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Supervision Beliefs in Cooperating Teacher-University Supervisor Dyad: Implications for Reflective Dialogue to Strengthen Partnership

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Abstract

In most teacher education programmes, school-faculty partnerships provide a vital opportunity for student teachers to learn about teaching. This partnership, however, is undermined by the lack of collaboration between cooperating teachers and university supervisors who are paired up in a student teaching triad to help student teachers improve their teaching skills. One way to resolve this lack of collaboration is to understand the supervision beliefs of cooperating teachers and supervisors as it has been reported in literature that both triad members act upon their personal beliefs of how to supervise student teachers. Therefore, drawing on the Personal Construct Theory, this case study aims at exploring the personal theories of a supervisor and a cooperating teacher in relation to effective supervision. The data was collected through the repertory grid technique and analysed on a REP Plus computer software program, which was subsequently followed by semi-structured interviews. The results revealed both shared and idiosyncratic personal theories of the university supervisor and the cooperating teacher and suggest the need for reflective dialogue and joint communication between dyad members over these beliefs to sustain a collaborative school-university partnership.

Keywords: Teacher education, school-university partnership, cooperating teacher, university supervisor

Uygulama Öğretmeni-Uygulama Öğretim Elemanı İkilisinde Danışmanlık İnançları: İşbirliğini Geliştirmek için Yansıtıcı Diyalog Önerisi

Öz

Birçok öğretmen eğitimi programında yer alan okul-fakülte işbirlikleri, öğretmen adaylarına meslekleriyle ilgili kendilerini geliştirmeleri anlamında önemli fırsatlar sunmaktadır. Ancak bu işbirlikleri, öğretmen adaylarının becerilerini geliştirmek için öğretmen adayı ile bir araya gelerek bir üçlü oluşturan uygulama öğretmeni ve uygulama öğretim elemanının arasındaki işbirliğinin eksik olması durumunda çoğunlukla istenen hedefe ulaşamamaktadır. Öğretmen adaylarına danışmanlık sunan uygulama öğretmenleri ve uygulama öğretim elemanlarının kişisel inançlarını bağlamında görevlerini yerine getirdikleri alan yazında belirtildiğinden, eksik olan bu işbirliğini iyileştirmenin bir yolu da uygulama öğretmeni ve uygulama öğretim elemanının etkili danışmanlığa ilişkin kişisel inançlarını araştırmaktır. Bu nedenle, bu vaka çalışması, Kişisel Yapı Kuramı çerçevesinde, bir uygulama öğretmeni ve bir uygulama öğretim elemanının etkili danışmanlığa ilişkin kişisel teorilerini araştırmayı amaçlamıştır. Çalışmanın verileri repertuar çizelgesi tekniği ile toplanmış ve REP Plus adlı bilgisayar programında analiz edilmiştir. Analizler takip röportajlarıyla desteklenmiştir. Çalışmanın sonuçları uygulama öğretmeni ve uygulama öğretim elemanının ortak ve farklı inançlarını ortaya koymuş ve bu inançlar doğrultusunda uygulanacak olan yansıtıcı diyalogları ve ikili iletişimi, okul-fakülte işbirliğinin gerçek anlamda işbirlikçi olarak uygulanması açısından önermiştir.

Anahtar kelimeler: Öğretmen eğitimi, okul-fakülte işbirliği, uygulama öğretmeni, uygulama öğretim elemanı

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1 | Introduction

Field/clinical experiences where student teachers gain practical knowledge from their teaching experiences in classrooms and relate this practical knowledge with the theories of teaching are present in most of the teacher education programs around the world (Butler & Cuenca, 2012; Darling-Hammond, 2006). These experiences are crucial for student teachers before they immerse themselves into the complex realities of classroom teaching. During these field experiences, a University-based Supervisor (US), a school-based Cooperating Teacher (CT), and a student teacher are teamed in a purposeful triadic discourse to maintain an effective teacher education in the clinical contexts. In this discourse, the positioning, roles, and responsibilities of the USs and the CTs are determined by the nature of school-university partnerships situated in the teacher education programs. However, it is widely acknowledged that the dyadic relationship between USs and CTs is idiosyncratic, and they bring their own beliefs, perceptions, and values, and act on them during field experiences (Bates, Drits & Ramirez, 2011; Butler & Cuenca, 2012; Bullough Jr & Draper, 2004).

To provide clinical experiences to student teachers, many teacher education programs engage in school-faculty partnerships. Although the purpose of these partnerships is fairly the same across contexts, Furlong (1996) defines three different models of partnership that represent varying positions on the universities and the schools and ultimately on the USs and CTs. The first one is the *collaborative partnership* in which "the commitment to develop a training programme where students are exposed to different forms of educational knowledge, some of which come from school, some of which come from HE [Higher Education] or elsewhere" is essential (p.44). In this form of partnership, both CTs and USs are regarded as equally legitimate, and ongoing collaboration is required to plan coursework for student teachers, which integrates both theoretical and practical knowledge. The second model is the *higher education institution-led (HEI-led) partnership* which is regulated by the tutors at the university who use schools as sites for creating learning opportunities for student teachers. In this model, there is an authority of the universities so that the role of the schools and the CTs is only delivering the learning opportunities that are determined by the higher institution. The final model is the *separatist partnership* where school and university "are seen as having separate and complementary responsibilities but where there is no systematic attempt to bring these two dimensions into dialogue" (p.47). The responsibilities of CTs and USs in this model are distinctive, and they are considered to be a part of separate knowledge domain without an opportunity to dialogue.

The collaborative partnership model seems to align well with the changes in the epistemology of preservice teacher training in which practical and theoretical knowledge receive equivalent respect other than the historically dominant view of universities as the main source of the teaching knowledge (Zeichner, 2010). However, there are numerous studies related to the field experiences in preservice teacher education that have reported the lack of connection and collaboration between university and school as the most prevalent problem (e.g., Borko & Mayfield, 1995; Slick, 1998).

The research up to date has documented various reasons of the disconnection between university and school reflected in the form a distant relationship between CTs and USs. One reason that seems to undermine this connection is the traditional conception of USs and CTs as representatives of two different knowledge domains. As represented by Furlong's *separatist partnership* model, CTs are often conceived as experienced classroom teachers (in most cases) who are responsible for sharing practical knowledge of daily-basis teaching while USs are distinctively considered as the source theoretical knowledge of teaching (Clarke, Triggs & Nielsen, 2014; Zeichner, 2010). The traditional authoritative perception of the theoretical/academic knowledge from USs also creates a hierarchical positioning within the student teaching triad, which builds power relations leading to a lack of effective communication and connection between CTs and USs (Bullough & Draper, 2004; Slick, 1997). One other factor that tends to complicate this dual relationship is the ambiguous role definitions of the triad members or unspecified roles leaving triad members to struggle in defining and negotiating their responsibilities within the triad they involve in (Beck & Kosnik, 2002; Slick, 1997). In those cases, both USs and CTs tend to negotiate their roles by

avoiding any conflicts with each other and with student teachers as a result of their desire for comfort and fewer risks during student teaching (Borko & Mayfield, 1995). This desire often results in minimum communication among members and less integration of knowledge that USs and CTs bring into the practicum to support the development of the student teachers.

Another reason that seems to deepen this separation is the differences in beliefs of CTs and USs about how student teachers learn to teach in the classroom context. From a cognitivist perspective, the beliefs held by CTs and USs about effective supervision during student teaching influence their thinking, their interpretation of the events, and their actions in the supervisory context of the student teaching triad (Bates et al., 2011). If there is a mismatch between these beliefs, conflict is expected to arise, breaking down the student teaching triad. To illustrate, Bullough Jr and Draper (2004), in their case study, described a failed relationship in a student teaching triad resulting from the unshared beliefs of a CT and a US in how student teachers learn to teach during field experience. In their study, the conflicting demands from the CT and the US frustrated the student teacher and the triadic relationship unsuccessfully turned into a dyadic one between the student teacher and the CT.

It has been recognised that CTs and USs have necessarily undertaken different roles in the student teaching triad, and their interpretation of their roles will be determined by their idiosyncratic assumptions, beliefs, and perceptions of how to supervise student teachers. However, to sustain a collegial and collaborative school-university partnership, Bullough Jr et al. (2004) suggest the necessity to create a community sense of partnering by "valuing the different but equally valuable input provided by all participants" (p.514). Therefore, to improve the quality of field experiences and teacher education for student-teachers, the authors suggest a need for building a shared community culture of supervision of which boundaries and role definitions are negotiated for and by members involving in the community of partnership (Bullough Jr et al., 2004).

School-Faculty Partnership in Turkey

In Turkey, the institution coordinating teacher education programs is the Council of Higher Education (CoHE). Since 1998 when the education faculties started to follow a standardised teacher education curriculum, field experience has been situated in a school-university partnership where student teachers have an opportunity to learn the practical side of teaching in the school sites while linking their experiences with the theory (Kiraz & Yildirim, 2007).

In particular to the school-faculty partnership practice in Turkey, there have also been problems related to the roles, responsibilities, and practices of CTs and USs, which has been well-documented in several local studies. Emerged from the review of these studies, the central themes are the unsatisfactory and inadequate mentoring and supervisory practices of CTs (Boz & Boz, 2006; Haciomeroglu, 2013; Kiraz, 2003; Paker, 2000) the lack of certainty in CTs' roles as mentors and supervisors (Akcan & Tatar, 2010; Koc, 2012; Rakicioglu-Soylemez & Eroz-Tuga,2014), CTs' lack of knowledge about how to supervise student teachers to address the needs of the student teachers (Altan & Saglamel, 2015; Kiraz & Yildirim, 2007), and the lack of collegiality and collaboration of CTs with USs (Boz & Boz, 2006; Gursoy & Damar, 2011; Mutlu, 2014; Yayli, 2008). On the other hand, other studies revealed that USs had infrequent visits to practice schools due to their busy schedule full of teaching and research, and their distant relationship with CTs as a result of tensions related to power status in the student teaching triad, which inevitably reduces the impact of USs on the development of student teachers (Aydin, 2009; Eraslan, 2008; Paker, 2008).

Addressing the above-mentioned problems in field experiences, in particular to the disconnection of schools and universities, the conduct of field experiences in Turkey has undergone a recent reform following an update in the curriculum of teacher education in 2018. These changes that have been stated in a circular regulated by the CoHE and the Ministry of National Education (MoNE) which monitors national public and private schools of primary, elementary and secondary education implies significant changes in

the principals of field experiences. Some of them involve the necessity for CTs to involve in mentor training programmes, more intensive cooperation between CTs and USs, and equal rights to CTs and USs to assess and evaluate the development of student-teachers. In parallel to those principals, the roles of both USs and CTs are redefined with relatively more emphasis on collegially and cooperation between these two parties. According to their definitions of roles, the USs, for example, are asked *to regularly follow up on the works of student teachers with cooperating teacher, to provide detailed feedback to the student teacher with the cooperating teacher right after the teaching practice*, etc (MoNE, 2018). The CTs, on the other hand, are expected to collaborate with USs in the following role descriptions: *to give advises to student teachers on their teaching practice work by collaborating with university supervisor and teaching practice school coordinator, to assess the process of the student teacher's teaching practice with the university supervisor for minimum four times in a term* (MoNE, 2018).

As a result of this recent reform, it is conceivable that the partnering between schools and universities is aimed at being enhanced for effective teacher education; however, as McIntye et al (1996, as cited in Slick, 1998) stated "without commitment to implementation, written agreement will not improve student teaching" (pp. 823-824). As important agents of the implementation of the collaborative school-faculty partnership, no matter how their role is described in the handbooks or circulars, CTs and USs enact their idiosyncratic beliefs about how to provide effective supervision. To sustain collaborative school-faculty partnership, it is essential to understand these two parties' effective supervision beliefs. This kind of information is important to get insights about the problems in school-faculty partnership from a different perspective, to help to build a richer environment of reflective practice for researchers and practitioners (Yayli, 2008, p.898), and as a result of such reflection, to help CTs and USs to negotiate their roles and responsibilities to create a community of practice sharing an aim of improving student-teacher development. Therefore, drawing on the Personal Construct Theory of Kelly (1955), this study aims to identify a US's and a CT's personal theories that underlie their supervisory practice. The study addresses the following research question:

What is the nature of the effective supervision beliefs of a university supervisor and a cooperating teacher who are teamed in the same dyad of field experience?

Theoretical Framework: Personal Construct Theory

The beliefs or personal theories that of the trainers in the student teaching triad hold about effective supervision are the central focus of this study. However, it is acknowledged that these personal theories are not constant, but they are dynamically constructed by the individuals over time with experience and by the social and cultural interactions in which the individuals involve. In addition to the recognised influential role of prior beliefs constructed through "*apprenticeship of observation*" (Lortie, 1975) as being supervised as a teacher candidate, the social context of student teaching, the dynamics in student teaching triad, and the culture of the supervision seem to affect CTs' and USs' supervisory practices.

Therefore, framed within the constructivist perspective, this study draws on Kelly's Personal Construct Theory which considers people as "personal scientists" who develop their own personal theories to interpret the world, predict the future events, and guide their behaviours and actions (Kelly, 1955). According to the theory, the development of the personal theories, or personal constructs, is an on-going and reflective process in which people, as scientists, continuously test their constructs and validate or revise them based on their experiences. In validating their personal constructs, people search for similarities in repeated events "which at the same time differentiate them from other events" (Winter, 1994, p.4). Therefore, in the Personal Construct Theory, each construct is considered bi-polar, and people's interpretation of the world depends on the range of the convenience between the two poles of each construct. Moreover, the personal constructs are not distinct entities, but they are arranged in "a construction system embracing ordinal relationships between constructs" (Kelly, 1970, p.11). So, the

anticipation of the events and individual behaviours do not base on a single personal construct, but the relationships between personal constructs organised in a hierarchal system of construction.

Although the present study focuses on the personal theories of a CT and a US captured at a single time, it is well recognised that the development and organisation of their personal theories in their construct system have taken time and "are subject to revision and or replacement" (Kelly, 2017, p.15). In addition, the individuality of participants and the construction of their idiosyncratic personal theories are acknowledged.

2 | Method

Research Design

This study has a case study design. The case study design is considered to be the most appropriate design for such an inquiry that focuses on discovering the meaning that a CT and a US in a dyadic relationship held about effective student teacher supervision. Merriam (2009) defines the case study is "an in-depth description and analysis of a bounded system" (p.40). In this study, the bounded-system, or the case, is identified as a student teaching dyad involved by a CT and a US who are paired up to supervise the same cohort of student-teachers. As the dyad is composed by the participation of two members, a CT and a US, who are categorically bound together in the dyad by sharing the fairly same role of nurturing student teacher development, the type of this case study is determined as multicase study including two units of analysis (Merriam, 2009). In other words, while the main unit of analysis is a CT-US dyad, the embedded subunits to be interpreted in the study are the individual CT and the individual US (Yin, 2003).

Participants

A US, who is called Dr. M throughout the study, was one of the participants of the study. At the time of the study, Dr. M was a teaching professor at the English Language Teaching (ELT) department at the faculty of education. Dr. M had her Ph.D. degree in the field of English language teaching and had often been teaching methodology courses at the program. She was an experienced US having worked with student teachers in the school sites for more than 10 years. The other participant is a CT, called Mrs. B, was a graduate of an ELT department and worked as an English language teacher at one of the state elementary schools which was picked out as a practice school for student teachers. She had 16 years of experience as an English language teacher at various state schools in Turkey. She had experiences of mentoring ELT student teachers before in the context of the current school she was working in. Both Dr. M and Mrs. B had gone through a dyadic relationship for supervising four ELT student teachers who were paired to involve in practicum studies. It should be noted that Dr. M and Mrs. B had had experiences of working together as they had been in the same student teaching dyad before. Other than the previous and current dyadic relationships, they reported not having any social and professional contact with each other.

Data Collection Tools

The main data collection tool utilised in this study is the repertory grids. Grounded in the Personal Construct Theory, the repertory grid technique is considered as a conversational method for exploring the personal construct system of participants. In eliciting the participants' personal constructs about effective student teacher supervision in this case study, Dr. M and Mrs. B were asked to fill into a grid of constructs and formulise the relationships between their constructs during a structural conversation with the researcher (Fransella et al., 2004) (see Appendix for a sample repertory grid form). In order to give a clear picture of data collection or construct elicitation procedure, it is necessary to define how construct and element are defined in the repertory grid technique, and in the Personal Construct Theory. A construct is defined by Fransella et al. (2004) as discriminations that individuals "make between people, events and things in our lives" (p.18). For example, for the qualities of a good student, one teacher may state that a

good student is hardworking. In that case, the teacher discriminates a good student from other students in relation to his/her construct of being hardworking. However, as mentioned earlier, the constructs are not discrete units, rather, they are bipolar dimensions that have been created and formed into a construing system by each individual (Fransella et al., 2004; Winter, 1994). The teacher in the previous example may state, for instance, a good student is not lazy. So the bipolar construct attributed for a successful student has been construed by this teacher as a range of convenience between *hardworking* and *lazy*. Element, on the other hand, is defined by Kelly (1955) as "the things or events which are abstracted by a construct" (p.137), and it can be considered as "an example of, exemplar of, instance of, sampling of, or occurrence within, a particular topic" (Jankowicz, 2004, p.13). For the teacher mentioned above, a student who is represented by a good student is an element that might be employed as a stimulus to elicit the teacher's meaning relevant to the qualities of a good student. In this study, five elements were supplied by the participants during the process of construct elicitation, which is explained in the next section.

Data Collection

The repertory grids were completed by each participant during an individual structural conversation with the researcher. Before construct elicitation, the participants were first introduced with the Personal Construct Theory, repertory grids, and the construct elicitation procedure. In addition, the concept of "being a supervisor" is clearly defined to the participants for clarification as "a knowledgable individual who supports and nurtures student-teacher development as they gain real-life experiences during their practicum studies". Later, they were asked to identify five elements for the grid elicitation including "an effective supervisor" (ES), "a typical supervisor" (TS), "an ineffective supervisor" (IS), "self as a supervisor" (SELF) and "an ideal supervisor" (IDEAL). Following the element identification, triadic sorting procedure was employed to elicit bi-polar constructs regarding the effective supervisor qualities. This procedure involved presenting three of the elements to the participants and asking them to suggest one quality in which two of these elements were similar and one quality in which the third element was different (Cohen et al., 2007). For example, the participants were asked to consider the group of elements including ES, IDEAL, and TS, and asked to suggest a quality (which is a construct, in fact) in which ES and TS are similar and one quality in which IDEAL is different from them. These triadic comparisons were repeated until the participants could not offer any new construct. Then, the participants were asked to rate the distance of each one of the elements on either pole of each construct. The range of ratings used was a 5-point scale where 3 represents a neutral relationship, 5 represents the closest relationship to the construct on the right pole, and 1 represents the closest relationship to the construct elicited on the left pole. The overall data collection procedure had lasted more than an hour with each participant and the conversations were audio-recorded.

