups in social studies lessons positively affected their academic achievement. Therefore, the finding that students' participation in social studies lessons with a group has a positive effect on academic achievement is supported by some other studies in the literature.

It was seen in this study that the pre-knowledge level of the students positively affected their academic achievement. Prior knowledge is the initial information that learners bring to the learning environment and it is compatible with the new information they will learn (Şimşek, 2017). In this context, it can be said that a student with a high level of prior knowledge has the necessary basic preparation to acquire new information. Prior knowledge is one of the most important features affecting success in the learning process (Thompson & Zamboagna, 2003). Therefore, it is expected that the academic achievement of students will be affected by their prior knowledge levels. There is no previous study in the literature predicting the effect of students' prior knowledge on their academic achievement in social studies lessons. However, it is emphasized in the literature that prior knowledge is an important variable affecting academic achievement in studies on different disciplines. In this context, Bayram, Sökmen, and Savcı (1997) stated that prior knowledge is an important variable that positively affected academic achievement in chemistry teaching. Therefore, the relationship between prior knowledge levels and academic achievement in the present study coincides with the literature. On the other hand, quantitative determination of the positive effect of students' prior knowledge on their academic achievement in social studies lessons is a unique result for this study.

In this study, it was observed that the direct participation of the teacher in the learning process negatively affected the academic achievement of the students. Therefore, it can be said that the teacher conducting the learning process alone in social studies lessons negatively affects the academic achievement of the students. On the other hand, it was also determined that teachers' participation in the learning process positively affected academic achievement in relation to students' orientation to the lesson (positive emotions-attitude, interest, and importance) and their participation in out-of-school learning environments. Another result obtained in this study is that the orientation of students to the lesson positively affected their academic achievement in relation to their individual and group participation in the lesson. In this context, it can be said that the fact that the teacher offers opportunities for students to participate in individual, group, or out-of-school learning environments in social studies lessons and encourages them to participate in the learning process positively affects their academic achievement. In studies in the literature, it is emphasized that the active participation of students in the course, the teacher's support of the students, and the involvement of students in the process positively affect academic achievement (Çelik, Örenoğlu-Toraman, & Çelik, 2018). Therefore, the results obtained in this study in the context of the effect of the role of the teacher on the academic achievement of students are supported by studies in the literature. On the other hand, there is no study in the literature predicting the effect of teachers' roles in social studies lessons on students' academic achievement. However, according to the results obtained in this study, a student-centered teaching process in social studies lessons will positively affect academic achievement. Student-centered education is explained as a process that places students' individual needs, preferences, and goals at the center and gradually adds students to the decision-making processes that affect their learning (Benson, 2012). In student-centered teaching, the teacher is expected to design environments



that will give the student the responsibility of learning, to encourage students to participate in these environments, and to motivate students (Weimer, 2002). In the literature, there are studies showing that student-centered teaching positively affects the academic achievement of students in social studies courses. In one of those studies, Yaşar et al. (2015) analyzed 51 thesis studies in which student-centered approaches, methods, techniques, and materials were used in social studies lessons. According to their results, student-centered approaches, methods, techniques, and materials had a positive effect on academic achievement. In a similar study, Yeşilpınar-Uyar and Doğanay (2018) found that, in general, teachers' use of a student-centered approach in the learning process affects students' academic achievement more positively. Therefore, the results of the present study regarding the relationship between teacher-centered teaching and academic achievement are explained and supported by the literature.

In this study, it was seen that the learning style of students had a positive effect on their academic achievement. Learning style is defined as the strengths and preferences of the learner in obtaining, processing, and retaining information in the learning process (Felder & Silverman, 1988). Therefore, it can be said that learning style is a learner feature that includes learning preferences toward the learning environment. In the literature, it is emphasized that learning style is an important variable that affects academic achievement in general (Bozkurt & Orak, 2016; Cevher & Yıldırım, 2020). The result that learning style has a significant effect on academic achievement in this study thus coincides with findings in the literature. However, according to the results of the present study, students with a visual learning style were more successful than students with a verbal learning style. It can be said that the frequent use of visual elements such as projection and interactive boards in current teaching practices, teachers not using meaningful learning techniques as before, and teachers preferring video lectures in interactive learning environments instead of storytelling and narration techniques cause this difference in success. Therefore, current teaching practices are thought to predominantly support the learning styles of visual learners. In the literature, it was concluded that learning styles differentiated academic achievement in social studies courses (Yurtseven, 2010), generally at the primary school level (Collison, 2000; Kazu & Koç-Akran, 2018). In this context, the result that students' learning styles positively affect their academic achievement in social studies lessons and that academic achievement in these lessons differs significantly according to learning style coincides with and is supported by studies in the literature.

It was found in this study that the cognitive styles of students had a positive effect on their academic achievement. "Cognitive style" refers to the preferred ways of receiving, organizing, processing, remembering, and retaining information until it is necessary (Witkin et al., 1977). Therefore, it can be said that cognitive styles are a distinctive learner feature that form learning styles. In the literature, it is generally emphasized that cognitive styles are an important variable affecting academic achievement (Şimşek, 2017). It was also found in this study that students with a field-independent cognitive style were significantly more successful than students with a field-dependent cognitive style. It is claimed in the literature that traditional teaching environments offer more advantages to students with field-independent styles (Bahar, 2003; Özarlan & Bilgin, 2016). Therefore, those teaching practices are thought to predominantly support the learning styles of independent learners. In different studies in the literature, it was concluded that cognitive styles differentiated academic achievement in social studies lessons (Ndudi & Mkpá, 2003) and at the primary education level (Kıncal & Yazgan, 2010; Onyekuru, 2015). In this context, the result that students' cognitive styles positively affected their academic achievement in social studies lessons and that academic achievement in this course differed significantly according to cognitive style coincides with and is supported by other studies in the literature.

Limitations of the Study

The results obtained in this study are valuable for social studies education and teaching in primary school. However, the study has some limitations due to its sample and method. In particular, the sample from which the study data were obtained consisted of students studying in a single school. In



this context, a school from an environment with average sociocultural and socioeconomic characteristics was selected. Therefore, repeating the study comparatively with different samples is very important for the validity and generalizability of the results. On the other hand, with this study, the relationship between different variables and success was discovered in a structural model created based on the literature and observations. However, empirical inferences are needed to analyze these relationships in more depth by establishing a cause-and-effect relationship. Despite these limitations of the study, according to the results obtained during the research process, the following suggestions can be offered to teachers in order to provide a more successful learning environment:

- Teachers can provide an effective and productive learning environment by preparing individual, group, or out-of-school learning environments for students in social studies lessons. This should not be understood simply as using individual, group, or out-of-school learning environments; teachers can use every type of environment in the learning-teaching process at the same time.
- Teachers should ensure that students participate in the learning environment with positive emotions for efficient and effective social studies teaching. For this, primary school teachers can diversify and enrich the activities and contents in the learning-teaching process according to students' interests and personal preferences.
- In this study, it has been seen that a completely teacher-centered teaching process creates limitations in terms of establishing an effective and productive learning environment in social studies courses. It was revealed that the teacher should encourage and engage students in the learning process; in other words, designing student-centered environments will facilitate effective and efficient teaching. In this context, teachers may sometimes shift the responsibility for learning and control of the learning environment to students in social studies lessons.
- In social studies teaching, it was observed that there was a difference in achievement due to students' learning styles. In order to eliminate this difference, teachers should consider different learning styles in the learning process. Teachers can solve this problem by including activities suitable for different learner characteristics in the learning-teaching process.