Data Analysis

The analysis of grids was carried on REP Plus computer software programme developed by Mildred Shaw and Brian Gaines in 2018. Among various analyses the programme offered, Focus cluster analysis was considered to be most suitable analysis for the gathered data as it sorts the data "to bring similar elements and similar constructs closer together, and also shows the hierarchical structure of similarities..." (Gaines & Shaw, 2018, p.63). Following the analysis of repertory grids, interviews were conducted to confirm the meanings of the constructs that had been elicited during structural conversations to complete repertory grid forms. The structure of the constructs was discussed to remove the researcher's any form of impositions on the interpretations of the meaning system of the participants, and to ensure the internal validity of the constructs in the participants' meaning system as well as the reliability of the data.

Research Ethics

The participants gave their full consent to join in this study. They were informed about the data collection and data analysis procedures, and they signed informed consent forms before their participation in the study. The identities of the participants also kept confidential throughout this research article.

3 | Findings

Focus Cluster Analysis of Dr. M's Repertory Grid

Dr. M supplied with 18 constructs on the grid related to the qualities of "an effective supervisor" as a result of her structural conversation with the researcher. The hierarchical relationship among these qualities in her understanding of effective student teacher supervision was analysed through Focus cluster analysis on the REP Plus programme. Figure 1 displays the Focus cluster plot produced for Dr. M's repertory grid data.

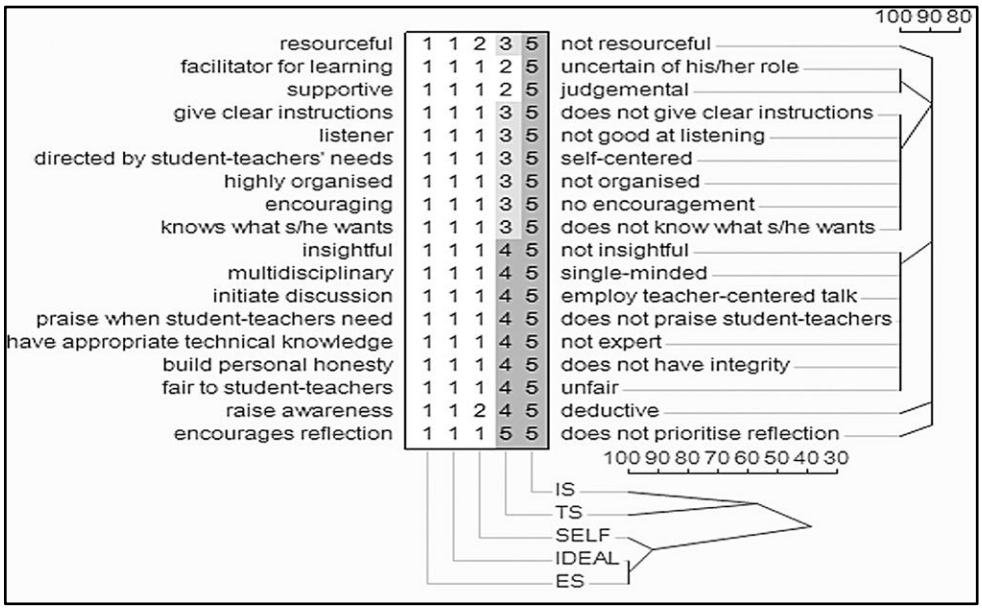

Figure 1. *Focus Cluster Plot of Dr. M's Repertory Grid*

The Focus cluster plot of Dr. M's repertory grid reveals one large cluster that includes substantially tight connection among her elicited constructs related to her understanding of effective student teacher supervision. As the construct dendrogram, the tree structure of the constructs on the right, displays there is an organisation of constructs at and above 88.8% similarity match. In particular, there are two clusters and one pair of constructs that include tightly matched constructs at 100% similarity match. In one of those clusters, Dr. M similarly rates on seven constructs and tends to consider them highly related to each other. These constructs are (Construct [C] 5) *insightful*, (C8) *multidisciplinary*, (C17) *initiate discussion*, (C10) *praise when student-teachers need*, (C12) *have appropriate technical knowledge*, (C13) *build personal honesty*, (C14) *fair to student-teachers*. During the follow-up discussion, Dr. M explained how she made the meaning of this tightly structured cluster. She stated:

> *[Student-teacher] supervision equally involves being an expert on teacher education to effectively nurture student teacher development and building a collegial relationship [with student teachers]. Therefore, besides professionally supporting their development with your expertise in teacher education by triggering discussions about their experiences and helping them to conceptualise their experiences with theoretical knowledge and technical language, you also need to build an effective interpersonal relationship by encouraging their effort, being honest about their development and fair in terms of their assessment.*

In another cluster, Dr. M has similar ratings on six constructs leading to a 100% similarity match on the tree structure of the Focus cluster analysis plot. The constructs within this cluster are (C18) *give clear instructions*, (C11) *listener*, (C7) *directed by student-teachers' needs*, (C6) *highly organised*, (C1) *encouraging*, (C4) *knows what s/he wants*. In follow-up interviews, the firm associations of the constructs within a construct were confirmed by Dr. M. She explained:

> *In fact, the whole process of student teaching should be organised according to needs [of the student teachers]. The needs of the student teachers should be well understood by carefully listening to them. Well, indeed, it may not be possible for all university tutors to work closely with student teachers due to their busy schedules, but I think a supervisor should be highly organised to effectively supervise student-teachers by determining the objectives of the whole process guided by the student teachers' needs and directing [student teachers] by giving clear instructions within the framework of those pre-specified objectives. Above all, student-teacher supervision is an important component of teacher education, so [university supervisors] should take it seriously!*

This cluster is collectively associated with another tightly matched pair of constructs. Matched at 100% similarity match, the constructs were (C2) facilitator *for learning*, and (C3) *supportive*. Dr. M elaborated on this match by highlighting the role of the supervisors.

> *The main role of a supervisor is to facilitate the learning of student teachers because, contrary to common belief, student teaching is not an endpoint of teacher training but a process of learning more about teaching. In doing so, an effective supervisor should support student teachers professionally.*

The other three constructs, namely (C9) *resourceful*, (C16) *raise awareness*, and (C18) *encourages reflection* seem to be isolated as they do not form either a pair or a cluster. However, the two clusters and one pair of constructs are associated with these three constructs at 88,8% similarity and form one large cluster. This means that Dr. M considered all the elicited constructs concerning effective student teacher supervision are highly related to each other.

The element dendrogram, on the other hand, shows that the prototypical representation of "ideal supervisor", and "effective supervisor" are closely associated with each other and with the representation of "self". This result implies that Dr. M considers herself as an effective supervisor and she left little room for further development in this regard.

Focus Cluster Analysis of Mrs. B's Repertory Grid

Mrs. B uttered 11 constructs related to the qualities of "an effective supervisor" during the data elicitation session. The hierarchical clustering of these constructs is provided by the Focus cluster analysis of which results are displayed on the Focus cluster plot in Figure 2.

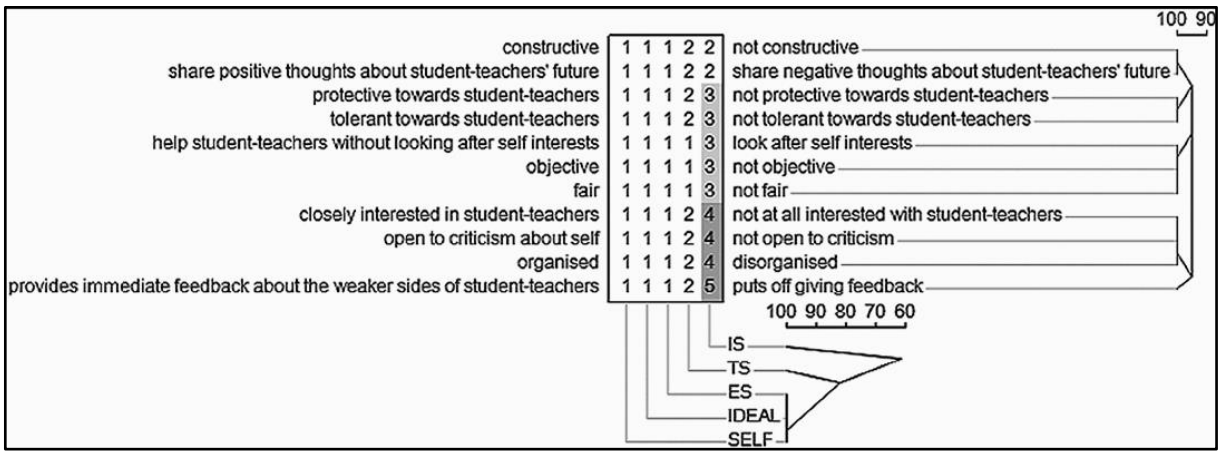

Figure 2. *Focus Cluster Plot of Mrs. B's Repertory Grid*

The Focus cluster plot of Mrs. B's personal constructs related to the qualities of effective student-teacher supervision produces a large cluster including all her elicited constructs related to each other at a 95% similarity match. Within this large cluster, there are two pairs of constructs and two clusters that include constructs tightly correlated with each other at 100% similarity match.

In one of those pairs, Mrs. B associated (C3) *constructive* and (C10) *share positive thoughts about student teachers' future* at 100% similarity which indicates that these two constructs are very close in her personal meaning. This close relationship implies how Mrs. B conceptualise being a constructive supervisor. That is, she did not mean to employ a constructive methodology to nurture student-teacher development but to support student teachers emotionally to motivate them for their future career. This is reported by Mrs. B during the interviews:

> *[An effective supervisor] should encourage student teachers by sharing positive sides of the profession, thoughts about how successful they are [in teaching], and how they will become successful teachers soon.*

Associated with these pairs, there is another pair of constructs involving (C5) *protective towards student teachers*, and (C6) *tolerant towards student teachers* which are closely related with each other at 100% similarity match. This association also implies how Mrs. B values the emotional support given to student teachers among the other qualities of an effective supervisor.

In another cluster, (C11) *help student-teachers without looking after self-interests*, (C2) *objective*, and (C3) *fair* are tightly associated at 100% similarity match. This association implies how Mrs. B thought about the personal characteristics of an effective supervisor. Therefore, Mrs. B considered an effective supervisor who is fair, objective, and helps student teachers without looking after self-interests. This idea was elaborated during interviews like:

> *There are no incentives given [by the Ministry] to supervise student-teachers. So, I observe some of my colleagues who do not like to accept [the supervisory duty]. When they had to do it, they do not care about being objective or fair in their evaluations. An effective supervisor should do what is required to do without looking after a personal interest.*

In the next cluster, three constructs are closely joined together at 100% similarity match. These constructs are (C9) *closely interested in student-teachers*, (C8) *open to criticism about self*, and (C1) *organised*. At 95% similarity, (C7) *provides immediate feedback about the weaker sides of student-teachers* is also associated with this cluster. This clustering of constructs suggests that Mrs. B cares about dealing with the needs of the student-teachers by providing them instant feedback, which requires being organised during the rush of school time.

In addition, the element dendrogram at the bottom of Figure 2 shows how the prototypical representation of the ideal supervisor, effective supervisor, and self as a supervisor are tightly associated at 100% similarity match. This element cluster suggests that Mrs. B perceives herself as an effective and ideal supervisor with leaving less or no room to change to her idea about self qualities as a supervisor.

4 | Discussion & Conclusion

This study is among a number of growing studies exploring the school-faculty partnership within the micro context of one particular student teaching triad, but uniquely involves the investigation of supervisory beliefs in a dyad of a US and a CT, which ultimately underlie their supervisory practices. The results revealed some overlapping beliefs of both participants regarding the qualities of an effective supervisor such as *being organised* as well as variations in their perceptions about how to effectively supervise student teachers. To illustrate, the university supervisor, Dr. M, tends to emphasise the student teaching process as a continuum where student teachers build on their theoretical background and appraise reflection to nurture their experiences during this process. She also prioritises the needs of student teachers and organising the process under the light of these needs to better qualify student teachers for their profession. The cooperating teacher, Mrs. B, on the other hand, tends to highlight the

personal characteristics of an effective supervisor, emphasise moral side of being a supervisor, and care and support provided for student teachers during the challenging student-teaching process.

The different beliefs held by the US and the CT in this particular study reflects the different positioning of two members of the triad. It might be concluded that while Dr. M would act as an academic counsellor to student teachers in this triad, Mrs. B would act as an emotional supporter (Butler & Cuenca, 2012) to provide student teachers a smooth transition to being a teacher. Traditionally, there had been a tendency to disregard those kind idiosyncrasies between supervisory beliefs within a triad, to value one of them over another, and blame one side of perspective as a reason of an ineffective school-faculty partnership. However, as Zeichner (2010) notes the epistemology of teacher preparation should transform "from a place where academic knowledge in the university is seen as the primary source of knowledge about teaching to a situation where academic knowledge and the knowledge of expert P-12 teachers are treated with the equal respect…" (p. 93). It is widely observed that the USs who are mostly the authors' of academic papers investigating the problems of school-faculty partnership often reflect one perspective of the issue, and imply training for CTs, which seems to prevail the ivory-tower stance of faculties over schools (Bullough et al., 1999). In the particular context of this research, the CT's priorities of offering support and care to the student teachers can be considered equally important as there is evidence for the importance of providing a caring work environment where student teachers can learn how to teach (Stanilus & Russell, 2000 as cited in Butler & Cuenca, 2004). Therefore, as Bullough and Draper (2004) suggest the different supervisory perspectives should be recognised, equally respected, and a common professional space should be built to foster communication and collaboration, which ultimately leads to the collaborative school-faculty partnership (Furlong, 1996). Therefore, this study might suggest building up workshop sessions before field experiences in which both USs and CTs join and creating opportunities to equally share their desires and expectations from the upcoming experience, and negotiate their beliefs and roles to sustain an effective teaching practice for student-teachers (Yayli, 2008). These joint workshop sessions can be considered effective not only to provide effective supervision to student teachers but also to contribute to the professional development of both CTs and USs (Bullough and Draper, 2004). In these sessions, as shown in this study, the repertory grids can be used as a method of eliciting supervisory beliefs of dyad members that will trigger their communication, evaluation, and professional development (Zuber-Skerritt & Roche, 2004).

It is also worth noting that both Dr. M and Mrs. B in this study associated their actual self as a supervisor with their representation of the ideal supervisor in line with their articulated constructs on the topic. Here it might be hypothesized that both supervisors located themselves at perfectionist poles and believed in their abilities in supervising student teachers. Although that form of tight association between the ideal self and actual self implies difficulties in bringing out changes in beliefs through professional development programmes, it might be possible to observe structural changes in these associations as a result of self-reflection of CTs and USs and their fruitful collaborative relationship. Future longitudinal research might yield further evidence for such structural changes.

This study reports on one particular case of a dyad between a US and a CT, and thus it is limited in terms of allowing us to generalise the extent of its results. However, using repertory grids as a method of analysis, the results drawn from this case study describe the shared and idiosyncratic beliefs that occur in the personal theories of two members of the dyad who share the same goal of training future teachers. The study further argues how idiosyncratic personal theories can be considered as a catalyst for improving a collaborative school-university partnership. Future research is needed to provide further evidence for the effectiveness of repertory grids to elicit supervisory beliefs in student teaching dyads and uses of them as a method for negotiating effective supervisory practices (Zuber-Skerritt & Roche, 2004).

Statements of publication ethics

The research has no unethical problems and the research and publication ethics have been fully observed. The approval of ethics committee was not provided for the study as the data for this research was collected before 2020.

Conflict of interest

The author has no conflicts of interest to disclose.

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Appendix: Sample Repertory Grid Form

Construct No	Triads	Emergent Constructs (Similarities) Elements	Rating Scale 1 ← 2 ↔ 3 → 4 → 5					**Implicit Constructs (Contrasts)** Elements
			ES	TS	IS	Self	Ideal	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

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Who Tests What? Prospective ELT Teachers' Conceptions and Suggestions on the New Distribution of the Subjects and Topics in the Subject Knowledge Test

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Abstract

Starting from its first implementation, Subject Knowledge Test (henceforward SKT) has been investigated in various subject fields due to the emerging questions about its content and applicability in selecting prospective teachers. With the contribution of 355 participants including senior students and the graduates from different ELT undergraduate programs of the universities throughout Turkey, this study aimed to investigate the conceptions and suggestions of prospective ELT teachers on the new distribution of the subjects and topics in SKT in 2019. The data were collected by conducting an online survey and semi-structured interviews held with ten ELT prospective teachers. The study revealed that the new distribution of the subjects and topics in SKT was not satisfactory and relevant to select ELT prospective teachers who are competent and qualified in their fields due to substantial obliqueness in its content and administration process.

Keywords: Prospective EFL teachers, Subject Knowledge Test, conceptions, suggestions.

Kim Ne Test Ediyor? İngilizce Öğretmen Adaylarının Öğretmenlik Alan Bilgisi Testindeki Konu ve Başlıkların Yeni Dağılımı Üzerine Görüş ve Önerileri

Öz

İlk uygulanmasından itibaren Öğretmenlik Alan Bilgisi Testi (ÖABT), öğretmen adaylarının seçilmesinde içeriği ve uygulanabilirliği bakımından farklı öğretmenlik alanlarında araştırılmıştır. Bu çalışma, Türkiye genelindeki üniversitelerin farklı ELT lisans programlarına devam eden 355 son sınıf öğrencisi ve mezun öğrencinin 2019 yılında uygulanan , İngilizce Öğretmenlik Alan Bilgisi Testi İngilizce (İÖABT) alan sınavında yer alan konu ve başlıkların yeni dağılımı üzerine görüş ve önerilerin yansıtmayı amaçlamıştır. Araştırmanın verileri çevrimiçi anket ve 10 İngilizce öğretmen adayı ile uygulanan yarı yapılandırılmış görüşmeler yoluyla toplanmıştır. Çalışma, İÖABT alan sınavında yer alan konu ve başlıkların yeni dağılımının içeriğinden ve uygulanış sürecinden kaynaklanan çarpıklıklardan dolayı alanlarında yetkin ve nitelikli İngilizce öğretmen adaylarının seçiminde tatmin edici ve amacına uygun olmadığı sonucunu ortaya koymuştur.