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EFFECTS OF POE ON PRE-SCHOOL STUDENTS' CRITICAL THINKING AND POE SKILLS

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Abstract

Apart from basic skills such as self-care and speaking, higher-order cognitive skills including inquiry, critical thinking, and scientific thinking can develop during early childhood. Thus, it is crucial to employ teaching methods that support the development of higher-order cognitive skills in these age groups and ensure that these children systematically use such skills. This study aimed to investigate the effects of the POE (Predict-Observe-Explain) method on the POE and critical thinking skills during early childhood. In this context, 27 pre-school students participated in the study, which involved an experimental design and was carried out for six weeks. In the study, the data collected by using quantitative and qualitative data collection tools were analyzed using appropriate analysis methods. The researchers compared the effects of scientific experiments prepared in line with the POE and gamification on students' critical thinking skills through philosophical inquiry (CTSPI) and POE skills, and skills that constitute the sub-dimensions of these skills. The findings revealed that in early childhood education the POE was more effective than gamification in developing students' critical thinking and POE skills. Similarly, teachers participating in the research process thought that the POE was more effective than gamification in motivating students and turning their attention to teaching processes. Considering the results, the POE is recommended to be used in early childhood education, especially in transferring scientific content in the fields of science.

Keywords: Predict observe explain, critical thinking, early childhood education.

INTRODUCTION

The skills used in science are among the basic competencies that individuals use to produce solutions to the problems encountered in daily life. These skills begin to develop during early childhood and that are far beyond the special abilities that researchers use in conducting scientific studies (Jacobson & Bergman, 1980). The child, driven by the natural sense of curiosity, uses these skills while inquiring and making sense of anything unknown to him/her. Besides ensuring the construction of scientific content, what is aimed at teaching environments is to enable individuals to realize, develop, and use these skills systematically and effectively (Padilla, 1990). In this context, teaching methods and techniques used in teaching processes (especially in science teaching) are expected to enable students not only to construct scientific content more easily but also to develop these skills, such as 21st-century skills, scientific process skills, etc. (Anderson, 2002). On the other hand, some of the methods and techniques used in teaching processes are more effective in constructing the scientific content while others foster different skills of the students. In this case, considering the development levels of the students and the characteristics of their education levels (such as pre-school, primary school, and high school), the question is: Should we use the one which is effective in constructing the contents or the one which is effective in developing skills? The answer to this question requires the use of the method appropriate to the developmental level of the students and the basic objectives of the teaching level. Thus, in pre-school education during which children gain basic competencies and skills,



methods ensuring the development of basic and advanced skills in children should be at the top of the list, and as the level goes up, methods ensuring the construction of scientific content and the development of skills should be employed more (Harms & Yager, 1980). Considering pre-school education processes and the characteristics of the students in this process, it is understood that these students develop basic skills (eating, drinking, speaking, simple writing, drawing, and socialization skills) as well as basic scientific skills (such as prediction and observation) (Jacobson & Bergman, 1980). Therefore, the teaching methods and techniques used at the pre-school level should be accommodated in a manner to allow students to foster basic life, inquiry, and scientific thinking skills and to use these skills systematically and efficiently (Harms & Yager, 1980).

The POE covers the most basic stages of argumentation. It involves asking students to make predictions about the presented problem situation, observe the applications, and make explanations on observations through the construction of content by grasping the accuracy/wrongness of their predictions. In this way, apart from constructing the scientific content, students develop skills in predicting, observing, and explaining as well as inquiring (Alexander, Haysom, & Bowen, 2010; White, & Gunstone, 1992).

The POE helps students develop basic scientific skills (prediction, observation, and explanation) and inquiry skills and structure the scientific content with active participation (Champagne, Klopfer, & Anderson, 1980; Gunstone, 1990). Since this approach was introduced to the literature many years ago and is accepted as an effective method, it has been studied in a great amount. When the studies in question are classified according to sample/study groups to have a good grasp of the studies and the results more easily, the POE is observed to be studied on preservice teachers more frequently as it is a teaching method. It has been emphasized in basic laboratory implementations on preservice teachers with various dimensions that the POE proves to be instrumental in the development of academic achievement, permanence, conceptual understanding, scientific process skills, attitudes, and helps identify and eliminate the misconceptions that preservice teachers have towards the selected scientific content (Ayvaci, 2013; Banawi, Sopandi, Kadarohman, & Solehuddin, 2019; Baltacı & Yıldız, 2018; Bilen & Aydogdu, 2010; Güleşir, Aydemir, Sergüzel, Uzel, & Gül, 2020; Harman, 2014; Hilario, 2015; Köklükaya & Yıldırım, 2018; Özdemir, 2011; Tiftikçi, Yüksel, Koç, & Çıbık, 2017; Yavuz & Çelik, 2013). It is reported that preservice teachers perceive the POE as an effective, but time-consuming method that is difficult to apply (Güngör & Özkan, 2017). Studies focusing on the effects of the POE on high school students reveal that it fosters the understanding of scientific content offered to students while increasing academic success, interest in physics, improving metacognitive skills and attitudes (Karadeniz, 2019; Rusçuklu & Özdilek, 2019; Treagust, Mthembu, & Chandrasegaran, 2014; Yaşar & Baran, 2020).

Similarly, studies conducted at different levels and courses at the primary education level revealed its effectiveness in the development of the students' scientific process skills, concept learning, academic achievement, conceptual meanings, critical thinking skills, mental models, and attitudes (Akarsu, 2018; Arsy, Prasetyo, & Subali, 2019; Jasdilla, Fitria, & Sopandi, 2019; Kara, 2017; Nana, Akhyar, & Rochsantiningasih, 2014; Özçelik, 2019; Palmer, 1995; Rini, Suryani, & Fadhilah, 2018; Rosdianto & Murdani, 2017; Sünkür, 2013). In a study conducted at the primary education level, it was found that the POE was effective in terms of predictions and explanations (Schönborn, Haglund, & Xie, 2014).

Studies on pre-school groups, the target groups in this study, mainly deal with the subject based on argumentation and its effects. It is thought that this is due to the detection that not only the predictive and observational skills of the children but also their argument-formation skills have improved (Dunn, Bretherton, & Munn, 1987).

It is understood that in this age group, topics such as argumentation, selection of strong arguments, argumentation-language development, and culture-argumentation have been investigated. In an experimental study conducted with the participation of 84 children aged 3-5; Mercier, Bernard, and Clément (2014) stated that among the argument examples presented, children chose the stronger one.



In addition, it is stated that children were affected by the circular argument and the competence of the individual who defends the argument. In another study conducted in this context, Zadunaisky & Blum-Kulka (2010) stated that peer discussions were effective on children's cultural and social development and set a strategy to determine the effects of argumentation on children's discursive and developmental level. In another study, Zadunaisky (2011) conducted focus group interviews with 15 pre-school students, reporting that children not only elaborated on them but also built arguments.

One of the few studies that tested the effects of the POE in this age group was carried out by Hsu & et al. in 2011 with 50 pre-school students. In the experimentally designed study, computer-assisted games developed for the concept of shadow were presented to one group with the POE and as game-based to the other group. According to the findings obtained through interviews in the study, the researchers found that POE-supported applications were much more effective in the development of the concept of shadow in children. 15 public school and 15 private school students participated in another experimental study aimed at revealing the effects of the philosophy curriculum with children on critical thinking skills in pre-school groups (Karadağ & Demirtaş, 2018). The researchers concluded that the philosophy curriculum with children increased students' critical thinking skills in both groups (Karadağ & Demirtaş, 2018).

It has been observed that studies have been conducted on the effects of the argumentation approach on the development of basic skills in these age groups (discussing, building arguments, and choosing the strong one, language, and social development) and the confirmation of the presence of argumentation skills. Considering science education, it is emphasized in the literature that science teaching should start at an early age, and the acquisition of basic scientific and inquiry skills in early childhood is essential in terms of preparation for subsequent education levels (Gullo, 2006; Marek, & Cavallo, 1997; Ravanis & Bagakis, 1998). In this context, the studies conducted in this field are considered insufficient to explain the effects of argumentation and related methods (such as the POE). Argumentation and related methods both foster socio-cultural skills and basic scientific skills for the nature of science and science fields (Erduran & Jiménez-Aleixandre, 2008; Osborne, Collins, Ratcliffe, Millar, & Duschl, 2003). However, there is a lack of research on pre-school groups.

It seems to be necessary to investigate the effects of the POE, which has proven its effectiveness in the development of scientific thinking and process skills in other age groups, in early childhood, and to conduct studies on how to use it more effectively. Similarly, it was emphasized that skills of prediction, observation, and explanation were improved in these age groups. However, to what extent these children can use these skills in basic science fields (such as physics, chemistry, biology), in which fields of science they can better inquire about, and the underlying reasons are among the issues that need to be researched.

This study has been designed to investigate the effect of the argumentation approach-based POE on the development of critical thinking skills through basic scientific process and inquiry in pre-school groups and to investigate to what extent these age groups can use basic scientific skills in basic science fields such as physics, chemistry, and biology. The research questions focused on the study are:

To what extent do scientific experiments, prepared according to the POE and gamification, effect the development of children's basic scientific process skills (POE)?

To what extent do scientific experiments, prepared according to the POE and gamification, effect the development of the students' critical thinking skills through inquiry?

How do pre-school teachers and science education experts evaluate the value of using the POE in early childhood?

METHOD

In this study, the effects of the POE on pre-school students' critical thinking and POE skills through philosophical inquiry were investigated. The study employed pre-test and post-test control group



quasi-experimental design (Campbell & Stanley, 2015). The research process and steps are explained in detail below.

Research Design

In this quasi-experimental designed study, students were divided into two groups as experimental and control via random assignment. Before the implementation, the measurement tools determined in both groups were applied as a pre-test. While the activities developed by the researcher in the control group were implemented in company with the methods used in the school curriculum, they were implemented using the POE in the experimental group. During the 6-week implementation period, the implementations were recorded on video. At the end of the implementation, measurement tools (The critical thinking skills through philosophical inquiry scale (CTSPI) and The POE Observation Form) were applied to the groups as a post-test and the implementation was terminated after taking the opinions of the teachers and observers (science experts) who participated in the implementation. The research design is presented in Table 1.

Table1. Research design

Group	Preparation Process	Pretest	Implementation	Posttest
Experimental Group	Planning Activities and Pilot	Ö ₁ -F ₁	POE Activities	Ö ₁ -F ₁ -F ₂ -F ₃
Control Group	Scheme	Ö ₁ -F ₁	Activities	Ö ₁ -F ₁ -F ₂ -F ₃

Ö₁: The critical thinking skills through philosophical inquiry scale (CTSPI), F₁: The POE Observation Form, F₂: The Teacher Observation Form, F₃: The Science Expert Observation Form

Study Group

Four pre-school teachers, 27 students (aged 5-6) attending 2 different classes of a private pre-school, and 2 teachers, who were in charge of each class, participated in the study. Students in this school receive education for 2 years and the teachers work as class teachers during this period. Necessary permissions were obtained from the institution for the implementation. Furthermore, families were informed and their permission was obtained to video record the process. Identities of students were kept strictly confidential. Twelve of the students in the study group were female and 15 of them were male. In the study, the classes were selected randomly and one of them was the experimental group while the other was the control group. The teachers were in the same group with the students they were responsible for, and thus 2 of them were in the experimental group, and the other 2 in the control group, as observers. Two science experts (1 in the control group, 1 in the experimental group) participated in the implementations in the experimental and control groups as observers. One of the researchers conducting an activity with students presented in Image 1.

Research Process and Implementations

In the preparation stage, 6 acquisitions which are among the acquisitions in the school curriculum, and related to the fields of physics, chemistry, and biology were determined.

Then, 6 activities were prepared in accordance with the acquisitions and the development characteristics of the students related to the specified fields of science. Two of these activities were biology-related (Which one is my house, don't eat it, eat me! (An expression of cuteness)), 2 of them were physics-related (Who is slow, who will jump first), and 2 of them were chemistry-related (Whose scent is ahead, why my colour has changed). The activities were presented to science experts and pre-school teachers to ask for an evaluation of the suitability for the levels of the students and science fields. A pilot scheme was conducted with the participation of 6 students from the same school who did not participate in the experimental study. At the end of the process,