Anahtar kelimeler: İngilizce Öğretmen Adayları, Öğretmenlik Alan Bilgisi Testi, Görüşler, Öneriler.

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1 | Introduction

Teaching profession necessitates qualified teachers who will prosecute and adapt themselves to the recent developments in education. Important political and educational applications have been put into action to educate and recruit qualified teachers throughout the world (Villegas-Reimers, 2003). Among these applications, selecting and recruiting prospective teachers is a topical concern. Darling-Hammond and Youngs (2002) point that recruiting effective prospective teachers is directly related to successful student achievement. In a similar vein, it is a way of making future investment for future teacher effectiveness in that educational context (Klassen & Kim, 2018).

Most countries in the world have difficulties in the selection and recruitment procedure of prospective teachers (Chevalier et al., 2005). This case is also valid in Turkish education system. In the last few decades, there has been an increase in the number of the education faculties throughout the country and accordingly in the number of the university students graduating from these faculties (Tekneci, 2016). Although inductions are provided by MoNE for vacant positions each year, the number of the prospective teachers applying for these positions is higher than those vacant positions. Hence, this case called for an examination to select the qualified prospective teachers that would perform the intended goals and objectives of MoNE (Eraslan, 2014).

Examination of Civil Servants in 1999 was the first examination that was held for the recruitment process of all types of professional posts in general. In 2001, this examination was held under the name of Central Elimination Exam for Public Positions. However, in 2002, these two examinations were mediatized under the name of Professional Posts in Public Organizations (henceforward CEEPP). After 2013, SKT was included into CEEPP as a part of this selection process of prospective teachers. Karaer[1] et al. (2018) stressed the role of the studies that reflect the conceptions and opinions of prospective teachers was one of the significant factors leading stakeholders to implement SKT for the following years.

In the recent literature, there are studies which reflect the views and suggestions of prospective teachers about SKT from different subject fields. These studies were mainly centred upon whether SKT should be implemented or not to choose the qualified teachers in their subject fields (Halmatov & Kızıltaş, 2019; Turan & Zengin, 2017; Çelik, 2016; Recepoğlu, et al., 2016; Şahin & Demir, 2016; Erdem &Soylu, 2013). However, no previous study has been implemented to reflect the conceptions and suggestions of ELT prospective teachers with this respect and on the new distribution of the topics and subjects in the latest SKT.

2 | LITERATURE REVIEW

Subject knowledge comprises the knowledge of the concepts and phenomena in the field; on the other hand, pedagogical field knowledge includes formulating and demonstrating these concepts and phenomena in a comprehensible way to the others (Shulman, 1987). Thus, selecting and recruiting the teachers who will transfer their subject knowledge and field knowledge is very crucial for the education policies of nations. Throughout the world different teacher selection and recruitment procedures are carried out to induct qualified teachers (Blank et al., 2004). Generally, this procedure includes two phases in most educational context; first, the identification of vacant positions based on geographical areas or subject areas, and second providing financial opportunities for the education and induction (See & Gorard, 2019). In their study, Blömeke et al., (2008) discuss a recruitment model based on two phases; focus on professional competence and the factors that might affect this professional competence. Incorporating prospective teachers to postgraduate courses as a pre-requisite for the admission to in-service teacher positions is another way for the recruitment (Ballantyne et al., 2002). These courses are regarded as very significant factors and contributory elements in this admission process (Darling-Hammond, 2000).

When considered this system in Turkey, it might be divided into two phases; *(1) teacher selection and recruitment without an examination system* and *(2) teacher selection and recruitment based on an examination system*. In the first system, various institutions, or schools, such as Primary Teacher Schools,

Country Teacher Schools, Trainer Courses, Country Institutions, Teacher High Schools, Education Institutions, Education Schools and Education Faculties were responsible for teacher education (Öztürk, 1999). These institutions and schools were in charge until 1973; howbeit, they were closed after the promulgation of Basic Law of National Education with the number of 1739 (MoNE, 1973). Although an examination named Teacher Proficiency Examination was implemented between the years 1985-1991, all the prospective teachers were inducted due to myriad deficiencies in public posts between those years. During this continuum until 1999, no examination system was put into action for the selection and recruitment of prospective teachers. These implementations were lasted when all teacher education institutions were gathered under the umbrella of education faculties until 1993. Memduhoğlu and Kayan (2017) argue that these continuous changes in teacher education policies might result from the efforts of keeping up pace with the developing educational contexts throughout the world, disponing the negative effects of being a newly established country and coping with the difficulty of teacher training.

The second system started under the name of Examination of Civil Servants which was held by Assessment, Selection, and Placement Centre (henceforward ASPC) with the coordination of State Planning Organization (henceforward SPO) in 1999. In 2001, this examination was redefined as Central Elimination Exam for Public Positions (henceforward CEEPP). However, all the regulations released for these two examinations were repealed after one year, and ASPC became responsible for the selection of the candidates for all the vacant positions in the public institutions including prospective teachers' selection. Within this continuum, ASPC started to administer CEEPP which is held in two sessions: morning session and afternoon session. The content of CEEPP comprises the topics of general knowledge and ability, general culture and educational sciences. In the morning session, general knowledge and ability and general culture test with 120 questions (comprising 60 % of the total examination) and in the afternoon session, educational sciences test with 120 questions (comprising 40 % of the total examination) are conducted to the exam takers. In addition to these sessions, MoNE, in line with its objectives and goals for a better teacher selection process, released a regulation that edited SKT consisting of Subject Knowledge and Subject Teaching tests for 15 teaching fields (MoNE, 2013).

CONTENT ANALYSIS OF THE OLD AND NEW DISTRIBUTION OF THE TOPICS IN SKT FOR ELT PROSPECTIVE TEACHERS

The topics and subjects in SKTs of ELT and Primary School Teaching were changed and reorganized according to a regulation released by ASPC (ASPC, 2018). As regards to this regulation, ASPC increased the number of the questions in subject knowledge test to 45 and subject teaching questions to 35. However, in the rest of the 13 teaching areas there were 60 subject knowledge questions and 15 subject teaching questions.

Table 1. The Percentages and Numbers of the Questions in SKT (2013 and 2018-2019)

Topics and Subjects	Total Percentage		Approximate Percentage		Number of the Questions	
	2013 and 2018	2019	2013 and 2018	2019	2013 and 2018	2019
1-Subject Knowledge Test	80 %	60 %			40	45
a) Language Proficiency			50 %	34 %		
b) Linguistics			16 %	13 %		
c) Literature			14 %	13 %		
2- Subject Teaching Test	20 %	40 %			10	30
Total	100 %	100 %			50	75

Table 1 illustrates the comparisons of the percentages and numbers for the topics in ELT field and subjects between the years of 2013 and 2018 and the new distribution in 2019. The total number of the questions was fifty between the years 2013 and 2018; howbeit, ASPC increased the number of the questions to seventy-five in 2019. Previous six years (2013-2018), the number of subject knowledge test questions was forty (80 %), while in 2019 it was forty-five (60 %). Additionally, the number of the questions in subject teaching test between the years 2013 and 2018 was ten (20 %) while it was thirty (40 %) in 2019.

Table 2 presents the previous (between the years 2013 and 2018) and the new distribution (2019) of questions that pertain to each topic and subject.

Table 2. The Number of the Questions for Each Topic and Subject in SKT with respect to the Years

Topics and Subjects	2013	2014	2015	2016	2017	2018	2019
Language Proficiency	16	16	16	16	16	16	20
Pedagogic Grammar	9	9	9	9	9	10	5
Linguistics	9	8	8	8	8	7	10
Literature	7	7	7	7	7	7	6
Methodology	1	2	2	2	2	2	9
Teaching Language Skills	1	1	1	2	2	2	12
Material Development	1	1	1	1	1	1	4
Testing	1	1	1	1	1	1	2
Teaching English to Young Learners	2	2	2	2	2	1	4
Second Language Acquisition	1	1	2	1	1	2	2
Factors Affecting Language Learning	2	2	1	1	1	1	1
Total	50	50	50	50	50	50	75

According to the previous distribution of the topics and subjects in Table 2, the number of the questions was nearly the same in Linguistics, Methodology, Teaching Language Skills, Teaching English to Young Learners, and Factors Affecting Language Learning between the years of 2013 and 2018. However, in the new distribution of the questions, there were salient differences with respect to these topics and subjects. Especially in Teaching Language Skill, there were two questions in the previous SKTs (between the years 2013 and 2018), while there were twelve questions in the new distribution (in the year 2019) of the questions. Furthermore, the number of the questions was only one in Material Development and two in Methodology in the previous SKTs, while it was four in Material Development and nine in Methodology in the new distribution of the topics and subjects. It is also quite clear that there was a halve reduction in the number of the questions for Pedagogic Grammar in which the questions were directed interchangeably with Linguistics.

Previous research on SKT has mainly focused on suggestions on the examination process and the implications of SKT takers with this respect. Kılıçkaya and Krajka (2013) reviewed language teacher selection examination and recruitment in Turkey and Poland and argued that in Turkey a reliable and valid examination should be implemented which measures the subject knowledge of exam takers, and in Poland a recruitment process based on objective criteria should be enacted rather than local prerequisites. Studies conducted on preschool prospective teachers showed the importance of SKT; however, they also reflected that a more comprehensive content should be included in by considering various factors (Recepoğlu, et al., 2016; Çelik, 2016; Halmatov & Kızıltaş, 2019). In a similar study, Turan and Zengin (2017) reflected that classroom teaching students stated the necessity of SKT for their field. On the other hand, prospective Turkish teachers demonstrated adverse opinions regarding SKT since it contains subjects and topics in general (Şahin & Demir, 2016).

Teachers should have field knowledge of the concepts, phenomena, and the pedagogical field knowledge to perform an effective teaching in their classroom contexts (Erdem & Soylu, 2013). To achieve this goal, Klassen et al. (2020) propose that SKT is a very significant progressional examination for prospective teachers since it helps them to annihilate some unexpected difficulties they may face later on in their professional lives. Therefore, the selection and recruiting process of these teachers necessitates a reliable and valid examination (Kılıçkaya & Krajka, 2013) for prospective teachers. Taking into consideration this relevance, this study aimed to reflect prospective ELT Teachers' conceptions and suggestions on the new distribution of the subjects and topics in SKT with a systematic investigation that has not been previously investigated in this field.

3 | Method

Data Collection Procedure and Instruments

Grounded on a survey-based research design, the data were collected to reveal ELT prospective teachers' conceptions on the new distribution of the topics and subjects in SKT and their further suggestions regarding SKTs that will be implemented for the following years. The data gathering process consisted of two main sections; an online-survey and semi-structured interviews held with ten ELT prospective teachers. In the online survey, the participants reflected their conceptions by stating their agreement or disagreement via a 5-point Likert scale *(1= I strongly agree, 2= I agree, 3= Neither agree or disagree, 4= I disagree and 5= I strongly disagree)* (Tullis & Albert, 2013). The quantitative data obtained from the online survey were analyzed via statistical software programme SPSS 22 to reveal descriptive statistics about the participants' conceptions. Additionally, the participants were asked to write their own conceptions without any limitation to choose pre-determined options or alternative answers at the end of the survey (Fowler, 2002). This section and the interview transcripts were translated into English taking care to preserve the intended message of the participants and interviewees' comments. These translations were then checked by two other ELT instructor working at the same institution. Before the administration of the survey, it was piloted with a group of 150 ELT prospective teachers. In consequence of this piloting study, its length, wording, and organization revised in line with their feedback.

The 13 items of '' *Specifying the Conceptions and Suggestions of Pre-service EFL Teachers' on the New Distribution of the Topics and Subjects in SKT''* scale was subjected to principal components analysis (PCA) using SPSS. Prior to performing PCA the suitability of data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of all coefficients are above .3 (Tabachnick & Fidell, 2013).

Table 3. Factor Analysis of the Sample Suitability for the Distribution of the Items

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)		.882
Bartlett's Test of Sphericity	Chi-Square	1659.580
	df	78
	Sig.	.000
Cronbach's Alpha		.822

According to Table 3, the results of Kaiser-Meyer-Olkin (KMO) test was *.882* which means that the sample size is convenient to conduct factor analysis for items in the survey. Additionally, when considered the results of Bartlett's Test of Sphericity (X2 =1659. 580; p<.01), chi-square result was significant. Lastly, Cronbach's Alpha value was *.822* which means that the items in the survey were coefficient reliable.

Table 4. Factor Loadings from PCA with Varimax Rotation for a Three-Factor Solution for SKT scale (N =355)

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.042	38.788	38.788	5.042	38.788	38.788	4.140	31.842	31.842
2	1.191	9.158	47.946	1.191	9.158	47.946	2.014	15.493	47.336
3	1.085	8.346	56.292	1.085	8.346	56.292	1.164	8.956	56.292
4	.984	7.572	63.864						
5	.829	6.378	70.242						
6	.754	5.801	76.042						
7	.706	5.427	81.469						
8	.610	4.692	86.161						
9	.531	4.087	90.248						
10	.387	2.978	93.226						
11	.350	2.696	95.922						
12	.300	2.306	98.228						
13	.230	1.772	100.00						

PCA in Table 4 also revealed the presence of three factors with eigenvalues exceeding 1, explaining 38.78 per cent, 9.16 per cent, 8.35 per cent of the variance, respectively.

Table 5. Rotated Component Matrix (RCM)

Rotated Component Matrix	Component		
	1	2	3
7- I am of the opinion that the new distribution of the topics and subjects in SKT measures my performance in terms of subject knowledge.	.730		
6- I am of the opinion that the new distribution of the topics and subjects in SKT measures my performance in terms of English language proficiency.	.712		
5- I am of the opinion that the content of the questions in the new distribution of the topics and subjects in SKT are related to the topics and subjects in the field of ELT	.659		
8- I am of the opinion that the new distribution of the topics and subjects in SKT measures my performance of interpretation in English.	.632		
3- I am of the opinion that the new distribution of the topics and subjects in SKT is in parallel with the subjects I had at my university.	.834		
11- I am of the opinion that the most challenging subject in the new distribution of the topics and subjects in SKT was ----------.	.824		
10- I am of the opinion that the new distribution of the topics and subjects in SKT was more successful and comprehensive than the previously implemented SKTs.		.792	
1- I am of the opinion that the new distribution of the topics and subjects in the SKT selects prospective ELT teachers who are competent in their field.		.773	
12- I am of the opinion that the new distribution of the topics and subjects in SKT met my expectations in terms of a relevant testing.		.750	
9- I am of the opinion that I have received sufficient information from the exam preparation stakeholders about the new distribution of the topics and subjects in SKT.			.512
4- I am of the opinion that the academicians at my department acknowledged me about the new distribution of topics and subjects in SKT.			.845
13- I am of the opinion that the time given to the new distribution of the topics and subjects in SKT is sufficient.			.468
2- I am of the opinion that the field education I obtained from my university is sufficient to be successful in SKT.			.612

The Rotated Component Matrix (RCM) in Table 5 revealed that the first factor which seemed to index *content of SKT* corresponded for the first six items; the second factor, which seemed to index *aim of SKT* corresponded for the second third items, and lastly the third factor, which seems to index *external factors that affect exam takers in SKT* corresponded for the last four items.

The second main section of the study involved semi-structured interviews consisting of pre-determined questions which were directed to ten prospective ELT teachers. They participated to the interviews on a voluntary basis. These interviews were held on Adobe-connect application which is a digital platform used for distance training activities accessible from anywhere, anytime. Before the implementation of the interviews, the participants were informed that they could use their mother tongue to answer the questions in order to convey the intended meaning in a clearer manner; howbeit, the questions were prepared and directed to them in English. Additionally, for the purpose of ensuring the confidentiality and ethical issues, they were also informed that pseudonyms would be used, and the recordings would not be released. The semi-structured research questions directed to the participants were as follows,

1- *Were you able to get well-prepared before SKT?*
2- *What was the most difficult section of SKT for you?*
3- *Was SKT an examination that met your expectations?*

The answers provided by the interviewee were recorded via Adobe-connect, and later these recordings were transcribed into word format to perform the coding process. In the coding process of the responses, two colleagues working in the same institution independently coded and created tally charts for the emerging themes. These emerging themes were then compared and discussed until an agreement was reached on for all the themes.

Arising questions and arguments about whether current approaches in the examination procedures for public positions are efficient and targeted or not in choosing the qualified prospective teachers in Turkish ELT Teacher Training contexts has been the major urge to conduct this study. For this purpose, it will be beneficial to obtain the conceptions and suggestions of ELT prospective teachers as one of the major stakeholders in this paradigm. With this respect, the study addressed the following research questions:

1- *What are the conceptions of prospective ELT teachers on the new distribution of the topics and subjects in SKT?*
2- *What are their further suggestions for SKTs which will be implemented in the following years?*

Participants

In the first sub-section the on-line survey (the first main section), the participants were asked about their gender, age, undergraduate programmes, academic achievement grade and attendance to a private teaching institution for the preparation of SKT and previous SKT experience. The participants of this study were 355 senior students who will graduate in the spring term of 2020 and the bachelors who graduated from different English language departments of the universities throughout the country.

Table 6. The Gender and Age Distribution of the Participants

	Frequency	Percent	Cumulative Percent
Gender			
Male	87	24.5	24.5
Female	268	75.5	100.0
Total	355	100.0	
Age			
19-25 interval	148	41.7	41.7
26 and above	207	58.3	100.0
Total	355	100,0	

According to the gender of the participants in Table 6.268 (75. 5 %) of them were female and 87 (24. 5 %) of them were male in this study. Their ages were ranged in two basic groups: between 19 and 25 and above 26. With respect to the results of these groups, 207 (58. 3 %) of them were above the age of 26 and 148 (41. 7 %) them were between the interval of 19 and 25.

In Turkey, the university students who graduate from English language departments such as Department of English Language and Literature, Department of English Linguistics, Department of English Language and Comparative Literature, Department of Translation Studies, Department of Translation and Interpreting, Department of American Culture and Literature have a right to take SKT provided that they take pedagogical formation certificate from the education faculties of the universities. These senior students and bachelors also have qualifications to become EFL teachers for the public positions after getting this pedagogical formation certificate from the education faculties (2014, YOK).