Image 1. An image of the implementation process



it was decided that the activities were suitable for the main implementation. Before the implementation started, the teachers were asked to fill the Critical Thinking Skills through Philosophical Inquiry Scale (CTSPI) for the students they were previously responsible for, and the POE observation form developed by the researcher. Brief information was given to the teachers about how to use both measurement tools. Following the pre-tests, the same activities were applied to both groups for 2 hours a week. The activities were applied in the experimental group through the POE and as game activity in the control group for a total of 12 hours. First, 1 biology, 1 chemistry, and 1 physics activity were conducted, and then 1 biology, 1 chemistry, and 1 physics activity were conducted, respectively, with an attempt to prevent the effect of scientific fields on the results of the study. In the implementation of the activities, short videos were shown to the students in the experimental group to make them realize the problem situation and then they were asked to predict the reason for the event. Then, the activities were conducted to allow them to make observations. Each student was given time to explain whether their predictions were correct or not, based on their observations. In addition, the students were allowed to have scientific discussions by asking questions that would create a discussion environment among them. At the end of the process, small rewards were given to the students who made correct predictions and explanations. In the control group, the applications were carried out with the traditional gamification frequently used by teachers. Activities were introduced to the students as a game and applied in this way. The implementation process in both groups was videotaped. Teachers and science experts joined the implementation as external observers and evaluated the students at the end of each experiment using the POE observation form. Thus, data on the development of the students throughout the process was obtained. After the implementation, the teachers filled in the CTSPI again for the students in the group they joined. Finally, video recordings were distributed to the teachers and science experts to fill in the POE observation forms again. At the end of the process, the teachers and experts who joined the experimental group were interviewed for 1 hour with semi-structured interview questions, and their opinions about the implementation process were asked and finally the process was terminated.

Data Collection Tools

The Critical Thinking Skills through Philosophical Inquiry Scale (CTSPI)

The measurement tool, developed by Karadağ, Demirtaş, & Yıldız (2017) to determine the critical thinking skills of the students aged 5-6, consists of 3 sub-dimensions as "Philosophical Inquiry", "Language and Cognitive Skills", and "Question Formation" and a total of 38 items. It is a 5-point Likert-type scale.

The Critical Thinking Skills through Philosophical Inquiry Scale (CTSPI) for students aged 5-6					
Acquisition/Indicator	1	2	3	4	5
S/he focuses on the stimulus (story, picture, etc.) presented for a philosophical discussion.					
1. S/he reflects on the stimulus (story, picture, etc.) presented for a philosophical discussion.					
2. S/he shares thoughts on the stimulus (story, picture, etc.) presented for a philosophical discussion with the group.					
S/he forms questions related to a philosophical topic of discussion.					
1. S/he forms questions of "What" related to a philosophical topic of discussion.					
2. S/he forms questions of "How" related to a philosophical topic of discussion.					
S/he expresses herself/himself creatively.					
1. S/he expresses feelings genuinely.					
2. S/he expresses thoughts genuinely.					

Figure 1. Sample items of the critical thinking skills through philosophical inquiry scale (CTSPI).



The researchers calculated the internal consistency coefficients of the measurement tool (Philosophical Inquiry, Language and Cognitive Skills, Question formation, and General Total) as .974, .955, .983, and .986 respectively. The measurement tool is filled in by the teacher on behalf of the student. The general structure of the measurement tool is presented in Figure 1.

The POE Form

The form developed by the researcher was used for teachers and experts participating in the study to observe during the implementation process. The characteristics of prediction, observation, and explanation skills included in the POE and Scientific Process Skills (SPS) while developing the forms were researched and their general characteristics were determined (Padilla, 1990). The form created in line with the research was presented to experts in the field of measurement to obtain their opinions its validity. Experts stated that the form is applicable. The general structure of the POE evaluation form is presented in Figure 2.

The POE Form					
This form has been prepared to evaluate your students' ability to predict (formulation of hypothesis), observe, and explain in the implementation process of the activities. During the evaluation process, each student will be evaluated separately for each experiment. During the evaluation, you are asked to score from 1 to 10 for the three specified skills of the students.					
While scoring, you are expected to set criteria based on the characteristics of the skills, whether students use clear and scientific expressions to demonstrate the relevant skills, and how such expressions are consistent with the process. Below are some questions taken as a basis for scoring by the observers:					
Prediction; Could the students clearly state the reason for the problem situation you presented to them and the suggestion that could be a solution to this problem situation? Do the students use scientific expressions while expressing the prediction and solution offer? Are their predictions consistent with the activity?					
Observation; Could the students catch the points that would determine the problem situation while watching the experimental process? Could the students give consistent answers to your guiding questions in the process? To what extent did they catch the important points of the experiment?					
Explanation; To what extent did the students explain their predictions scientifically using their observations and reasoning at the end of the experiment?					
Group	Identity	Prediction	Observation	Explanation	Total
E	Student A	3	3	1	7
C	Student B	4	3	2	9

Figure 2. The sample POE form and sample scoring

Figure 2 demonstrates that there were 4 different scores for each student in the POE form containing prediction, observation, explanation, and total. Observers can score between 1 and 10 for each field (prediction, observation, and explanation) for each student. The sum of the scores given in 3 fields provides the POE total score. The POE scores were grouped about the general grouping method in educational processes. Any skill or achievement score out of 100 in educational processes is considered low between 0-20, acceptable between 20-40, moderate between 40-60, good between 60-80, and very good between 80-100. Accordingly, the scores obtained from the POE observation form are grouped into 5 categories as (a) low level ($a \leq 2$), acceptable level ($2 < a \leq 4$), moderate level ($4 < a \leq 6$), good level ($6 < a \leq 8$), and very good level ($8 < a \leq 10$). There were also guidelines prepared by using Harlen (1999) and Padilla (1990) regarding the observers' correct evaluation of prediction, observation, and explanation skills. Guidelines contain explanatory information about the definition of prediction, observation, and explanation skills, which are the steps of the POE and included in SPS, their characteristics, and the characteristics that the observer should take into account.

Science Expert and the Teacher Interview Form

A semi-structured interview was held with the teachers and science experts in the experimental group to get their opinions about the POE and implementation process. The form containing the interview questions was developed by the researchers, included 2 questions about the characteristics of the POE and the activities as well as the effects of the implementation. Questions included in the teacher interview form were as follows: "Did you find the method effective? Why?" and "Would you like to



use this method in your lessons later? Why?" Questions included in the science expert interview form were as follows: "Did you find the method suitable for the level of the students? Why?" and "Did you find the selected experiments in the fields of science suitable to the level of the students? Why?" Interview forms were used to get the opinions of 2 teachers and 1 science expert as observers in the experimental group.

Data Collection and Analyses

The data on the CTSPI was obtained through the implementation of the scale. Four teachers (2 in the experimental group, 2 in the control group) in charge of the study groups filled out the measurement tool separately for each student in their group before the first implementation and at the end of the sixth implementation. The post-test scores of the students were obtained by taking the arithmetic mean of the pre-test scores given by 2 teachers in each group for the same student and of the scores given by the teachers for the post-test. The data obtained from the measurement tool were analysed after being transferred to the SPSS. At the end of the implementation, the pre-test and post-test scores of the students were compared to determine the change in the CTSPI while descriptive statistics, parametric, and non-parametric analyses were conducted on these scores. The data on the POE skills of the students were obtained from the POE form. After each implementation, 2 teachers and 1 expert in each group filled out the POE form separately for the students they were responsible for. The arithmetic mean of the POE score of the student given by 2 teachers and 1 expert refers to the student's POE 1 score for that experiment. To increase the reliability of the data obtained from the POE form, video recordings were given to the experts and teachers 15 days after the implementation to ask for a re-evaluation of the study groups they were responsible for through the POE form as specified in the implementation process. Thus, the student's POE 2 score was obtained for that experiment by taking the arithmetic mean of the scores given by 2 teachers and 1 expert for the same student. The Kappa analysis value on the POE 1 scores obtained from the evaluations of teachers and experts in the process for the same student and the POE 2 scores obtained from the evaluations in the video recording was calculated as .90. This means that the POE 1 and POE 2 scores of the experts and teachers were highly compatible, which shows that the data were reliable. The student's POE scores were obtained for each experiment by taking the arithmetic mean of the students' POE 1 and POE 2 scores. The POE score obtained by the students at the end of the first experiment was accepted as the pre-test while the POE score obtained at the end of the sixth experiment was accepted as the post-test score. At the end of the implementation process, the POE pre-test and post-test scores were compared statistically and descriptive statistics, parametric and non-parametric analyses were conducted on the data to determine the changes in their POE skills. The researcher determined how the POE skills of the students changed in the process through a graphical representation of the POE scores of the students from each experiment.

The opinions of the teachers and experts about the process and the POE method were determined by semi-structured interview forms. Content analysis was made on the data from the interview form. The themes obtained from the responses given by the experts and teachers are presented in the findings.

RESULTS

Normality tests related to the data obtained from the quantitative measurement tools (the POE observation form and the CTSPI) used in the study are presented in Table 2.

Table 2. Normality tests related to the students' scores of the POE and the CTSPI

Measurement Tools	Mean	Shapiro-Wilk	
		Std.Dev.	p
The CTSPI pre-test	136.81	.754	.000
The CTSPI post-test	154.81	.716	.000
The POE pre-test	13.93	.946	.175
The POE post-test	18.00	.917	.053



Table 2 reveals that the pre-test and post-test scores taken by the students from the CTSPI scale and its sub-dimensions do not comply with the normal distribution, and the POE pre-test and post-test scores show a normal distribution (Dallal & İlkinsen, 1986). Accordingly, non-parametric tests were applied on the CTSPI scores of the students and parametric tests on the POE scores.

Table 3. The Wilcoxon signed rank test findings related to the pre-test and post-test scores of the experimental group students from the CTSPI and its sub-dimensions

Measurement Tools	Groups	N	Mean	Sum of Ranks	Mean Rank	z	p
The Philosophical Inquiry Sub-Dimension Pre-test and Post-test	Negative rank	12	1	90	7.50	-3.112	.002*
	Positive rank	1	7.5	1.00	1.00		
	Equal	1					
Cognitive Skills Sub-dimension Pre-test and Post-test	Negative rank	13	.00	91	7.00	-3.182	.001*
	Positive rank	0	7	0	0		
	Equal	1					
Inquiry, Question Formation Skills Sub-dimensions Pre-test and Post-test	Negative rank	10	5.67	74.0	7.40	-2.014	.044*
	Positive rank	3	7.40	17.0	5.67		
	Equal	1					
The CTSPI Pre-test and Post-test	Negative rank	14	.00	105	7.5	-3.297	.001*
	Positive rank	0	7.50	0	0		
	Equal	0					

*p<.05

Table 3 reveals that there is a significant difference ($p < .05$) between the pre-test and post-test scores of the students in the experimental group from the CTSPI and its sub-dimensions ($p < .05$), which is positive in favor of the post-tests. Accordingly, the experimental group students' skills in the CTSPI and its sub-dimensions improved significantly after the implementation.

Table 4. The Wilcoxon signed rank test findings related to the pre-test and post-test scores of the control group students from the CTSPI and its sub-dimensions

Measurement tools	Groups	N	Mean	Sum of Ranks	Mean Rank	z	p
The Philosophical Inquiry Sub-Dimension Pre-test and Post-test	Negative rank	11	1.50	76.50	6.95	-2.950	.003*
	Positive rank	1	6.95	1.50	1.50		
	Equal	1					
Cognitive Skills Sub-dimension Pre-test and Post-test	Negative rank	8	4.00	54.00	6.75	-1.891	.059*
	Positive rank	3	6.75	12.00	4.00		
	Equal	2					
Inquiry, Question Formation Skills Sub-dimensions Pre-test and Post-test	Negative rank	7	1.75	41.50	5.93	-2.263	.024*
	Positive rank	2	5.93	3.50	1.75		
	Equal	4					
The CTSPI Pre-test and Post-test	Negative rank	12	12.00	78.00	6.50	-3.062	.002*
	Positive rank	0	6.00	0.00	0.00		
	Equal	1					

*p<.05

Table 4 reveals that there is a significant difference ($p < .05$) between the pre-test and post-test scores of the students in the control group from the CTSPI and the philosophical inquiry and question formation sub-dimensions ($p < .05$), which is positive in favor of the post-tests. Accordingly, the control group students' skills in the CTSPI, critical thinking, philosophical inquiry, and question formation improved significantly after the implementation while no improvement was observed in cognitive skills at this level.



Considering the findings of the CTSPI and its sub-dimensions, pre-test scores of the students in the experimental and control groups presented in Table 5, it is understood that the students in the groups are statistically equal in terms of the CTSPI before the study.

Table 5. The Mann-Whitney U test findings related to the pre-test scores from the CTSPI and its sub-dimensions

Measurement Tools	Groups	N	Sum of Ranks	Mean Rank	U	z	p
The Philosophical Inquiry Sub-Dimension Pre-test	Experimental	14	202.500	14.464	84.500	-.315	.752
	Control	13	175.500	13.500			
Cognitive Skills Sub-dimension Pre-test and Post-test	Experimental	14	225.500	16.107	61.500	-1.447	.140
	Control	13	152.500	11.730			
Inquiry, Question Formation Skills Sub-dimensions Pre-test	Experimental	14	209.000	14.928	78.000	-.651	.515
	Control	13	169.000	13.000			
The CTSPI Pre-test	Experimental	14	209.500	14.964	77.500	-.656	.512
	Control	13	168.500	12.961			

*p<.05

Table 6. The Mann-Whitney U test findings related to the post-test scores from the CTSPI and its sub-dimensions

Measurement Tools	Groups	N	Sum of Ranks	Mean Rank	U	z	p
The Philosophical Inquiry Sub-Dimension Pre-test	Experimental	14	260.000	18.571	27.000	-3.135	.001*
	Control	13	118.000	9.076			
Cognitive Skills Sub-dimension Pre-test and Post-test	Experimental	14	267.000	19.071	27.000	-3.510	.000*
	Control	13	111.000	8.538			
Inquiry, Question Formation Skills Sub-dimensions Pre-test	Experimental	14	237.500	16.964	49.500	-2.117	.034*
	Control	13	140.500	10.807			
The CTSPI Pre-test	Experimental	14	284.500	20.321	2.500	-4.302	.000*
	Control	13	93.500	7.192			

*p<.05

Table 6 reveals that there is a statistically significant difference (p<.05) between the post-test scores of the students in the experimental and control groups in the CTSPI and its sub-dimensions (philosophical inquiry, cognitive, and question-formation skills). Accordingly, it can be stated that the students in the experimental group improved their philosophical inquiry, cognitive, and question-formation skills, and thus their critical thinking skills, significantly more than the students in the control group.