Table 7. The Distribution of the Undergraduate Programs of the Participants

Undergraduate programs	Frequency	Percent	Cumulative Percent
Department of English Language Teaching	181	50.8	50.8
Department of English Language and Literature	154	43.5	94.4
Department of English Linguistics	5	1.4	95.8
Department of Translation and Interpreting	5	1.4	97.2
Department of American Culture and Literature	5	2.8	100.0
Total	355	100.0	

Table 7 illustrates the distribution of the participants with respect to the departments they pursue or graduated before 2019. According to the distribution, 181 (50.8 %) of them were the students of Department of English Language Teaching and 154 (43.5 %) of them were the students of Department of English Literature and Language. The number of the participants apart from the Department of English Language Teaching and Department of English Language and Literature was 15 (5.6 %).

Table 8. Academic Achievement Grades of the Participants

Academic Achievement Grade	Frequency	Percent	Cumulative Percent
3,6 – 4 interval	20	5.4	5.4
3,1 – 3,5 interval	114	32.2	37.6
2,6 – 3 interval	155	43.8	81.4
2,1 – 2,5 interval	63	17.8	99.2
2 and lower	3	0.8	100.0
Total	355	100.0	

When considered the participants' academic achievement grades, Table 8 shows that 155 (43.8 %) of them were between the 2.6 - 3, 0 interval and 114 (32.2 %) of them were 3.1 – 3.5 intervals. The 3, 6-4.0 interval group included 20 (5.4 %) of the participants and 2.1- 2.5 interval group included 63 (17.8 %) of the total participants. Attendance to a private teaching institutions and courses is an alternative way which prospective teachers prefer to prepare themselves for SKT.

Table 9. Attendance to a Private Teaching Institution or Courses for SKT and Previous SKT Experience of the Participants.

	Frequency	Percent	Cumulative Percent
Attendance to a private teaching institution for SKT			
YES	85	23.7	23.7
NO	270	76.3	100
Total	355	100	
Previous SKT experience			
YES	222	62.7	62.7
NO	133	37.3	100
Total	355	100	

Table 9 illustrates that the number of the participants who preferred taking SKT courses from a private teaching institutions or courses was 85 (23.7 %), while 270 (76.3 %) did not take or attend to any of the courses from those institutions. On the other hand, the number of the participants who had a previous SKT experience was 222 (62.7 %) and the number of the participants who did not have such an experience was 133 (37.3 %).

The participants, who took part in the semi-structured interviews in second main section of the study, were ten undergraduate students graduated from different English language programs of the universities in Turkey. Their participation process into the interviews was totally on a voluntary basis. Pseudonyms were used in order to provide confidentiality for the interviewees, and they were also ensured that the video-recordings of the interviews would not be released or used at any cost. The participants were informed the fixed time of the interviews on the live distant learning platform beforehand, and each interview was lasted in 20 minutes. The following table illustrates detailed information about the interviews.

Table 10. The Distribution of the Participants in the Interview

Names	Gender	Age	Undergraduate programs	Academic Achievement Grade	Attendance to a private teaching institution for SKT	Previous SKT experience
1- Merve	Female	23	Department of English Language Teaching	2.6-3.0 interval	YES	YES
2- Cemile	Female	22	Department of English Language Teaching	3.6-4.0 interval	YES	NO
3-Havva	Female	24	Department of English Literature and Language	2.6-3.0 interval	NO	YES
4- İbrahim	Male	28	Department of English Language Teaching	2.6-3.0 interval	NO	YES
5- Pelin	Female	25	Department of Translation and Interpreting	2.6-3.0 interval	YES	YES
6- Ayberk	Male	25	Department of Translation Studies	3.1-3.5 interval	YES	NO
7- Hasan	Male	24	Department of American Culture and Literature	3.6-4.0 interval	YES	YES
8- Tülay	Female	28	Department of English Language and Comparative Literature	3.6-4.0 interval	YES	YES
9- Serap	Female	24	Department of English Literature and Language	3.6-4.0 interval	YES	YES
10- Kamil	Male	22	Department of English Literature and Language	3.1-3.5 interval	YES	NO

According to the distribution in Table 10, six of the interviewees were females and four of them were males whose ages range between 22 and 25 except Ibrahim and Tülay who were at the age of 28. When considered their undergraduate programs, three of the interviewees graduated from Department of English Language Teaching programs, and three of them graduated from Department of English Language and Literature programs of different universities. Other four interviewees were from the departments of Department of English Language and Comparative Literature, Department of Translation Studies, Department of Translation and Interpreting, Department of American Culture and Literature. Merve, Havva, İbrahim and Pelin's academic achievement grades were between 2.6-3.0 interval, Ayberk and Kamil's academic grade was between 3.1-3.5 interval and Cemile, Hasan, Tülay and Serap's academic achievement grade was between 3.6-4.0 interval. Lastly, Merve, Havva, İbrahim, Pelin, Hasan, Tülay and Serap had previous SKT experiences while Cemile, Ayberk and Kamil did not have any SKT experiences.

4 | Findings

The first three items were related to their conceptions about the new distribution of the topics and subjects in SKT and in relation to their university education background and programmes.

Table 11. Participants' Conceptions about the New Distribution of the Topics and Subjects in SKT and in Relation to their University Education

Items	1		2		3		4		5	
	f	%	f	%	f	%	f	%	f	%
1- I am of the opinion that the new distribution of the topics and subjects in SKT is in parallel with the subjects I had at my university.	28	7.9	87	24.5	28	7.9	144	40.6	68	19.2
2- I am of the opinion that the academicians at my department acknowledged me about the new distribution of topics and subjects in SKT.	24	6.8	64	18.0	37	10.4	141	39.7	89	25.1
3- I am of the opinion that the field education I obtained from my university is sufficient to be successful in SKT.	31	8.7	77	21.7	17	4.8	134	37.7	96	27

As shown in the Table 11, the participants firstly reflected their conceptions whether the new distribution of the topics and subjects in SKT was in parallel with the topics they had at their faculty programmes. The results indicated that 40.6 % (144) of the participants reported their disagreement as regards to the new distribution of the topics and subjects in SKT was not in parallel with the topics and subjects they had at their faculty programmes. On the other hand, 24.5 % (87) of them agreed that the new distribution of the topics and subjects in SKT was in parallel with the topics they had at their universities. In the second item, 39.7 % (141) of the participants remarked that the academicians at their departments did not acknowledge them about the new distribution of the topics and subjects. As for the last item in this sub-section, 37.7 % (134) of the participants were of the opinion that the field education they obtained from their faculties was not sufficient for them to be successful in SKT.

In the second section, the participants were expected to respond the items related to the aim and the content of the new distribution of the topics and subjects in SKT.

Table 12. Participants' Conceptions on the Aim and Content of the New Distribution of the Topics and Subjects in SKT

Items	1		2		3		4		5	
	f	%	f	%	f	%	%	f	%	f
1- I am of the opinion that the new distribution of the topics and subjects in SKT selects prospective ELT teachers who are competent in their field.	14	3.9	67	22.8	25	29.9	140	69.3	109	30.7
2- I am of the opinion that the content of the questions in the new distribution of the topics and subjects in SKT are related to the topics and subjects in the field of ELT.	23	6.5	116	32.7	38	10.7	120	33.8	58	16.3
3- I am of the opinion that the new distribution of the topics and subjects in SKT was more successful and comprehensive than the previously implemented SKTs.	19	5.4	36	10.1	44	12.4	116	32.7	140	39.4
4- I am of the opinion that the new distribution of the topics and subjects in SKT measures my performance of interpretation in English.	36	10.1	108	30.4	38	10.7	111	31.3	62	17.5
5- I am of the opinion that the new distribution of the topics and subjects in SKT measures my performance in terms of English language proficiency.	25	7.0	83	23.4	45	12.7	116	32.7	86	24.2
6- I am of the opinion that the new distribution of the topics and subjects in SKT measures my performance in terms of subject knowledge.	19	5.4	104	29.3	36	10.1	122	34.4	74	20.8
7- I am of the opinion that the most challenging subject in the new distribution of the topics and subjects in SKT was ----------.	244	68.7	21	5.9	16	4.5	56	15.8	18	5.1
8- I am of the opinion that I have received sufficient information from the exam preparation stakeholders about the new distribution of the topics and subjects in SKT.	18	5.1	57	16.1	28	7.9	103	29.0	149	42.0
9- I am of the opinion that the new distribution of the topics and subjects in SKT met my expectations in terms of a relevant testing.	9	2.5	32	9.0	40	11.3	134	37.7	140	39.4
10- I am of the opinion that the time given to the new distribution of the topics and subjects in SKT is sufficient.	22	6.2	99	27.9	31	8.7	81	22.8	122	34.4

The second section involved ten items related to the aim and the content of the new distribution of the topics and subjects in SKT. Table 12 illustrates that in the first item, 69.3 % (140) of the participants were of the opinion that the new distribution of the topics and subjects in SKT did not select prospective ELT teachers who were competent in their field with regards to its purpose. In the second item, 33.8 % (120) of the participants reflected their dissatisfaction with the unrelatedness between the new

distribution of the topics and subjects in SKT and the topics and subjects in the field of ELT. Considering the third item, 39.4 % (140) of the participants expressed that the new distribution of the topics and subjects in SKT was not more successful and comprehensive than the previously implemented SKTs. As for the fourth item, there was nearly an equivalence with respect to the results; namely, 30.4 % (108) of the participants were of the opinion that the new distribution of the topics and subjects in SKT measured their performance of interpretation in English, whereas 31.3 % (111) of them expressed their disagreement in this regard. The fifth and sixth items showed that (32.7 %) (116) of the participants remarked the new distribution of the topics and subjects in SKT did not measure their performance in terms of English language proficiency and for 34.4 % (122) of them subject knowledge in ELT. The seventh item was directed to the participants to reveal the most challenging topic or subject for them [*1= Language Proficiency (68.7 %) , 2= Subject Teaching (15.8 %), 3= Linguistics (5.9 %), 4= Pedagogic Grammar (5.1 %), 5= Literature (4.5 %)*] as regards to the new distribution of the topics and subjects. Accordingly, 68.7 % of the participants (244) stated that ''Language Proficiency'' was the most challenging subject in this distribution. In the eighth item, 42.0 % (149) of the participants viewed that they were not sufficiently informed about the new distribution of the topics and subjects in SKT before the implementation process. According to the ninth item, 39.4 % (140) of the participants totally disagreed upon the idea that the new distribution of the topics and subjects in SKT met their expectations in terms of a relevant testing. In the last item, the time given to the new distribution of the topics and subjects in SKT was not sufficient for 34.4 % of the participants.

Borg (2009) argues that questionnaires do not reflect an-in-depth understanding of the particpants' beliefs and views; hence it is highly advisable and appropriate to support the questionnaire with qualitative data. Hence, we also supported our quantitative data with the third section of the survey and the interviews held with 10 ELT prospective teachers. In this section, the participants reflected their conceptions on the new distribution of the topics and subjects in SKT without any prescribed questions and forms. In addition, they provided suggestions for future SKTs which will be administered in the following years.

> *(1) Before we took SKT, a booklet or something that informed us about the new distribution of the topics and subjects. Nobody was expecting five paragraph questions, because we were not taking university entrance examination. The number of subject knowledge questions should have been increased instead of these paragraph questions.*

In the first excerpt of this section, he/she claimed that a booklet should have been published and released which informed the new distribution of the topics and subjects of SKT. He/she also complained about the increased number of the paragraph questions and proposed increasing the number of the subject knowledge questions.

> *(2) I felt as if I had taken university the university entrance examination. That was the biggest disappointment for me. I wish they had asked questions from all topics and subjects in ELT in equal numbers instead of asking language performance questions.*

In the given second excerpt, he/she expressed the disappointment about the content of the new distribution of the topics and subjects in SKT. He/she argued that he/she felt himself/herself as if he/she entered university entrance examination again in which only the language proficiencies of the students are measured at the end of high school. He/she also stated that the old distribution of the topics and subjects in SKT was better than recent distribution in terms of measuring all subject and topics equally.

> *(3) I think this new form of SKT does not measure our subject knowledge. Because there were too many paragraph questions. I recommend them to measure our subject knowledge constituting of approaches, methods, and techniques instead.*

In the third excerpt, he/she argued that the changing format of SKT was far from measuring the subject knowledge of the exam takers since it was full of language proficiency questions such as the paragraph

questions. He/she also proposed that they should put into practice an examination which centers upon measuring the techniques and approaches used in this field.

> (4) *It would be far better if there were questions in all types. Five paragraph questions that were asked successively prevented us to read and answer the following questions clearly.*

In the fourth excerpt, He/she claimed about the five paragraph questions in the new distribution of the topics and subjects of SKT that these paragraph questions confused their minds and prevented them to read the other questions in an open-minded way.

> (5) *Cloze test questions were unexpected questions in SKT. Additionally, asking five paragraph questions was nonsense for me. There were also some concepts and terms which I have never heard before and they were very challenging for me.*

In this excerpt (5), He/she mentioned that the cloze test questions were unexpected in the new distribution of the topic and subjects in SKT. He/she complained that there were notions and concepts which he/she did not experience or encounter before the examination. Furthermore, these notions and concepts were compelling to explain him/her.

> (6) *It was such an examination that as if it were prepared in the last minute. You cannot measure one's competence or performance only by directing paragraph questions.*

In the sixth excerpt, He/she stated that the questions in the new distribution of the topics and subjects of SKT were as if prepared before day of the administration process. Hence, he/she stated his/her disagreement in measuring the competence of prospective teachers via paragraph questions.

> (7) *Paragraph questions should have been diversified and the duration of the exam should have been extended.*

As opposes to previous excerpt, in this excerpt (7) he/she proposed that the paragraph questions might be diversified and the duration of SKT might also be prolonged accordingly.

> (8) *The time allocated to the examination was not sufficient. Proficiency section should not have contained only paragraph questions. It was shocking for me to face different types of questions and the nonsense distribution of these questions.*

In the last excerpt of the third section, he/she explicated the insufficiency of the time allocated to SKT and complained about language proficiency section which was mainly constituted of paragraph questions. It was also shocking for him/her to see the different question types and the malarkey of the topics and subjects.

SEMI-STRUCTURED INTERVIEWS

The semi-structured interviews were structured on the basis of interview questions. In the analysis process, their responses were discussed with respect to the emerging themes under each research question and sample excerpts were provided related to these emerging themes. To increase the degree of inter-rater reliability, two researchers working at the same institution were asked to identify themes in the transcriptions of the interview. The results indicated that close agreement were provided for the merging themes.

Question 1: Were you able to get well-prepared before SKT? Why-Why not?

Data analysis highlighted several factors that influence the preparation process of SKT exam takers. The interviewees' answers in this question fell into five main themes as were found through their responses in the transcriptions of the interviews.

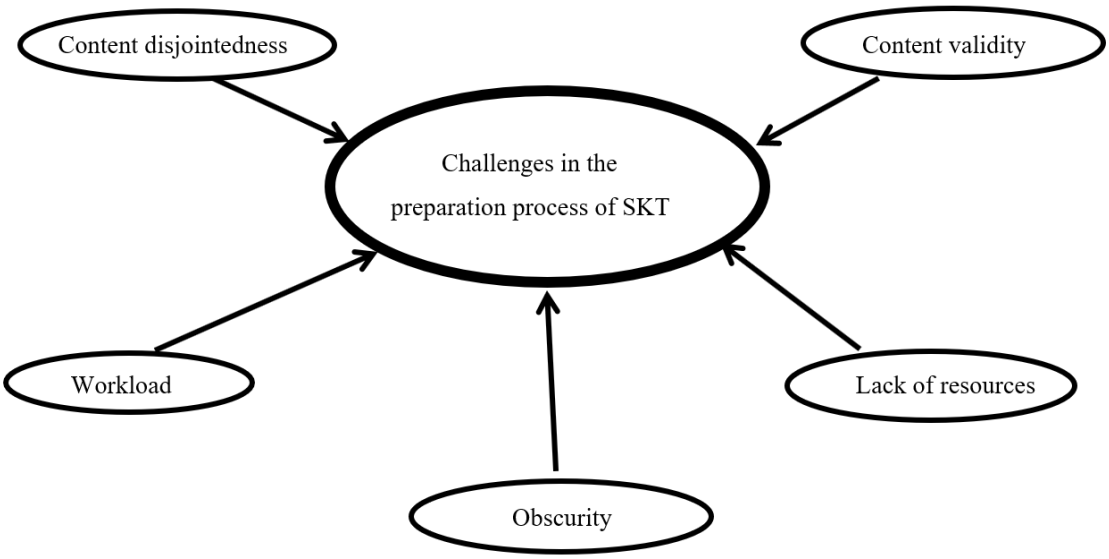

Figure 1. *Themes emerging from the first interview question*

When asked the first question of the interview to the interviewees, they all responded that they could not get well-prepared before the exam. As for the first reason, although they attended a special course for SKT, the content disjointedness between their faculties and SKT discouraged them to put into practice an effective preparation strategy for the examination.

(1) *The most challenging part of SKT is the discrepancy between the topics and subject in SKT and the courses we took at our faculties. For example, when I had decided to study SKT, I had difficulty in starting from a topic because of my anxiety and stress.*

Cemile remarked in the given excerpt (1) that the content disjointedness between her faculty curriculum and the content of SKT caused anxiety for her in the preparation process of SKT. She also stressed that the topics and subjects she had to study were much dispersed.

(2) *It was an examination with an invalid content. There were few questions of pedagogic grammar. Additionally, there were not questions of translation, dialogue, irrelevant sentence. It was full of disappointment and negatively surprising. I wish I had not studied subject knowledge topics. I am so worried since had studied a lot to those topics since I forgot them. I wish I had also studied paragraph questions more.*

In the given excerpt (2), Tülay stressed that it was an invalid examination due to its content validity. For her, it was a total disappointment since SKT contained few questions on pedagogic grammar; furthermore, there were not any questions on translation, dialogue, questions that break coherence and paragraph completion. She expressed that the new distribution of the topics and subject in SKT was completely surprising and disappointing for her. Lastly, she was also disappointed since she studied the topics related to subject field instead of studying paragraph question in language proficiency.

The interviewees expressed their workload during the preparation process of SKT. They all claimed that the congestion of the topics and subjects at their faculties and the subjects and topics they had to study in SKT put a heavy burden on them.

(3) *When I tried to start to study SKT, I was locked up between the topics and subjects of SKT and my courses at the faculty. Because while you were trying to make a study plan, there was always something unexpected such as a project work, homework or a project of internship. Because of this workload on me prevented me to allocate time to study SKT efficiently.*

As mentioned in the given excerpt (3), Havva commented on the hardships in planning and organizing an effective study program; hence, this case prevented them to actualize a fruitful preparation

process for SKT. She also lamented that she had problems in organizing a simultaneous study program between SKT preparation and their faculty programs.

(4) *I have been taking this examination for two years. At the same time, I am working at a private school in order not to be a burden on my family and to linger on my life. We all know the private institutions in our country. They force us to work long hours like a slave by paying driblet salaries. You see, it is very difficult and heavy burden for me to study for SKT and work at a private school at the same time.*

Pelin in this excerpt (4) complained about her workload due to his working conditions in relation to the preparation process of SKT. She mentioned that she had been working like a slave at a private school in exchange for a minimum salary for two years in order not to be a burden on his family and to lead her own life. She argued that it was very difficult and heavy for her to study for SKT and to work at a private school as well.

The obscurity in their exam system and induction process depending on this examination system was mentioned by the interviewees.

(5) *The examination system of our country is constantly changing in every field and unfortunately these changes are made without informing the students who take those exams. There is a constant uncertainty about this. In addition, this uncertainty appears not only in the examination system, but also in the appointment process. ''Will there be an appointment this year? If so, how many appointments will we have in our branch? "These questions always occupy our mind.*

Kamil stated in the given excerpt (5) that the national examination system was constantly changing in every field, and unfortunately these changes were made without informing the exam takers before the essential time interval that the exam takers need to study. He also added that this obscurity appeared in not only the examination system, but also in the induction process in which the arising questions whether there would be induction or how many teachers would be assigned the following year were always sought answers by prospective teachers.

(6) *It was so cruel that a five-year-long exam was completely replaced without informing us, and we learned about it a little while ago. This leaves not only us, but also the publishing houses that help us to prepare for this exam in a difficult situation. For example, if you look for a resource or a test book that you will study according to this new exam system currently, you cannot find it. Why? Hoppp !!!! The content of SKT was changed. So these are the main problems that have to be considered on.*

Hasan claimed in this excerpt (6) that it was very cruel for them to change the content of SKT that was administered for five years without any reason and to learn this in a jiffy. He interpolated that this case not only affected the exam takers but also test-book publishers from whom the exam takers benefit in the preparation process of SKT.

Question 2: What was the most difficult section of SKT for you?

All the interviewees stated that the most difficult section of SKT was language proficiency section for them.

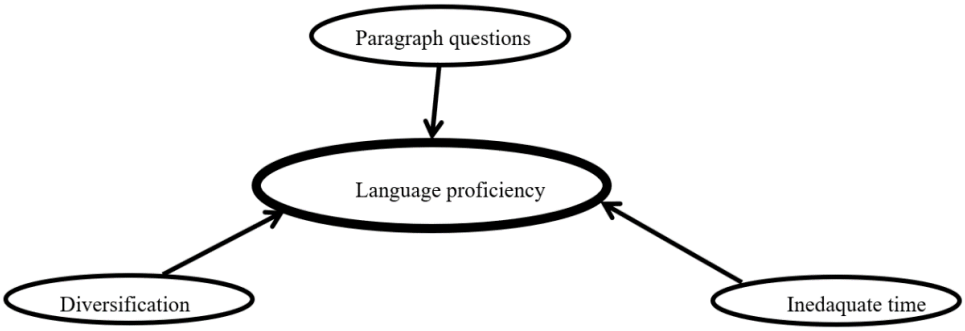

Figure 2. *Themes emerging from the second interview question*

When asked the underlying reason for their arguments, Ayberk expressed that the number of the proficiency questions was higher than he expected; therefore, he was not able to get around finishing them in time. Additionally, Havva indicated her extemporaneousness for the language proficiency questions since subject knowledge test topics engrossed her preparation process for SKT.

(1) *ASPC should have informed us about the paragraph questions beforehand.*

(2) *The types of paragraph questions should be diversified, or the time allocated to these paragraph questions should be extended.*

(3) *Paragraph questions are high in number. Pedagogic grammar questions should be directed instead.*

(4) *For me, the number of the paragraph questions are outnumbering, furthermore I think that they do not measure our grammatical performance.*

The given excerpts of the interviewees (1-4) mainly centred upon the paragraph questions in language proficiency section. They mentioned that ASPC should give information about the additional inclusion in the number of these paragraph questions. Furthermore, they argued that the time allocated for the examination should have been extended and the types of these paragraph questions should have been diversified to measure also their grammatical knowledge.

Question 3- Was it an examination that met your expectations?

All the interviewees stated that SKT did not meet their expectations in terms of selecting ELT prospective teachers who were proficient and competent in their fields.

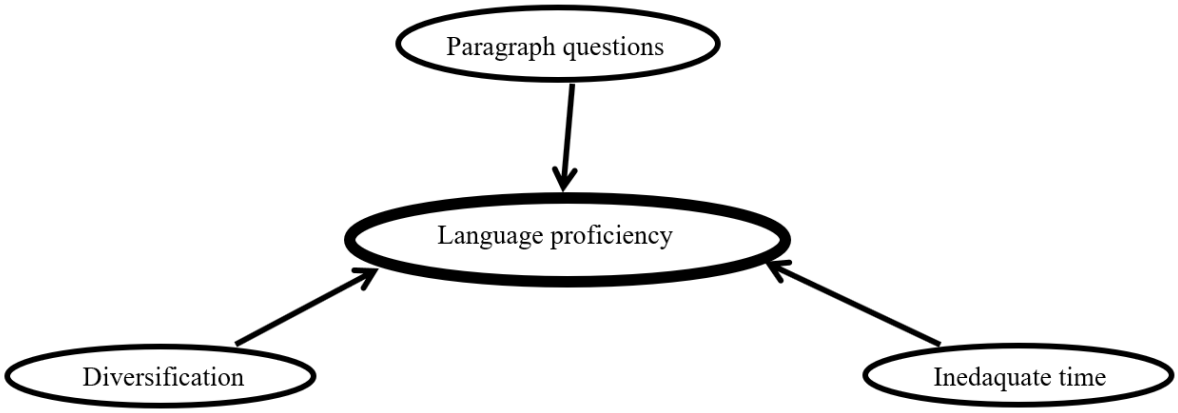

Figure 3. *Themes emerging from the third interview question*

(1) *The examination was not an examination that would measure what and to what extent we know about our subject field. The distribution of the topics and subjects was terrible. Hence, I am of the opinion that there should be an equal distribution in the numbers of questions with respect to the topics and subjects.*

Serap stated in the given excerpt (1) that it was not a test which measured their subject knowledge. In that, the distribution of the questions with respect to the topics and subjects was poor for her; hence she recommended an equal distribution in the numbers of the questions with regards to the topics and subjects for SKTs that would be held in the following years.

(2) *We already respond questions related to pedagogic topics in SKT. Therefore, it is nonsense for me to take those questions in educational sciences section. To me, it will be better and beneficial for us an increase in the number of questions related to the topics of approaches and methods.*

Merve pointed in this excerpt (2) that they responded questions related to pedagogic topics therefore it was nonsense for her to be responsible for the educational sciences in the afternoon section of CEEPP. This problem, for her, might be obviated by increasing the number of the questions in the methodology

and approaches topics and subjects of SKT, and abrogating educational sciences in the afternoon section of CEEPP for ELT prospective teachers.

> (3) *I will graduate at the end of this semester. I tried to answer the questions of SKT held in 2019; however, I encountered with some topics and subjects which I have never seen throughout my discipleship at the university. This examination is far from measuring our knowledge and performance in our subject-field.*

In this excerpt (3), Ayberk mentioned that he downloaded the questions of the recent SKT (2019) and tried to answer them. However, there were questions from the topics which he had never seen before. He claimed that it was very difficult for him to finish all these topics and subjects in time. Fundamentally, he stressed upon the poorness of the new distribution of the topics and subjects in measuring their competencies and performances.

> (4) *I do not really understand the mentality in directing cloze test questions to SKT exam takers. If you want to do something you should also implement a psychology test to SKT exam takers. Additionally, an examination based on measuring our four basic skills in EFL, such as IELTS or TOEFL, should be administered if we will be inducted as English teahers.*

Lastly, İbrahim in this excerpt (4) remarked the whimsicality of asking cloze tests to ELT students. For him, all prospective teachers should be given a Psychological test before inducting them. In addition to that, SKT should be implemented as an examination that was based on measuring their competence and performance with respect to four basic skills as was in IELTS or TOEFL (He directed his ideas to the stakeholders; ASPC and MoNE).

5 | Discussion

This study attempted to annunciate the perceptions and suggestions of the prospective ELT teachers related to the new distribution of the topics and subjects in SKT since this examination plays a crucial role for their future lives. From 2013, the average number of ELT prospective teachers who take SKT each year is 20.000, and an average number between 1500 and 3000 of these ELT prospective teachers are inducted to the public schools throughout the country. In teacher training programmes, recruitment of prospective teachers is regarded as a kernel issue (Ronfeldt, 2015). Hence, for their employability in the public positions, the success in SKT for the exam takers not only depends on themselves and their preparation process, but also the other factors related to the examination system which measure their subject knowledge and language proficiency.

There are at least five different undergraduate programs at the universities which provide ELT education for their graduates. The differences and inconsistencies between the curricula of these different undergraduate programs and the topics and subjects in SKT pose a major problem for ELT prospective teachers. In addition to this situation, ELT prospective teachers are not supported and informed sufficiently about SKT and its content by their instructors or academic members of their faculties (Şimşek & Akgün, 2014; Karaer[1]et al., 2018). It is an undeniable fact that university education on the subject and field knowledge is very important for prospective teachers. The ELT prospective teachers, especially graduating from the undergraduate programs apart from Department of English Language Teaching as illustrated in Table 7 (the demographic distribution of the programmes) face a number of challenges mainly stemming from absences of the pedagogic topics and subjects in their educational sciences. Although they try to close this gap by attending to the private education institutions which provide SKT courses, this compensation for these topics and subjects for the preparation process do not suffice for them. Another significant result emerged from the survey that the new distribution of the topics and subjects in SKT does not select prospective ELT teachers who are competent in their fields with regards to its purpose. A possible explanation for this might stem from the fact that the content of the questions in the new distribution of the topics and subjects in SKT are scant as they do not correspond to the topics and subjects in these fields as was in ELT.

When compared the distribution of the topics and subjects in the previous SKTs to the new distribution of the topics and subjects in the recent SKT, the disapprobation of ELT prospective teachers mainly centred

upon language proficiency questions; forwhy the most challenging topic in the recent SKT was language proficiency section for the majority of ELT prospective teachers. This may have resulted from the fact that they did not have an expectation for the increase in the number of these types of questions. This uncertainty and caliginosity of the selection and testing procedures in Turkey have always engendered hardships for the exam takers. Hence the wash-back effect of these examinations has always been negative for the prospective teachers. This case was also valid for the test takers of CEEPP implemented for other public positions (Sönmez & Atav, 2013; Erdem & Soylu, 2013). Although recent literature revealed that there should be a valid and reliable examination in the selection and induction process of prospective teachers, the content of the new distribution of the topics and subjects in the recent SKT was not satisfactory for ELT prospective teachers in selecting the qualified teachers in their fields. Lastly, the time allocated to these type examinations does not suffice for the examinees to complete the test in time. Therefore, the timing procedure in such tests should be well-calculated since the examinees are also work against the time.

The interviews held with ten ELT prospective teachers revealed integral results with those of the survey results; in that content disjointedness, content validity, workload, lack of resources and obscurity were the emerging problems related to the new distribution of the topics and subject in SKT. The interviewees' major focus was centred upon what they obtained from their faculties and what they were tested for the induction. This content disjointedness between their faculty programmes and the examination procedure of ASPC also brings the problem validity in SKT. Additionally, resulting from the obscurity in the examination and induction process, the SKT exam takers are not able to plan their future careers since there are two ways for being an ELT teacher in Turkey; whether you have to study SKT until the induction in a public school or work at private institutions or schools. The prospective teachers who prefer working in these private institutions or schools face with laborious working conditions such as long working hours in exchange for insufficient salaries. Another problem resulting from the obscurity is that the shortage of the resources that they benefit from in the preparation process of SKT. The test-book publishers are not able to catch up with these constant changes in these kinds of examinations; as a result, there is always neediness of exam preparation books and test-books that are major sources that contain pending topics and subjects with regards to the topics and subjects.

6 | Conclusion

Pre-service teachers initial aim is to be inducted after completing their programmes; however, their quality and ability is not always at desired levels based on the criteria of their educational policies (Chevalier et al, 2005). Therefore, the main goal of SKT should select prospective teachers who have essential knowledge and concepts in their fields and implement these essential knowledge and concepts in an effective way into the classroom setting (Ingvarson et al., 2004). The new distribution of the topics and subject in the new SKT falls short in actualizing this goal. Taking into consideration this ineffectiveness of the recent SKT, a number of suggestions might be proposed to put into action a more comprehensive ELT prospective teacher selection and induction process.

Firstly, it is an undeniable fact that there is disjointedness among the stakeholders (MoNE, ASPC and Faculties of the Universities and State Personnel Administration) in this selection procedure of prospective teachers. This lack of cooperation among the stakeholders has always engendered problems. MoNE and Universities and State Personnel Administration should orginize and put into action at least five year plan for a persistent induction regulation; thereby the students who will attend the education faculties should know beforehand the number of the vacant positions in the induction process in their fields. Secondly, a consistent and coherent testing procedure should be prepared and implemented under the cooperation of the education faculties and ASPC for all undergraduate programs. Furthermore, the topics and subjects in this testing procedure should be announced to SKT takers beforehand, in this way they will be cognizant of what to study and how much time to spend for this preparation process.

The last suggestion for the selection process of ELT prospective teachers is related to rendering the theoretical knowledge into practice. Hence the selection process should not only be limited to measure prospective teachers' knowledge and concepts which are basic essentials in their subject field but also the practicum process they participate in their senior years should be taken into consideration in this paradigm. However, the existing drawbacks and problems emerging from both internal and external factors confine to pursue a fructiferous practicum processes administered by MoNE and education faculties. Hereby, the stakeholders especially, MoNE and the deaneries at the universities should follow a consolidated and explicit practicum plan. This plan should include some significant items such as preparing a curriculum, contriving detailed evaluation criteria and educating highly qualified mentor teachers who will assist ELT prospective teachers. With this respect a further research might be conducted which investigates whether the practicum should be taken into consideration as a measurement and evaluation criterion in the selection and induction process of ELT prospective teachers and whether a skill based SKT as is in IELTS and TOEFL would be beneficial in choosing qualified ELT prospective teachers.

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Efficacy Beliefs and Metacognitive Awareness in English Language Teaching and Teacher Education

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Abstract

Teacher self-efficacy and metacognitive awareness could be regarded as significant in teaching and teacher education due to psychological and cognitive aspects of them which are directly linked to quality of teaching since 21st century skills which involve elaborate use of cognitive skills also necessitate teachers having those skills as well, which is part of metacognitive awareness. Thus, this paper presents findings of a mixed-method study that has been conducted with pre-service (*N*=97) and in-service (*N*=53) English language teachers on their perceived levels of teacher self-efficacy and metacognitive awareness and aimed to explore any similarities or differences between the two groups in the two variables taking into account that a comparison could reveal further issues to consider such as factor leading to them. For this purpose, teacher self-efficacy scale developed and validated by the researchers and Metacognitive Awareness Inventory (Schraw & Dennison, 1994) were administered to the participants and followed by semi-structured interviews focusing on in-depth analyses of quantitative data. The findings indicated that in-service teachers had higher levels of metacognitive awareness than pre-service teachers whereas levels of their teacher self-efficacy were not significantly different. Qualitative data, on the other hand, suggested a number of factors leading to that difference.

Keywords: Teacher self-efficacy, metacognitive awareness, English language teacher education

İngilizce Öğretmenliği ve Öğretmen Eğitiminde Öz-Yeterlik İnançları ve Üst Bilişsel Farkındalık

Öz

Bilişsel becerilerin etkili biçimde kullanılmasını içeren 21. Yüzyıl becerilerinin vurgulandığı bir eğitim sisteminde, öğretmenlerin de bu becerilere sahip olması gerektiğinden dolayı, öğretmen öz-yeterliği ve üst bilişsel farkındalık kavramları etkili öğretim ile doğrudan ilişkili psikolojik ve bilişsel yönleri nedeniyle öğretimde ve öğretmen eğitiminde önemli yer tutmaktadır. Bu doğrultuda, bu makale, gruplar arası karşılaştırmanın olası benzerlik ve farklılıkları ve bu farklılıklara sebep olabilecek etmenleri ortaya çıkarabileceği düşüncesiyle, 97 İngilizce öğretmeni adayı ve 53 İngilizce öğretmeninin öz-yeterlik ve üst bilişsel farkındalıkları konularındaki algılarını karşılaştıran karma çalışma yöntemiyle yürütülmüş bir çalışmanın bulgularını sunmaktadır. Bu amaçla, araştırmacılar tarafından geliştirilen ve geçerlik güvenilirlik analizleri yapılan öğretmen öz-yeterlik ölçeği ve Üst Bilişsel Farkındalık Envanteri (Schraw & Dennison, 1994) katılımcılara uygulanmış ve nicel veri yarı yapılandırılmış görüşmelerden elde edilen nitel veri ile desteklenmiştir. Çalışmanın bulguları, hizmet içi İngilizce öğretmenlerinin hizmet öncesi İngilizce öğretmenlerinden daha yüksek üst bilişsel farkındalık düzeyine sahip olduğunu ortaya koymuştur, ancak iki grup arasında öğretmen öz-yeterliği bakımından önemli bir fark gözlenmemiştir. Çalışmanın nitel verisi ise bu farklılıklara sebep olan birtakım etmenler ortaya koymuştur.