Table 7. Findings regarding the levels of the study groups according to the pre-test and post-test average scores in the CTSPI and its sub-dimensions

Groups	Philosophical Inquiry			Language and Cognitive Skills			Question Formation			The CTSPI Total Score		
	Mean	Value	Criteria	Mean	Value	Criteria	Mean	Value	Criteria	Mean	Value	Criteria
Exp. Pre-test	61.3	M		60.4	M		18.7	M		140.5	M	
Post-test	78.2	H	L:18-36	72.9	H	L:15-30	21.5	H	L:5-10	172.9	H	L:38-76
Cont. Pre-test	58.8	M	M:37-72	56.6	M	M:31-60	17.3	M	M:11-20	132.7	M	M:77-152
Post-test	65.3	M	H:73-90	58.8	M	H:61-75	19.1	M	H:21-25	142.5	H	H:153-190

L: Low level, M: Moderate level, H: High level

Due to the nature of the CTSPI, it offers the opportunity to rate the participants at 3 levels (low, moderate, high) according to the average scores obtained from the measurement tool and its sub-dimensions. Table 7 created using this feature of the measurement tool reveals that the experimental group's pre-test average scores are at M (medium) level, and the post-test average scores are at H



(high) level. On the other hand, it is seen that the pre-test and post-test average scores of the control group are both at M (moderate) level. In this context, although the level of the experimental group in terms of critical thinking and skills in the sub-dimensions increased after the implementation, the aforementioned skills of the control group remained at approximately the same level.

Table 8. Paired-sample t-test findings on the POE observation form of the control group pre-post-test scores

Groups	Measurement	N	Mean	Std.Dev.	df	t	p	d
Control	Prediction Pre-test	13	4.31	1.797	12	1.889	.083	.523
	Prediction Post-test	13	5.08	1.285				
	Observation Pre-test	13	5.38	2.631	12	.618	.548	.171
	Observation Post-test	13	5.05	1.121				
	Explanation Pre-test	13	4.15	2.230	12	.780	.451	.125
	Explanation Post-test	13	4.59	.818				
	The POE Pre-test	13	13.85	3.955	12	1.036	.321	.086
	The POE Post-test	13	14.72	1.677				

d: Effect size, $p < .05$

Table 8 reveals that there is no statistically significant difference between the pre-test and post-test scores of the students in the control group ($p > .05$), and the effect size of the differentiation is very low ($d = .086 - .523$) (Green, Salkind, & Akey, 2005). In this context, it is observed that the POE and skills of the control group students in the sub-dimensions did not show a statistically significant improvement before and after the implementation.

Table 9. Paired-sample t-test findings on the POE observation form of the experimental group pre-post-test scores

Groups	Measurement	N	Mean	Std.Dev.	df	t	p	d
Experimental	Prediction Pre-test	14	4.71	2.301	13	6.810	.000	1.625
	Prediction Post-test	14	7.31	1.136				
	Observation Pre-test	14	5.43	2.533	13	3.820	.002	1.021
	Observation Post-test	14	7.57	.800				
	Explanation Pre-test	14	3.86	2.282	13	4.193	.001	1.120
	Explanation Post-test	14	6.17	1.115				
	The POE Pre-test	14	14.00	4.772	13	6.914	.000	1.848
	The POE Post-test	14	21.05	1.563				

d: Effect size, $p < .05$

Table 9 reveals that experimental group students' pre-test and post-test scores of the POE and its sub-dimensions (prediction, observation, and explanation) have a significant difference ($p < .05$), and this difference is positive in favor of the post-tests. On the other hand, it is seen that the effect size of this differentiation ($d = 1.021 - 1.848$) is high. This may be due to the effect of the POE on the prediction, observation, explanation, and POE skills of the experimental group students.

The results of the statistical operations performed on the scores obtained by the study groups before and after the implementation from the POE observation form and its sub-dimensions are presented below. The Levene test, which is prerequisite for the MANOVA, was conducted for the POE pre-test scores of the study groups, and as a result of the analysis, it was understood that the POE form and its sub-dimensions of the groups provided the homogeneity of the variances, which is prerequisite for the MANOVA, ($p > .05$).

Table 10. Findings obtained from the MANOVA regarding the POE form pre-test scores

Effect	Wilks λ	F	Hypothesis Sd	Error Sd	p	η^2
Group	.983	.127	3.000	23.00	.943	.16

$p < .05$, Effect: Wilks' Lambda



The findings for the hypothesis test presented in Table 10 reveal that there is no significant difference between the groups (Wilks λ =.983, p =.943). Accordingly, the POE form of the groups is equal in terms of pre-test scores and the H_0 hypothesis is valid.

Table 11 reveals that there is no significant difference between the scores of the groups obtained from the POE form and its sub-dimensions before the implementation (p =.615 -.965) and the effective value of the grouping process (η^2 =.000 -.005) is very low. Accordingly, it can be stated that the students in the experimental and control groups are equal in terms of the features examined in the POE form and its sub-dimensions before the implementation.

Table 11. Findings obtained from the MANOVA regarding the pre-test scores of the groups on the POE form

Dependent Variable-Source	Mean	Sum of Squares	df	Mean Square	F	p	η^2
Prediction Pre-test	Experimental	4.71	1	1.114	.259	.615	.010
	Control	4.31					
Observation Pre-test	Experimental	5.43	1	.013	.002	.965	.000
	Control	5.38					
Explanation Pre-test	Experimental	3.86	1	.593	.116	.736	.005
	Control	4.15					
The POE Pre-test	Experimental	14.00	1	.016	.008	.928	.000
	Control	13.85					

The Levene test, which is a prerequisite for the MANOVA test, was performed on the post-test scores obtained from the POE form and its sub-dimensions, as in the POE Pre-test scores, and it was understood that the POE post-test scores of the study groups provided the homogeneity of the variances (p >.05).

Table 12. Findings obtained from the MANOVA regarding the POE form post-test scores

Effect	Wilks λ	F	Hypothesis Sd	Error Sd	p	η^2
Group	.192	32.259	3.000	23.00	.000	.808

p <.05, Effect: Wilks' Lambda

The findings presented in Table 12 reveals that the hypothesis test for the post-test scores of the POE form and its sub-dimensions of the study groups show a significant difference (p =.000) and the effect size of the difference is high (η^2 =.808). Accordingly, it is understood that the groups are not equal in terms of their post-test scores. The results of the MANOVA conducted to determine the level of differentiation in the post-test scores of the groups are presented in Table 13.