Anahtar kelimeler: Öğretmen öz-yeterliği, üst-bilişsel farkındalık, İngilizce öğretmeni eğitimi

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1 | Introduction

Effective teaching is the ultimate goal of educational programs and involves qualifications for teachers proposed in the literature (e.g., Chen, Brown, Hattie, & Millward, 2012; Stronge, Tucker & Hindman, 2004). Effective language teaching, on the other hand, is defined as "clear and enthusiastic teaching that provides learners with the grammatical (syntactical and morphological), lexical, phonological, pragmatic, and sociocultural knowledge and interactive practice they need to communicate successfully in the target language" by Bell (2005, p. 260), and it is a multi-faceted process that requires language teachers to have knowledge about languages and competency and effective use of instructional strategies. This aspect is also involved in metacognitive awareness defined as one's awareness about his or her knowledge and how to apply that knowledge. Additionally, teachers' beliefs about how well or how much they could achieve teaching related tasks, which refers to teacher self-efficacy (Tschannen-Moran & Hoy, 2001) could be considered as part of effective teaching since beliefs are accepted to have upmost importance in shaping behaviors. Therefore, this study aims to focus on these two concepts in English language teacher education and teaching. Also, a comparison is made between pre-service and in-service EFL teachers so as to reveal any similarities or differences and (if any) possible factors leading them, which is neglected in the literature. Yet, any similarities or differences between the two groups in the related concepts could enhance understanding of other associated elements in language teaching and teacher education. Thus, this study focuses on exploring EFL teachers' (pre-service and in-service) self-efficacy beliefs and metacognition in light of a number of probable demographic and contextual factors.

Bandura's (e.g., 1989; 1997; 2001) *Social Cognitive Theory* stating that human actions are result of personal factors and an interaction with social environment (also called as "*Triadic Reciprocal Determinism"* (e.g., Bandura, 1997)) is the theory laying behind the concept of self-efficacy. Also playing a significant role in learning, self-efficacy is defined as a person's beliefs about his or her capabilities in achieving a task (e.g., Tschannen-Moran & Hoy, 2001). To this end, sources of efficacy beliefs could be either personal emotional states "*mastery experiences and physiological arousal*" or aspects of social interaction "*vicarious experiences* and *social persuasion*". In other words, efficacy beliefs are shaped through previous achievements (*mastery experiences)*, observing a model *(vicarious experiences)*, support and encouragement of others (*social persuasion)* or moods and feelings *(physiological arousal).* According to Bandura (1997) the most sustainable beliefs are the result of mastery experiences as they are shaped through individual long-term attempts and achievements.

Teacher self-efficacy, on the other hand, that could be defined as a teacher's beliefs about his or her capabilities to fulfil teaching related tasks (Tschannen-Moran & Hoy, 2001) has been explored in terms of sources, and so far, studies have put forward variation in the findings. In one of these studies, Tschannen-Moran and Hoy (2007) carried out a study that compared novice and experienced teachers in two states of the U.S. about the sources of their self-efficacy beliefs. The findings of this study indicated that teachers' previous experiences (mastery experiences) and support (social persuasion) were the main sources for novice teachers while these sources were not equally important for the experienced teachers in the study. In a similar vein, Clark and Newberry (2019) explored sources of self-efficacy beliefs of 783 pre-service teachers in the U.S.A. The data of the study that were collected through a quasi-experimental study design revealed that all sources; *"mastery experience, vicarious experience, social persuasion and physiological arousal"* were effective in the participants' perceived levels of teacher self-efficacy beliefs. As a suggestion, the researchers indicated that other contextual factors are to be looked into.

Various contextual factors such as school setting (e.g., Ma & Cavanagh, 2018) have commonly been associated with levels of teacher self-efficacy and asserted to have either positive or negative impact on teacher self-efficacy (e.g., Chen & Yeung, 2015; Knoblauch & Chase, 2015; Tschannen-Moran & Johnson, 2011). To this end, the findings of Caprara, Barbaranelli, Steca and Malone's (2006) study the aim of which was to explore any probable relationship among the concepts of self-efficacy, job satisfaction and student achievement and which was conducted with more than 2000 in-service teachers revealed that there was

a statistically significant relationship among these elements commenting on that any increase or decrease in the levels of self-efficacy beliefs affected job satisfaction and student achievement in turn. Similarly, in a quantitative study carried out with 2249 Norwegian teachers on the relationship between teacher-self-efficacy and job satisfaction or burn-out, Skaalvik and Skaalvik (2010) revealed that there was no positive connection among the factors, which was contrary to the study of Caprara et al. (2006). Additionally, despite being limited, research on teacher self-efficacy and contextual factors in ELT has put forward that undergraduate education, practicum and language proficiency have a positive impact on pre-service EFL teachers' self-efficacy beliefs (Sevimel & Subaşı, 2018). On the other hand, a mismatch between the content of the courses during undergraduate education and real classroom conditions has been suggested to have a negative impact on pre-service teachers' perceptions (e.g., Seferoğlu, 2006).

Demographic factors of gender, years of experience and academic achievement have also been regarded as possibly effective factors on the levels of teacher self-efficacy (e.g., Alcı & Yüksel, 2012; Merç, 2015; Klassen & Chiu, 2010; Sarıçam & Sakız, 2014). Yet, existing research has set forth opposing findings on the function of demographic factors especially the function of gender and experience. While gender has emerged to have either no effect (e.g., Merç, 2015) or significant effect also connected to concepts of burn-out and stress (e.g., Klassen & Chiu, 2010), academic achievement has been reported to be a significant determinant of pre-service teachers' self-efficacy beliefs (e.g., Külekçi, 2011).

A comparison between self-efficacy beliefs of pre-service and in-service teachers has been one of the focuses in teacher self-efficacy research (e.g., Azar, 2010; Campbell, 1996; Dolgun & Caner, 2019). These studies have set forth different findings and highlighted the effect of contextual factors in the differences. For instance, Azar (2010) conducted a study on pre-service and in-service secondary science teachers' self-efficacy, and the findings suggested that there was no significant difference between the two groups. On the other hand, the study of Campbell (1996) revealed that there was a difference between these two groups as pre-service teachers had higher levels of self-efficacy. In English language teaching research, Dolgun and Caner (2019) found no difference between pre-service and in-service teachers in the study, but they suggested factors influencing language teachers' self-efficacy beliefs.

Metacognitive awareness (or metacognition) that is defined as a person's higher order skills about their knowledge and how to apply that knowledge is a concept that could be associated with teacher self-efficacy, which is the other focus of the current study. In the literature, metacognition is categorized as *metacognitive knowledge*; *declarative* (knowledge of what), *procedural* (knowledge of how) and *why* (knowledge of conditional) and *metacognitive regulation*; cognitive activities to organize knowledge such as planning, monitoring comprehension (eg., Schraw & Dennison, 1994). On the other hand, teachers' metacognitive awareness involves skills such as "*preparing and planning for learning*, *selecting and using learning strategies*, *monitoring strategy use*, *orchestrating various strategies* and *evaluating strategy use and learning"* (Anderson, 2002, p. 3). Furthermore, "*promoting content learning*, *identifying appropriate strategies*, *making moment-to-moment decisions to ensure students' learning* and *adjusting for individual differences"* (Duffy, Miller, Parsons & Meloth, 2009, p. 3) are other proposed skills included in teachers' metacognitive awareness and these skills are particularly important in the new era due to emphasis on 21st century skills such as critical thinking.

Metacognitive awareness has been addressed in teacher education and teaching research (e.g., Baylor, 2002; Bulut, 2018; Metallidou, 2009; Wilson & Bai, 2010) in consideration of abovementioned importance of it. In one of those studies, Şendurur, Şendurur, Mutlu and Başer (2011) explored metacognitive awareness of pre-service teachers considering demographic factors of gender, educational background and academic achievement that was addressed with GPA scores of the participants. Data collected quantitatively were analyzed, and it emerged that all demographic factors in the study were effective in the difference among the groups. With that regard, female pre-service teachers in the study had higher GPA scores and metacognitive awareness levels than male pre-service teachers, which suggested that gender was an effective factor for the group differences in the levels of metacognitive awareness and GPA

scores. Moreover, it was reported that educational background addressed through type of high school which the participants graduated from in the study was effective in the difference.

As to language teacher education and teaching research, research has focused on general aspects of language teachers' metacognition and the concepts related to it (e.g., Nahrkhalaji, 2014; Öz, 2015; 2016; Sarıçoban, 2015). For instance, Nahrkhalaji (2014) investigated possible influence of metacognitive awareness on EFL teachers' (N=50) teaching performance and whether demographic factors of gender, educational background and teaching experience were effective in the levels of metacognitive awareness of the participants. To this end, it was found out that educational background and teaching experience were effective in the difference between the groups. However, there have been studies revealing no significant effect of background factors on metacognition of pre-service EFL teachers (e.g., Öz, 2016; Sarıçoban, 2015).

Overall, although studies have addressed both pre-service and in-service teachers' self-efficacy and metacognitive awareness separately, the research concern is that they have either been conducted in other fields of teaching than language teaching or concerned beginning teachers, which has also been suggested in the literature (eg., Atay, 2007; Koçoğlu; 2011). Additionally, through a review of literature, it is easy to detect that there is lack of research on both pre-service and in-service EFL teachers' self-efficacy beliefs in Turkey. Specifically, no study in Turkey has compared pre-service and in-service EFL teachers' efficacy beliefs and metacognition. However, any similarities or differences to be revealed as a result of comparison between the two groups could enhance understanding of related concepts in English language teacher education and teaching. Therefore, the current study aims to address the following research questions:

1. What is the extent of EFL teachers' (pre-service and in-service) perceived self-efficacy and metacognitive awareness?

2. Are there any similarities/differences in the levels of self-efficacy and metacognitive awareness between pre-service and in-service English language teachers? If so;

a) Are there any factors effective in the similarities/differences between the two groups?

2 | Method

Population and Sample

In light of these research questions, one of the state universities in Turkey was determined as the setting of the study. As the focus of the current research was to address both pre-service and in-service English language teachers, the setting was determined as two faculties/schools of that university. That is, while the setting for pre-service teachers was Faculty of Education, English language teaching (ELT) department of the university, data related to in-service teachers were collected at the School of Foreign Languages of the university. As to eligibility of that university, it admits students among top achievers of university entrance exam in Turkey, which could enable to analyze especially metacognitive awareness of pre-service ELT teachers. Therefore, School of Foreign Languages of the university was determined as the convenient setting for in-service teachers.

The participants were 96 senior students at ELT department of the university and 53 English lecturers working at the School of Foreign Languages. Since one of the focuses of the study is to investigate whether demographic factors have an impact on teacher self-efficacy or metacognitive awareness, the participants were selected among volunteers by considering this focus and they filled out an informed consent form informing about the processes involved in the study. Table 1 and 2 demonstrate demographic aspects of the participants.

Table 1. The Group of Pre-service EFL Teachers

Gender (M=1.21 SD=.41)		Age (M=1.09, SD= .38)			GPA (M=3.08, SD= .65)		
Female	Male	20-26	27-35	45+	1.5-2.99	3.00-3.50	+3.50
75	21	89	6	1	17	54	25

Table 2. The Group of In-service EFL Teachers

Gender (M=1.11, SD=.31)		Years of experience (M=2.81, SD=.78)			
Female	Male	0-5	6-10	11-20	20 +
47	6	2	16	25	10

Research Design

The current study was designed as a mixed-method study. In this respect, quantitative data were collected through Likert type scales on the variables of the study. In order to support the quantitative data, the qualitative data were collected through semi-structured interviews. The collected data were analyzed through tests of quantitative and qualitative research methods.

Data Collection

The quantitative data on teacher self-efficacy were collected from pre-service EFL teachers through a scale that was developed and validated by the researchers referring to a number of resources such as the EAQUALS framework for language teacher training and development (2013) and adapted for in-service teachers. All phases of scale development related to validity and reliability were considered during the study. To this end, referring the sources aforementioned, 52 items addressing the categories of *planning*, *teaching*, *assessment* and *professional development* were selected from the item pool, and 12 items were removed by considering the expert judges' feedback. Moreover, one item was removed just before administering the construct as it was found to be confusing. The finalized version of the construct was administered to a group of 200 pre-service EFL teachers who were not involved in the target sample for pilot-study, and factor analyses were conducted on the collected data. As a result of these analyses, a one-factor construct with 23 items emerged, so it was administered to the same group (*N*=187) for test-retest analyses.

The developed scale (PLTES) included *planning, teaching, assessment and professional development* areas in 9-Likert scale type 23 items, and validation and reliability analyses revealed that the scale is valid and reliable (α= .93). Furthermore, *Metacognitive Awareness Inventory* (Schraw & Dennison, 1994) was the instrument employed to address metacognitive awareness of the participants following obtaining permission of the developers to use it in the study. The scale that involves 52 items on "*metacognitive knowledge (declarative, procedural and conditional)"* and "*regulation of metacognition (information management strategies, comprehension monitoring, debugging strategies and evaluation)"* has been commonly used, valid and reliable scale in the related literature (e.g., Akın, Abacı & Çetin, 2007; Harrison, & Vallin, 2018; Hughes, 2019). While there is variation in the response types for the items (eg., Yes/No responses or Likert-scale), 7 Likert-scale version was used in this study. Finally, semi-structured interviews in which there were questions on the participants' ideas about their self-efficacy beliefs (strength and areas for further development), metacognitive awareness in learning and teaching (how to transfer that knowledge into teaching) and factors considered as effective in the levels of self-efficacy and metacognitive awareness were conducted to collect qualitative data.

Data Analysis

Data were analyzed by using SPSS version 23 for quantitative data and NVivo 12 Pro for qualitative data. Accordingly, statistical analyses of descriptive statistics, normality tests, Independent-Samples T-test and Mann Whitney U test; One-Way ANOVA and Kruskal Wallis H test were conducted in order to analyze data for research purposes. Furthermore, qualitative data that were collected from semi-structured interviews were coded in light of the themes in the interview questions for content analyses and analyzed to provide in-depth support for quantitative data. For inter-reliability, coding and content analysis were conducted by another researcher in the field, and the analyses were compared to finalize.

Research ethics

Ethical concerns were handled before conducting the research and required permission to conduct the study was obtained from Ethics Committee of a state university in Turkey (dated March 1st, 2018 and numbered 35853172/433-938). Also, department heads of the settings in question were informed about the study and the processes involved, thus, they were requested permission to carry out the study in their departments. The principle for recruiting participants into study was on a voluntary base. Therefore, the participants were informed about the study and that no personal information was to be used and their consent to participate was documented through a consent form.

3 | Findings

Self-efficacy and Metacognitive Awareness of EFL Teachers

In order to explore self-efficacy beliefs and metacognition of EFL teachers, the scales were administered to the participants, and the data were analyzed quantitatively though descriptive statistics. See Table 3 for pre-service EFL teachers' perceived self-efficacy.

Table 3. Self-efficacy of Pre-service EFL Teachers

Components of teacher self-efficacy	M	SD
Planning	7.08	1.19
Teaching	6.63	1.08
Assessment	6.74	1.10
Professional development	6.78	1.26

As illustrated in the table, pre-service EFL teachers had higher levels of perceived self-efficacy for the component of planning. Furthermore, data on metacognitive awareness revealed that they were aware of knowledge and regulation components of metacognitive awareness when considering nearly equal mean values except for component of evaluation. See Table 4 for pre-service EFL teachers' metacognition.

Table 4. Metacognitive Awareness of Pre-service EFL Teachers

	M	SD
Declarative	5.35	.92
Procedural	5.2	1.08
Conditional	5.35	.99
Planning	5.21	.99
Information management	5.32	1.08
Monitoring	5.13	.86
Debugging	5.72	.98
Evaluation	4.81	1.1
Metacognitive knowledge	5.32	.9
Regulation of cognition	5.23	.91

On self-efficacy beliefs of in-service English language teachers, the findings indicated that they also had higher values for planning component of the scale, which is demonstrated in Table 5.

Table 5. Self-efficacy of In-service EFL Teachers

Components of teacher self-efficacy	M	SD
Planning	7	1.26
Teaching	6.94	1.33
Assessment	6.71	1.30
Professional development	6.11	1.87

As to their metacognitive awareness, the results suggested that mean values of the components were nearly equal indicating that they were both aware of their knowledge and how to apply that knowledge. See Table 6 for descriptive statistics of in-service EFL teachers' metacognitive awareness.

Table 6. Metacognitive Awareness of In-service EFL Teachers

	M	SD
Declarative	5.68	.77
Procedural	5.47	.83
Conditional	5.59	.71
Planning	5.47	.80
Information management	5.75	.68
Comprehension monitoring	5.31	.87
Debugging strategies	5.95	.72
Evaluation	5.28	.97
Metacognitive knowledge	5.60	.71
Regulation of cognition	5.56	.67

Differences in Self-efficacy and Metacognitive Awareness of English Language Teachers

In addition to data collected from pre-service and in-service English language teachers on their teacher self-efficacy and metacognition, a comparison was made between the two groups for in-depth analyses to enhance understanding of related concepts. For this purpose, quantitative data were analyzed statistically following normality tests. The output of Kolmogorov Smirnov test revealed that variables had significant values, thus, did not have normal distribution (*teacher self-efficacy*; Skewness of -.71 (*SE*=.19) and Kurtosis of -.19 (*SE*=.39) and *metacognition;* Skewness of -.40 (*SE*=.19) and Kurtosis of .12 (*SE*=.39) ($p < .05$). Thus, nonparametric Mann Whitney U tests were conducted for comparison of the two groups and the analyses suggested that while there was no statistically significant difference between pre-service (*Mdn*=6.91) and in-service (*Mdn*=6.95) EFL teachers in their self-efficacy beliefs (*U*=1450, *p*=.70), there was a relatively significant difference between the two groups (pre-service; *Mdn*=5.25 and in-service; *Mdn*=5.71) in their metacognitive awareness (*U*=1965, *p*=.02, *d*=.3)

Factors Effective in Self-efficacy and Metacognitive Awareness of English Language Teachers

That the findings revealed a significant difference in metacognitive awareness of pre-service and in-service EFL teachers made it necessary for further research into the factors possibly effective in the stated difference. Accordingly, *gender* and *academic achievement* were associated with self-efficacy and metacognitive awareness of pre-service teachers whereas *gender* and *years of experience* were investigated in relation to in-service teachers. Furthermore, qualitative data set forth other associated factors.

Being normally distributed (teacher self-efficacy; Skewness of -.58 (*SD*=.24) and Kurtosis of .17 (*SD*=.48) and *metacognition;* Skewness of -.17 (*SD*=.24) and Kurtosis of -.09 (*SD*=.48) (p=2), the data collected from pre-service were analyzed statistically by conducting parametric tests of Independent Samples t-test (Student-t) (for gender) and One-way ANOVA (for achievement groups). The output of Student t-test revealed that there was no significant difference between male (*M*=6.99, *SD*=.89) and female (*M*=6.7, *SD*=1.08) teachers in their self-efficacy beliefs ($t(94)= 1.1$, $p>.05$) and metacognition (female; *M*=5.26, *SD*=.91 and male; *M*=5.27, *SD*=.80, $t(94)= .05$, $p>.05$). As to academic achievement, the output of Bonferroni post-hoc tests of One-way ANOVA stated that academic achievement was effective both in teacher self-efficacy (F (2, 93) = 4. 97, p=.009, η_p^2=.097) and metacognitive awareness (F (2, 93) = 4.22, p=.017, η_p^2=.083) and the group who had highest GPA scores (above 3.5) also had higher levels of teacher self-efficacy and metacognitive awareness.

Gender and years of experience were examined as factors that could possibly cause a difference among the groups. To this end, nonparametric tests of Mann Whitney U test (for gender) and Kruskall Wallis H test (for experience) were conducted as the data had significant values (*teacher self-efficacy*; Skewness of -.79 (*SE*=.32) and Kurtosis of -.02 (*SE*=.64) and *metacognition;* Skewness of -.79 (*SE*=.32) and Kurtosis of (*SE*=.64). The output of Mann Whitney U test revealed that there was no statistically significant difference between female (*Mdn*= 6.95) and male (*Mdn*= 6.91) teachers in the levels of teacher self-efficacy (*U*= 140.5, *p*=.98, *d*=.0) and metacognitive awareness (female; *Mdn*=5.71 and male; *Mdn*= 5.53, *U*=125.5, *p*=.66, *d*=.0). As to *years of experience*, the analyses conducted through Kruskal Wallis H test pinpointed no significant difference among the groups in their self-efficacy ($H(3)$=4.95, p=.17; mean ranks of 7 for 0-5 years group, 26.9 for 6-10 years group, 26.2 for 11-20 years group and 33 for more than 20 years group) and metacognitive awareness ($H(3)$= 1.91, p=.59; mean ranks of 34.5 for 0-5 years group, 25.1 for 6-10 years group, 25.6 for 11-20 years group and 31.9 for more than 20 years group).

In addition to demographic factors, analyses of qualitative data revealed a number of associated factors with self-efficacy beliefs and metacognitive awareness. To this end, undergraduate education, practicum (in a positive manner) and discrepancy between theoretical courses in teacher education and real classroom setting (in a negative manner) were commonly stated factors by pre-service teachers while high or low

level of learner motivation, workload and lack of support by the administration were regarded as related factors to self-efficacy beliefs and metacognition of in-service language teachers. See extracts below:

PT5-male/ GPA; 1.5-2.99: *"I feel efficacious particularly about lesson planning thanks to high standard education we got at this university. I think I got trained even more than enough because we prepared too many lessons plans and were supervised too much. Therefore, I do not think that I will have any problems about lesson planning."*

PT3-female/ GPA; 1.5-2.99: *"I believe I definitely need to improve my abilities about classroom management because even during practicum, there used to be an experienced teacher with us (either the teacher at that school or our supervisor) and they would always lead us. I have no experience teaching children and managing class on my own. Although I know what is necessary to do for classroom management in theory, I do not think that I will be able to manage it well in practice. I mean I am not efficacious enough about that."*

Interviews also included data about pre-service and in-service English teachers' metacognitive awareness. To this end, qualitative data revealed whether the participants could transfer their metacognitive awareness in their teaching practices. Accordingly, while some of the participants responded positively, others expressed factors affecting them for transferring their metacognitive awareness. See the extract below as evidence.

T7-female/ completed degree; MA/11-20 years of teaching: "*Visualizing is important for me or leading from familiar to unfamiliar, most frequent to least frequent, these are cognitive skills that I use the most and I use them in my teaching, too. You know there is famous saying: the way you learn become the way you teach, so I think I can transfer my knowledge and cognitive skills in my teaching in different pace of a lesson.*"

T11-female/ completed degree; MA/11-20 years of experience: "*I think technological improvements affect a teacher's self-efficacy. Well, actually, I would say learner motivation. I know it is a cliché, but it is definitely the case for us. We wonder why we could not motivate them. Maybe, it is because of us or our techniques and practices are not appealing to them. Overall, they affect a teacher's efficacy either positively or negatively.* "

Overall, this study revealed that there was no significant difference between pre-service and in-service English language teachers in their efficacy beliefs and metacognition regardless of demographic factors. Still, there were contextual factors influencing especially the levels of their self-efficacy mainly undergraduate education and practicum for pre-service English language teachers and such as student motivation for in-service teachers.

4 | Discussion & Conclusion

The current study investigates efficacy beliefs and metacognition of EFL teachers (pre-service and in-service) in consideration to any differences or similarities between the two groups in the aforementioned variables and any factors effective in these variables. Thus, the data collected from the participants through scales on the variables and semi-structured interviews were analyzed quantitatively and qualitatively, and the findings suggested that there were no significant differences between the two groups in their efficacy beliefs and metacognitive awareness.

In existing research, there is no research on the comparison between pre-service and in-service EFL teachers' efficacy beliefs and metacognition. On the other hand, the studies focused on the two variables separately in other fields of teaching had converse findings (eg., Azar, 2010; Campbell, 1996). To this end, while Azar's (2010) study that was performed with secondary science teachers (pre-service and in-service) on their self-efficacy beliefs revealed no difference between two groups. However, in a previous study,

Campbell (1996) suggested that in-service science teachers seemed to have higher levels of self-efficacy than the pre-service group in the study. Similarly, metacognitive awareness of the two groups was compared in other fields of teaching. For instance, Metallidou (2009) investigated how problem-solving strategies were used by primary school teachers (pre-service and in-service), and the researcher found out that the group of in-service teachers could use strategies better than the group of pre-service primary school teachers, which could partly be associated with the finding of the current study which stated that in-service EFL teachers in the study had higher scores for their metacognition than pre-service teachers. This study could be considered as significant since it contributes to the literature by providing insight into EFL teachers' efficacy beliefs and metacognition and also revealing a difference between the groups, which has been neglected so far or investigated separately.

Examined to reveal any possible factors influencing prospective and experienced English language teachers' self-efficacy and metacognitive awareness, the data suggested a number of demographic or contextual factors that could be associated with the ones in the existing research either in a supporting or contradictory way. To start with, that the study revealed no effect of gender on teacher self-efficacy supports the findings of Merç's (2015) study that explored whether there was any relationship between self-efficacy beliefs and speaking anxiety of pre-service ELT teachers with respect to demographic function of gender and school setting. With regard to function of gender on metacognitive awareness, the study of Şendurur et al. (2011) revealed that gender, GPA scores and educational background of pre-service teachers were effective in their metacognitive awareness. However, while the findings of the current study on GPA scores support this study, the finding related to gender is not in line with it as no effect was traced regarding to gender, as also revealed in previous studies (e.g., Öz, 2015; 2016; Sarıçoban, 2015)

As to the findings related to connection between experience and teacher self-efficacy, the present study revealed no effect of it on teacher self-efficacy, which is not in line with the study of Chen and Yeung (2015) which suggested that experience causes a difference in the levels of teacher self-efficacy. Likewise, the findings of this study on the connection between metacognitive awareness and demographic factors of experience and educational background are not in line with existing research. For instance, Nahrkhalaji (2014) revealed that educational background and teaching experience played a role in metacognitive awareness of EFL teachers, which could not be supported by this study since there was no difference among groups of experience in their metacognition.

Among contextual factors having an impact on the participants' efficacy and metacognition, undergraduate education and practicum emerged to be positively effective in pre-service teachers' self-efficacy while student motivation was stated to be the most common factor influencing their efficacy beliefs by in-service teachers. Additionally, pre-service teachers stated that there was a mismatch between theoretical background that was presented to them and real teaching practices. In the literature, teacher self-efficacy has been considered as related to various concepts such as burn-out or stress for in-service teachers and contextual factors for pre-service teachers. Specifically, in ELT research, Sevimel and Subaşı (2018) examined associated factors with teacher self-efficacy by conducting a study with 113 pre-service teachers and found out that undergraduate education and teaching practice through practicum were considered to have a positive effect on the participants' self-efficacy. Yet, the participants stated that the content of the courses they took during their undergraduate education was not in line with real classroom contexts as it was so theoretical. Therefore, the finding of this study supports the study of Sevimel and Subaşı (2018) and findings of previous research (e.g., Atay, 2007; Koçoğlu, 2011; Seferoğlu, 2006) for mismatch between the amount and content of theoretical courses and real teaching practice.

As to in-service teachers, the literature mostly has connected teacher self-efficacy with contextual factors such as school setting (eg., Chen & Yeung, 2015; Knoblauch & Chase, 2015; Ma & Cavanagh, 2018), which is in accordance with the finding of this study as in-service teachers in the current study expressed that student motivation, workload and lack of support by the administration are among the factors influencing their self-efficacy. They considered the same factors as inhibiting for reflecting their metacognitive awareness into teaching practices. These findings are in line with the study of Chen and

Yeung (2015), who investigated self-efficacy beliefs of graduates of a language teacher education programs and found out that "teacher factors (language proficiency and teaching experience)", "student factors (student motivation and classroom management)" and "contextual factors (culture, class size and school district)" had an impact on teacher self-efficacy.

To conclude, this study presented that despite being small, differences were revealed between pre-service and in-service EFL teachers' efficacy beliefs and metacognition. Highlighted findings were in-service teachers' lower level of self-efficacy for professional development and pre-service teachers' lower level of metacognitive awareness for evaluating completed work or task. Considering the findings related to in-service teachers indicating that their efficacy about professional development was lower than planning or teaching and they could not focus on their development because of contextual factors such as heavy workload or lack of support by the institution, it could be suggested that professional development of teachers be encouraged by the support of educational systems and be involved in institutional policies in accordance. As to the findings related to pre-service teachers' lower level of metacognitive awareness for the sub-scale of evaluation, the suggestion is that there could be revision in the content of the programs. Pre-service teachers could be presented with more practical content in which they analytically think over situations and teaching practices. Thus, they could also reflect their metacognition into teaching. As a result, there would be no conflict between teacher education with highly motivated, efficacious and metacognitively aware candidates and teaching profession with language teachers who are in pursue of continuous professional development and it would result in effective language teaching. As to further research, the suggestion of this study could be that more studies comparing pre-service and in-service EFL teachers' self-efficacy beliefs and metacognitive awareness are especially necessary in order to shed light on differences between the two groups and possible factors effective in them as they may help improve conditions for language teaching and teacher education programs.

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STATEMENTS OF PUBLICATION ETHICS

The authors declare that this study has no unethical problem in consideration of research and publication ethics. In this sense, ethical issues were handled meticulously in that no plagiarism was attempted, and all the resources used were listed appropriately in the references.

RESEARCHERS' CONTRIBUTION RATE

This study was produced from the first author's Ph.D. Dissertation. Thus, the first author was primarily responsible for each and every phase of the study. The second author, the supervisor of the dissertation, contributed on the construct of the study by giving continuous constructive feedback.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Examining the Relationship between Computational Thinking, Lifelong Learning Competencies and Personality Traits Using Path Analysis

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Abstract

The purpose of this study is to determine the relationship between computational thinking, lifelong learning competencies and personality traits of university students. It was aimed to create a model that explains and predicts the relationship among the variables determined in the study. Convenience sampling method was used in determining the study group. Data were collected from 228 university students through social media. Descriptive statistics, correlation and path analysis were used to analyze the data. The results indicated that extroversion, agreeableness, and openness are statistically significant predictors of computational thinking. Among the personality traits, agreeableness yielded the greatest effect, while extroversion and openness resulted in medium effect on computational thinking. In addition, computational thinking significantly predicts lifelong learning competencies.

Keywords: Computational thinking, lifelong learning competencies, personality traits, university students

Bilgi İşlemsel Düşünme, Hayat Boyu Öğrenme Yetkinlikleri ve Kişilik Özellikleri Arasındaki İlişkinin Path Analizi Kullanılarak İncelenmesi

Öz

Bu çalışmanın amacı üniversite öğrencilerinin bilgi-işlemsel düşünme, yaşam boyu öğrenme yeterlikleri ve kişilik özellikleri arasındaki ilişkilerin tespit edilmesidir. Çalışmada belirlenen değişkenler arasındaki ilişkileri açıklayan ve yordayan bir model ortaya çıkarmak amaçlanmıştır. Çalışma grubunun belirlenmesinde uygun/elverişli örnekleme yöntemi kullanılmıştır. Betimsel tarama türündeki bu çalışmada, 228 tane üniversitede öğrenim gören öğrenciden sosyal medya üzerinden veri toplanmıştır. Verilerin analizinde betimsel istatistikler, korelasyon ve yol analizi kullanılmıştır. Araştırma sonucunda; yol analizi bulguları doğrultusunda, dışa dönüklük, yumuşak başlılık, ve deneyime açıklık, hesaplamalı düşünme üzerinde istatistiksel olarak anlamlı ve pozitif etkilidir. Kişilik boyutlarından yumuşak başlılık büyük derecede etkiye sahipken dışa dönüklük ve deneyime açıklık bilgi-işlemsel düşünme üzerinde orta etkiye sahiptir. Ayrıca, bilgi-işlemsel düşünme yaşam boyu öğrenme yetkinliklerini önemli ölçüde yordamaktadır.

Anahtar kelimeler: Bilgi-işlemsel düşünme, yaşam boyu öğrenme yeterlilikleri, kişilik özellikleri, üniversite öğrencileri

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1 | Introduction

For a qualified society in this era, individuals need to be well-trained by considering the specific needs of the society. The published development plans draw attention to the concept of developing competencies and lifelong learner in the context of current needs (Presidency Strategy and Budget Directorate, 2019). On the other hand, current conditions and needs require qualified manpower equipped with contemporary skills. Such skills that are defined as the 21st century skill set are being updated day by day with the addition of new ones, and the acquisition of these skills is vital with respect to lifelong learning competencies and problem solving ability (Alsancak-Sırakaya, 2019; Durak & Durak, 2020; Sayın & Seferoğlu, 2016). Computational thinking (CT) is defined as a must-have skill for everyone. For example, Wing (2006) defined CT as a way of computer thinking, problem solving, and system design by grasping the basic concepts of computer science. According to ISTE (2015), computational thinking is defined as a problem-solving approach that blends technology and thinking techniques and is applied to all fields. According to Gülbahar, Kert and Kalelioğlu (2019), today's students who are raised in digital era should be well-equipped individuals who have acquired 21st century skills, able to learn throughout life, and have high problem solving competencies. At this point, previous studies' findings suggest that it is important to support the relationship between lifelong learning competencies and CT skills in the continuity of these competencies. Along with the importance of this issue, it is necessary to investigate the relationship between CT skills and lifelong learning, and evaluate the findings in the context of lifelong learners, their personality traits, and competencies. However, there is no study addressing this relationship in the current literature. In addition, revealing the level of this relationship also have potential to contribute to the literature on the effects of personality traits that are hypothesized to have an effect on the research variables.

Computational Thinking

CT is defined as a thinking competence that includes understanding the basic concepts of computer science, problem-solving, system-design and human behavior (Wing, 2006). It is among the 21st century skills that future generations should develop (Zhang & Nouri, 2019). As explained by Barr, Harrison and Conery (2011), CT includes using computers and other tools to solve problems, and analyzing data, presenting data with abstraction, application of advanced solutions with algorithmic thinking, and automation. According to Shute et al. (2017), there are different operational definitions of CT based on how it is measured. The concept is still evolving as researchers continue to research on it. According to Korkmaz, Çakır, and Özden (2015), CT is an overarching concept that relates to an individual's problem solving skills through computers, creativity, algorithmic thinking, collaborative work and critical thinking skills. The conceptual framework proposed by Korkmaz et al. (2015), and Yildiz-Durak and Saritepeci (2018) was employed in this study.

Lifelong Learning Competencies

Lifelong learning has been accepted as an important socio-political and socio-economic element since the 70's (Lüftenegger et al., 2016). The reason for the increased emphasis on lifelong learning, especially as of the 90's, is the rapid transformation of the socio-economic structure. In the past, deviations in the skills and competencies that individuals should have for their social and professional lives were rather limited. However, today, competencies related to an individual's social and professional life can transform quickly. Thus, lifelong learning has become an important component for people (European Commission, 2018; Field, 2012). Evidently, it is not possible for formal instruction at schools to provide individuals all the knowledge and competencies they will need in their personal, social and professional life (Sharples, 2000). This requires individuals to obtain self-directed learning skills which include determining their own learning needs and developing a learning plan to address these needs in order to adapt to transformations in their personal, social and professional life. Self-directed learning and motivation are the two basic components of lifelong learning (Klug et. al, 2016).

Eight basic competencies of lifelong learning are listed as "*communication in mother tongue, communication in foreign languages, mathematical competence and basic competences in science and technology, digital competence, learning to learn, social and civic competences, initiative and entrepreneurship understanding, and cultural awareness and expression*" in the European Key Competences Reference Framework for Lifelong Learning (European Commission, 2018).

Personality Traits

Personality traits are relatively permanent traits that are consistent in behaviors such as thinking, feeling, and acting with respect to many different situations through life (Landers & Lounsbury, 2006; Ones et al., 2005). Among the personality frames, the five factor model stands out in determining the structure of basic personality traits (Costa & McCrae, 1992; Lin, 2010; Roccas, Sagiv, Schwartz & Knafo; Yildiz Durak & Saritepeci, 2019). This model suggests that most personality traits can be defined by the factors of openness, extraversion, neuroticism (emotional stability), compatibility, and conscientiousness. Openness is associated with being open and creative to new experiences or ideas, and having intellectual curiosity and aesthetic perception. (Costa & McCrae, 1992; Curtis, Windsor & Soubelet, 2015). Extraversion is related to the tendency of being social, active, enthusiastic, optimistic and energetic (McCare & John, 1992; Watson & Clark, 1999). Neuroticism can be expressed as an indicator of the tendency to experience negative emotional states such as depression, anxiety, concern, anger and the level of being emotionally unstable (Costa & McCare, 1992; McCare & Costa, 1997). Agreeableness is associated with the degree of being flexible, reliable, benign and humble. (Costa & McCare, 1992; Sulea etal., 2015). Conscientiousness is a personality trait associated with the degree of being determined, success-oriented, goal-oriented, reliable, planned, organized and responsible (Curtis, Windsor & Soubelet, 2015; Salem, Beaudry & Croteau, 2011).