Table 13. Findings obtained from the MANOVA regarding the post-test scores of the groups obtained from the POE form

Dependent Variable	Source	Mean	df	Mean Square	F	p	η^2
Prediction Pos-test	Experimental	7.310	1	33.599	22.962	.000	.479
	Control	5.077					
Observation Post-test	Experimental	7.571	1	42.811	45.750	.000	.647
	Control	5.051					
Explanation Post-test	Experimental	6.167	1	16.762	17.316	.000	.409
	Control	4.590					
The POE Post-test	Experimental	21.048	1	270.066	103.095	.000	.805
	Control	14.718					

The findings related to the POE form post-test scores of the study groups in Table 13 reveals that there is a significant difference between the post-test scores of the POE and its sub-dimensions of the study groups (p =.000 for all sub-dimensions) and the effective value of differentiation is high for all sub-dimensions (η^2 =.409 - .805). The post-test average scores of the groups from the sub-dimensions reveal that in all sub-dimensions, the experimental group post-test average scores (Mean=7.310, 7.571,



6.167, 21.048) are higher than the control group post-test average scores (Mean=5.077, 5.051, 4.590, 14.718). In this context, it is understood that the significant difference between the groups with a high effective value, is in favor of the experimental group.

During the implementation process (from the 1st to the 6th implementation), the scores of prediction, observation, and explanation skills obtained from the POE form obtained by the students in the study groups were transferred to the graphs to examine the development of the students' skills throughout the process.

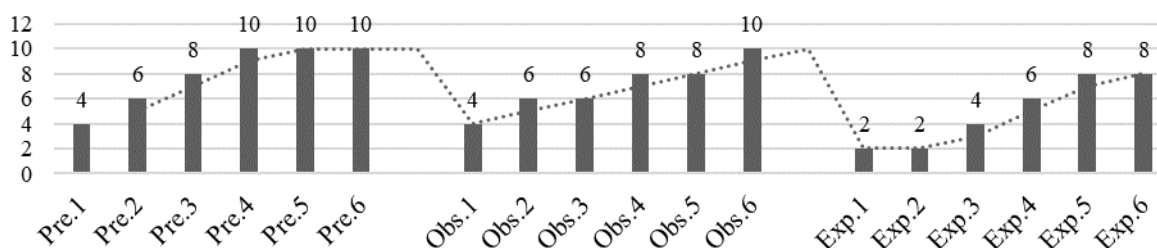


Figure 3. Column chart showing the change of experimental group students' average POE scores throughout the implementation process

The chart in Figure 3 highlights that the scores of prediction and observation skills of the students in the experimental group were at an acceptable level ($\bar{x}=4$) at the beginning of the implementation, increased linearly throughout the implementation, and increased to a very good level ($\bar{x}=10$) at the end of the implementation. Similarly, it is understood that the explanation skill scores of the students in this group were low ($\bar{x}=2$) at the beginning of the implementation, increased linearly throughout the implementation, and increased to a good level ($\bar{x}=8$) at the end of the implementation. On the other hand, considering the classification made in scientific process skills, POE skills can be listed from simple to advance as prediction<observation<explanation. In this context, the data in the chart reveal that students' basic skills such as prediction and observation were relatively higher at the beginning of the implementation, the improvement throughout the implementation was at a higher level, and higher-order skills such as explanation increased linearly like other skills at the beginning of the implementation but did not increase to a very good level.

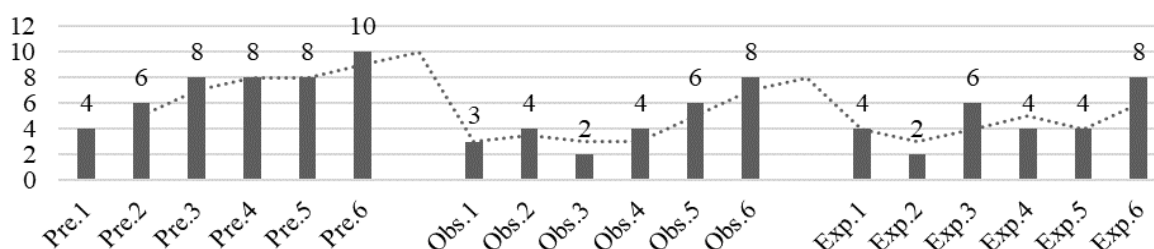


Figure 4. Column chart showing the change of control group students' average POE scores throughout the implementation process

The chart in Figure 4 includes the average scores of the students in the control group regarding the prediction, observation, and explanation skills obtained from the POE form throughout the implementation. The chart reveals that at the beginning of the implementation, the average scores of the control group students' ability to make predictions were at an acceptable level ($\bar{x}=4$) and increased to a very good level with a linear increase during the application process. Similarly, the average scores of the observation skills of the students were at an acceptable level ($\bar{x}=3$), increased relatively linearly throughout the implementation, and increased to a good level ($\bar{x}=8$) at the end of the implementation. On the other hand, it can be said that the average scores of the students' explanation skills were at an



acceptable level ($\bar{x}=3$) at the beginning of the implementation with a fluctuating increase throughout the implementation and increased to a good level ($\bar{x}=8$) at the end of the implementation.

Considering the change in average scores of these skills, one may notice that as the level of development of skills increases (prediction<observation<explanation), the increase in average scores slows down and the linear increasing trend deteriorates.

The findings obtained from the interviews with 2 teachers and 1 science expert who participated in the experimental group as observers are presented below.

The teachers as external observers responded to the question below as follows:

Q₁: “Did you find the method effective? Why?”

T₁: “I find the method effective enough to be used not only for science subjects but also for all subjects, for example, teaching traffic rules on a social issue or teaching daily maintenance skills. In other words, while teaching traffic rules, traffic rules can be taught by showing the accidents and using the POE. Furthermore, the importance of washing hands before and after meals can be taught. I also prepare and use the method based on games.”

T₂: “The method is really effective. The attention of the students was slightly less distracted than before. While we make it based on a game, they often get out of the game in a very short time. However, they focused their attention much longer in the experiments. At first, they saw it as a game, and then as they discovered, they attended events more interested, especially to get their predictions right. They responded with excitement and enthusiasm while making explanations. Only those who predicted wrong got a little upset. It is much more effective and instructive than gamification. They continued to talk to each other after we left anyway. I observed such things. So I found it effective. It also suits their levels. It just took more time, that’s all.”

Q₂: “Would you like to use the method later? Why?”

T₁: “I definitely use it because the method can also be used as a game. Seeing that children make such explanations, defend their own ideas, make their observations, or predictions such as “I saw it this way, it should be like this, I predicted it correctly” shows that they really gained scientific skills. At first, I was skeptical, but especially after the second experiment, I saw the difference. At the end of the activities like games, they never talked about the subject and care about different things before, but they were influenced by these, and then they continued to talk.”

T₂: “I will use it, though not very often because it is necessary to prepare content and so on. But the method is really effective and useful. I use myself.”

The statements given by the teachers regarding the interview questions reveal that they find the POE effective and useful and more efficient than gamification in ensuring that students focus and develop scientific skills, adding that the POE can be used effectively in fields other than science.

The science expert who participated in the study as an external observer in the experimental group answered the questions as follows.

Q₁: “Did you find the method suitable for the level of the students?”

“The method is fitted for the levels of the students, but the guide or implementer should manage the process well as kids can get bored. However, they hardly ever got bored and distracted for 6 weeks throughout the implementation. Especially after the second experiment, they adapted better. Later on, they made much better predictions, observations, and explanations. Their prediction skills and their ability to express sentences improved noticeably throughout the process. I saw 4 students repeat themselves several times not to forget their observations. It could have been much more successful with fewer students, for instance, 5-6 students would be enough. But POE skills improved significantly over the period. Especially in the 5th and 6th experiments, they explained topics very well. They more often used such things as “I saw that, so that should be the answer, etc.” The effects of the method should be tested outside of science subjects, that is, social issues such as basic development skills. That is all I will say.”

Q₂: “Did you find the content created by the science teacher suitable for the level of the students?”

“The experiments were well-selected. At first, I thought that the experiments were successful because they were good and I asked the teachers if they were doing experiments. I saw the experiments they had done. Earlier experiments sounded more interesting, these were little more scientific. But when you use the method in this way, I mean, step by step the contents were quite suitable. After the 4th experiment, 15 minutes after the implementation was completed, I asked the children about the experiment. I got very positive answers. One of the teachers said they started acting in games just like they did in experiments. They used expressions such as “this is because”, or “because of that”. I think it is necessary to adjust the level well while preparing the content.”

Considering the responses of the science expert to the questions, one may notice that s/he considers the POE as a method that can be used by students at this level, increases their attention, and can be effective in the development of POE skills. On the other hand, it is also understood that s/he is of the opinion that in the implementation of the method, the teacher should have the ability to use the method



effectively, and that the contents were suitable for the levels of the students and more remarkable than gamification with the POE.

The interpretation of the findings obtained from the research, comparison with the literature, and the results obtained are discussed next.

DISCUSSION and CONCLUSION

In addition to basic skills such as self-care and speaking, higher-order skills such as inquiry, critical thinking, scientific thinking, and scientific process develop in individuals in early childhood (Jacobson & Bergman, 1980). In this context, it can be said that teaching methods that will enable the development of high-level skills of students should be used in pre-school education. This study was designed to determine the effect of the POE on students' critical thinking and POE skills in early childhood, and important findings were obtained.

The findings of the study reveal that the experiments conducted using the POE are more effective in the development of all skills of the students in the CTSPI and its sub-dimensions than gamification, and the skills that are initially at the intermediate level have been developed to a higher level. It was observed in the implementation process that students did not sufficiently inquire about the content offered to them and did not focus on problem situations as they perceive activities of gamification as a game. The students were better-focused through the POE while watching the videos that reflect the problem situation. It is also thought that students had an increased tendency of inquiry and critical approach when they were told that the questions asked by the teacher to recognize the problem situation before the prediction process would be recorded and compared with the result to be achieved at the end of the process. Similarly, during the observation process (the stage of experiments), the experiments carried out under the guidance of the researcher along with guiding and thought-provoking questions during the process contributed to the students' critical approach to the subject throughout the process.

On the other hand, although gamification is not effective in the linguistic-cognitive skills of the students, the POE is highly effective in these skills (Table 6). It is believed that this is because students were asked to make explanations based on the observation process during the explanation process, which is the last stage of the POE, and guided with questions that would allow them to discuss their observations. Similar results were obtained in the study that focused on the effect of the philosophical teaching program conducted in 2018 on the CTSPI in early childhood by Karadağ & Demirtaş, who reached the conclusion that the philosophical teaching program in early childhood affects the development of the students' skills in CTSPI and its sub-dimensions.

Another remarkable finding is that the POE-based implementations are more effective in the development of the students' prediction, observation, and explanation skills than gamification and that gamification does not significantly affect the development of the students' prediction, observation, and explanation skills, whereas the POE has a high degree of effect on students' prediction, observation, and explanation skills while also improving these skills to a very good level. On the other hand, it is understood that the POE creates a linear continuous increase in the development of these skills while gamification has a fluctuating (decreasing-increasing) effect on the development of these skills.

The POE was observed to allow for a better and effective implementation of prediction, observation, and explanation, to motivate students to make predictions, observations, and explanations, and to allow guiding these stages with scientific questions. It can be argued that the POE has both a linear and stable contribution to the development of the aforementioned skills, and its high effective value is due to the above-mentioned issues. On the other hand, the students perceive the activities of gamification only as entertainment and therefore fail to make the best use of the process efficiently. The low level and indefinite change in gamification are also due to the above-mentioned issues. The findings of the study by Hsu et al. (2011) on pre-school students support the findings of this study, and



researchers report that POE implementations supported by computer games increased students' conceptual understanding of the concept of shadow.

Teachers participating in the study as external observers are experienced educators, who have a seniority of 10 years, have taken care of the students in the study group for 2 years, and thus get to know the students closely. External observers stated that apart from being interesting and motivating in these age groups; the POE can be used in transferring socio-scientific issues other than science. It is believed that the motivation of the students is enhanced if proper management of what/why/how questions through the POE is ensured, if small rewards are given where their predictions are correct, and if students are encouraged to discuss during the explanation process. On the other hand, the teachers also point out that the presentation of socio-scientific issues with gamification does not have enough effect since students perceive the process as a game and cannot reflect such information in reality. Yet, the POE allows students to observe the events in the context of cause-effect relationships and to explain them with their own expressions through mental processing, thus, leading teachers to think that the POE would be more effective in understanding socio-scientific issues.

It can be concluded that POE-based activities are more effective than gamification (traditional practices) in the development of the students' higher-order skills such as critical thinking and the POE in early childhood and that the POE not only improves basic scientific skills and critical thinking skills and students' speaking and discussion skills in these age groups but also helps attract the attention of the students during lesson and motivates them. On the other hand, it is understood that the teachers see the POE as an effective method that can be used not only in science but also in teaching socio-scientific subjects. Finally, according to the science experts, the POE is suitable for the levels of the students in this age group, and knowing the features of the method and proper management may facilitate revealing the superior aspects of the method.

Based on the findings, the following recommendations may be suggested:

Pre-school teachers can use the POE while teaching scientific and socio-scientific subjects and employ the POE more in pre-school education programs. Research on the effects of the POE on the teaching processes carried out with large groups and to determine the effect of the POE on students' different skills (analytical thinking, reasoning, scientific discussion, etc.) in early childhood is likely to make significant contributions to the literature.

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