Structural Relationship among the Research Variables

The basis of increasing emphasis on the importance of lifelong learning competencies can be explained by the differentiation of the way that tasks are completed in daily and professional life. Similarly, CT is highlighted as one of the most important skills that everyone should acquire (Wing, 2006) and involves individuals acquiring thinking patterns that they can transfer to new problems that they can encounter in the future (Chen et al., 2017). The main reason of emphasizing the necessity of building individuals' lifelong learning competencies and CT skills is to prepare them for life under rapidly changing conditions and needs. In this respect, it can be claimed that CT has an important effect on improving lifelong learning competencies of individuals. In addition, based on the literature, personality traits may mediate the relationship between lifelong learning competencies and CT skills. There are various studies supporting that a significant relationship exists between CT and personality traits (Román-González et al., 2016), and between lifelong learning and personality traits (Bath & Smith, 2020; Ekşioğlu, Tarhan & Çetin Gündüz, 2017). The purpose of this study is to determine the relationship between computational thinking, lifelong learning competencies and personality traits of university students.

2 | Method

In this study, we first created a theoretical path model as seen in Figure 1. In the model, the relationship between determined variables (computational thinking, lifelong learning competencies and personality traits) were examined. Based on the questions under inquiry, the employed research model is a descriptive survey model since it aims to reveal an existing situation without manipulating variables.

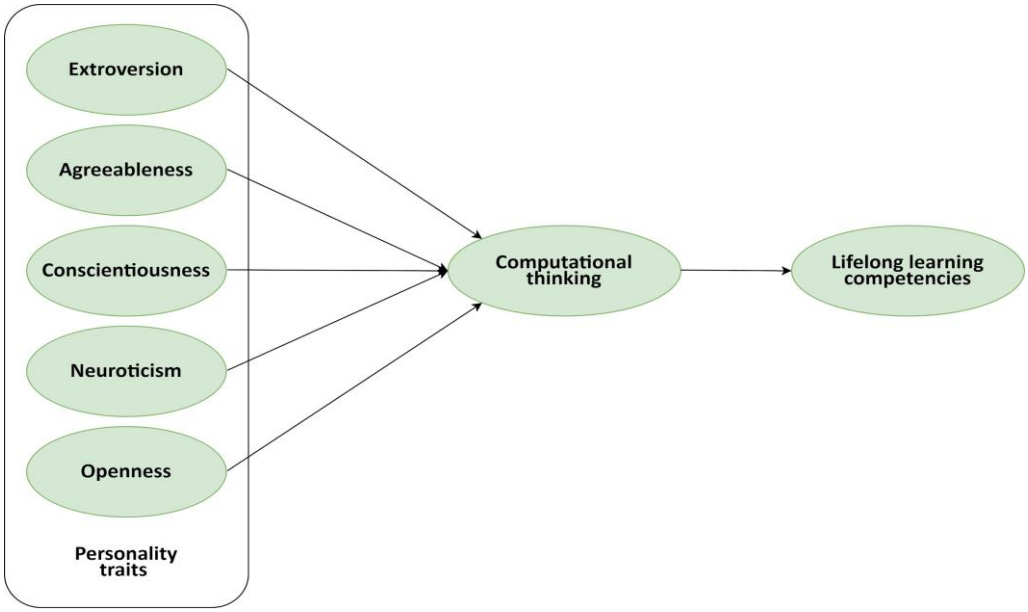

Figure 1. *Research Model*

PARTICIPANTS

The study group that consisted of 228 university students from different disciplines was chosen by using convenience sampling approach. This sampling approach enables to conduct a study with easily accessible participants. Data was collected through a digital platform from students who volunteered to participate in the 2018-2019 academic year. Personal information is presented in Table 1.

Table 1. Personal Information

Options		f	%
Gender	Female	148	64.9
	Male	80	35.1
Age	Mean=20.03; SD=2.66; Min=17; Max=34		
Branch	Computer Education and Instructional Technology	82	36.0
	Mathematics	57	25.0
	Psychological advice and guidance	33	14.5
	Turkish	56	24.6
The duration of daily use of Internet	Less than 1 hour	15	6.6
	1-2 hours	83	36.4
	3 hours and above	130	57.0
The duration of daily use of social media	Less than 1 hour	42	18.4
	1-2 hours	90	39.5
	3 hours and above	96	42.1
Online course taking experience	Yes	79	34.6
	No	149	65.4

As seen in Table 1, 64.9% of the participants are women and 35.1% are men. Participants are between the ages of 17-34 and the average age is 20.03. 57.0% of the participants stated that they use Internet for 3 hours or more per day; 42.1% of them use social media for 3 hours or more per day. The proportion of the students who have experience of taking an online course for personal development purposes in the context of lifelong learning is 34.6%.

Data collection

A personal information form and three different scales were used to collect data for addressing research questions.

Personal Information Form

This form is developed by the researchers to collect demographic information such as participants' gender, age, grade level, department, technology usage etc. (7 items).

Lifelong Learning Competencies Scale

This scale, developed by Uzunboylu and Hürsen (2011), consists of 51 items and 6 sub-dimensions. The responses are scored on a 5-point Likert scale. The Cronbach's alpha reliability coefficient for the scale was calculated as 0.965.

Computational Thinking Scale

Developed by Korkmaz, Çakır, and Özden (2016), this scale consists of 29 items and 5 sub-dimensions. The scale has a 5-point likert structure. The 5-factor structure explains 56.12% of the total variance. Cronbach's alpha reliability coefficients of the full scale and its subscales vary between 0.727-0.869.

Personality Traits Scale

It was developed by Rammstedt and John (2007) and adapted to Turkish language by Horzum, Ayas and Padır (2017). This scale has 10 items and 5 factors and aims to measure personality traits.

DATA ANALYSIS

First, descriptive statistics including means, standard deviations, skewness and kurtosis values were calculated to summarize data. Additionally, Pearson correlations among the variables were checked. Based on the literature, a theoretical path was produced and presented in Figure 1. In the model, five personality traits, extroversion, agreeableness, conscientiousness, neuroticism, and openness are exogenous variables while lifelong learning competencies is endogenous variable. CT variable is the mediator variable between endogenous and exogenous variables. In order to test the hypothesized model, path analysis was conducted using LISREL version 8.8 (Jöreskog & Sörbom, 2007). As suggested by the literature (e.g., Schumacker and Lomax, 1996; Steiger, 2007), a number of fit statistics including root mean squared error of approximation (RMSEA), comparative fit index (CFI), goodness of fit (GIF) were used to check if the hypothesized model yields a good fit. Interpretation of each fit indices along with cut values for acceptable fit are presented in the results section.

Research ethics

This research study complies with research publishing ethics. The scientific and legal responsibility for manuscripts published in Bartin University Journal of Faculty of Education belongs to the authors.

3 | Findings

Descriptive statistics and relationships between variables in the study are presented in Table 2.

Table 2. Descriptive Statistics and Correlations

	1	2	3	4	5	6	7
1-Computational thinking	1	0,578**	0,226**	0,461**	0,191**	0,02	0,259**
2-Lifelong learning competencies		1	0,135*	0,446**	0,192**	0,037	0,229**
3-Personality traits (Extroversion)			1	-,265**	,187**	-0,025	,229**
4-Personality traits (Agreeableness)				1	0,045	0,076	0,064
5-Personality traits (conscientiousness)					1	0,122	,134*
6-Personality traits (Neuroticism)						1	0,111
7-Personality traits (Openness)							1
Mean	107,75	195,237	6,627	6,739	7,805	5,237	6,009
SD	16,172	27,982	1,407	1,818	1,499	1,849	1,460

When Table 2 is examined, it is seen that the CT levels (M = 107.750; SD = 16.172) reported by the participants are at the medium level. The lifelong learning competencies score of the participants is obtained as 195.237 and it is at a medium level.

As seen in Table 2, the correlation values between the CT levels of the participants and other variables are as follows; computational thinking-lifelong learning competencies awareness (r = 0.578, p <0.01), computational thinking-extroversion (r = 0.226, p <0.01), computational thinking-agreeableness (r = 0,461, p <0.01), computational thinking-conscientiousness (r = 0.191, p <0.01), computational thinking-neuroticism (r = 0.02, p> 0.05) and computational thinking-openness (r = 0.259, p <0.01).Correlation coefficients between 0.07-1.00 as absolute values are high, A relationship between 0.70-0.30 is defined as medium, and between 0.30-0.00 is defined as a low level relationship (Büyüköztürk, 2009). Based on these findings, there is a statistically significant and positively medium relationship between CT and lifelong learning competencies variables. There is a statistically significant positive low or medium level relationship between computational thinking, lifelong learning competencies variables and 4 dimensions of personality traits (except neuroticism).

Path Analysis- Computational thinking, lifelong learning competencies and personality traits

The model examining the relation between personality traits, CT skills and lifelong learning competencies were tested through path analysis using LISREL 8.8 Version (Jöreskog & Sörbom, 2007). Goodness of fit indices and the standardized path coefficients are presented below.

Model Fit Results of the Hypothesized Model

The model fit statistics of the hypothesized model were compared with the recommended values in Table 3. The fit statistics values of the hypothesized model indicated good model fit.

Table 3. Fit Statistics for the Path Model

Fit statistics	Good fit	Acceptable fit	Obtained value	Decision
*X*2	Non-significant value	-	*X*2 (4)= 2.24, p=.69	Good
*X*2/dof	≤ 3	≤ 4-5	0.56	Good
RMSEA	≤0.05	0.06-0.08	0.0 with 90%CI[0.0, .07]	Good
CFI	≥0.97	≥0.95	1.00	Good
NFI	≥0.95	0.94-0.90	0.99	Good
GFI	≥0.90	0.89-0.85	1.00	Good
SRMR	≤0.05	0.06-0.08	0.013	Good

*The recommended value are presented based on the literature (Hu and Bentler, 1999; Klein, 1998; Schumacker and Lomax, 1996; Steiger, 2007; Tabachnick and Fidell, 2001; Simsek, 2007).

Summary of Effects

As a rule of thumb, standardized path coefficients with absolute value smaller than .10 indicates small effect, values around 0.30 indicates medium effect and values greater than 0.50 indicates large effect (Kline, 1998). The standardized path coefficients and their significance are presented in Table 4 and Figure 2. According to the results, R-squared (1- unexplained variance squared) is equal to 0.63 (1- 0.37) in the first path which means personality traits explain 63% of the variance in computational thinking. Similarly, CT explains 76% of the variance in lifelong learning competencies.

Table 4. Standardized Coefficients

Direct Effect	Standardized coefficients	*t*	Rsquare
Computational Thinking			0.37
Extroversion*	0.29	5.39	
Agreeableness*	0.54	9.91	
Conscientiousness	0.10	1.95	
Neuroticism	-0.03	-0.71	
Openness*	0.15	2.95	
Lifelong learning competencies			0.66
Computational thinking*	0.89	9.22	

Based on the parameter estimates, extroversion (γ = 0.29), agreeableness (γ = 0.54), and openness (γ = 0.15) are statistically significantly positive effect on computational thinking. Among them, agreeableness has large effect while extroversion and openness have medium effect on computational thinking. In addition, CT (γ = 0.89) significantly predicts lifelong learning competencies.

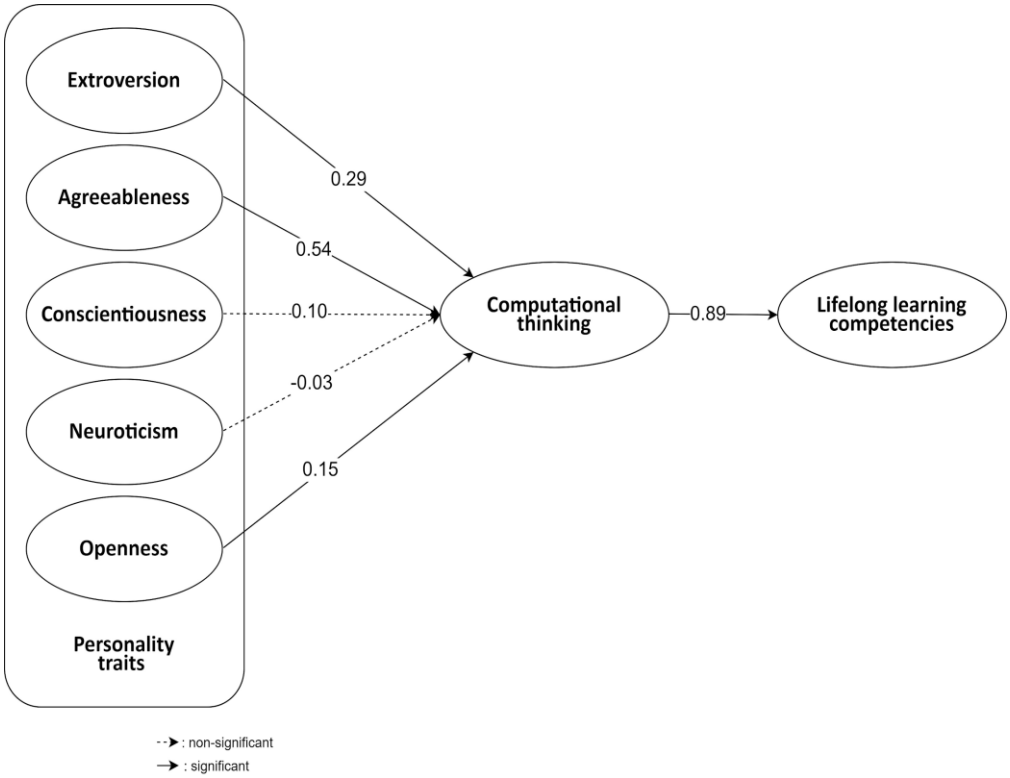

Figure 2. *Research Model Coefficients*

4 | Discussion & Conclusion

In this study, a model was created to determine the relationships between computational thinking, lifelong learning and personality traits, and the relationship between these variables was examined. According to the descriptive findings, it has determined that the CT and lifelong learning competence levels of the participants were medium. When the dual correlations were examined, a significant relationship was found between personality traits (except neuroticism) and CT and lifelong learning competencies. In addition, the most substantial relationship in correlations is between CT and lifelong learning competencies.

According to the results of the study, agreeableness has the most important relative effect on CT in the big five. This situation is compatible with the correlation between variables. CT is closely related to problem solving skills, and it can be said that "flexibility" (Costa & McCare, 1992), which is one of the basic indicators of agreeableness personality trait in particular, enables individuals to have a vast perspective on problem situations. In addition, one of the main reasons for the formation of such a strong relationship can be shown as the effectiveness of agreeableness in ensuring the continuity of participation in the course (Stajkovic et al., 2018), and it can be said that this creates that ensure individuals to make more efforts for higher performance in CT teaching activities. However, Román-González et al. (2018) concluded that there is no significant relationship between agreeableness and CT in their study. The basis of this difference between the two studies can be shown as the education level of participants in the studies. While there are participants between 5th and 10th grades in the Román-González et al. studies, this study was carried out with the participation of university students.

The relative effect of extraversion on CT is significant. Accordingly, it is understood that extraversion personality trait is an important predictor of CT. The main indicators of extroversion personality trait are associated with the tendency to be social, active, enthusiastic, optimistic and energetic (McCare & John, 1992; Watson & Clark, 1999), and they are more prone to cooperative learning. Accordingly, It can be said that it will be more enthusiastically individuals with predominant extraversion have involved collaborative

learning, which is one of the important convergent areas of computational (Yıldız-Durak & Saritepeci, 2018) such as collaborative group studies such as design-based learning (Saritepeci, 2020) and STEM (Sengupta, Dickes & Farris, 2018) in the development of CT teaching and related skills. Also, similar to the results of this study, Román-González et al. (2018) reported that there is a significant relationship between extroversion and computational thinking.

Openness personality trait is another significant predictor of computational thinking. CT is a skill closely related to problem solving and creativity (Ambrosio et al., 2014; Aho, 2012; Saritepeci, 2020). Openness represents creativity and intellectual curiosity (Costa & McCrae, 1992; Curtis, Windsor & Soubelet, 2015) as the premise of involvement and continuity of participation in problem solving processes. Scherer and Gustafsson (2015) reported that openness and creative problem solving are related. Similarly, Román-González et al. (2018) found that there is a significant relationship between CT and openness in their study.

It has been concluded that conscientiousness and neuroticism are not an important predictor of computational thinking. The conclusion that it is not significant Neuroticism, an indicator of emotional imbalance level (Costa & McCare, 1992; McCare & Costa, 1997), relationship with CT is consistent with the literature (Román-González et al., 2018). On the other hand, the result that conscientiousness is not an important predictor of CT indicates a situation contrary to the expectation. Being an important personality trait in the context of problem solving (Chartrand et al., 1993) and task performance (Reiter-Palmon & Illies, 2009) created a positive relationship expectation between conscientiousness and computational thinking. On the other hand, Reiter-Palmon and Illies (2009) emphasize that conscientiousness does not show an important role in the context of a performance task that requires creativity and creative problem solving.

According to the results of the study, it was determined that the relationship between CT and lifelong learning competencies is significant. Accordingly, it can be said that activities for teaching CT skills will improve the individual's lifelong learning competencies. The basis of this situation lies in the close relationship between lifelong learning basic competencies and computational thinking. Digital (Juškevičienė & Dagienė, 2018; Nouri et al., 2020) and STEM (Burbaitė, Drąsutė & Štuikys, 2018; Sengupta, Dickers & Farris, 2018) out of 8 key competences for lifelong learning determined by the European Commission (2018) competences has a mutual interaction with computational thinking. Regarding this situation, Juškevičienė and Dagienė (2018) state that CT is a fundamental skill that includes basic digital competencies and requires lifelong learning.

While our study provides evidence of CT and the relationships between lifelong learning competencies and personality structures, care should be taken in generalizing the findings outside the scope of the study. Student volunteering was taken as a basis in the selection of study groups. This situation can create a tendency for personality structure.

In future studies, taking into account the personality structure, the effect of CT and lifelong learning competencies can be examined by forming homogeneous or heterogeneous student groups in terms of dominant personality structure. The effects of personality structure on CT and lifelong learning competencies should be examined in detail with qualitative studies. In addition, the design characteristics that can be effective in supporting different personality traits should be defined in more detail and their effects should be examined.

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Designing Web-Based "Measurement and Evaluation" Learning Modules for Teachers' Needs*

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Abstract

The challenging aspects of scheduling face-to-face in-service training programs are a barrier to make needed training widespread and accessible. Due to the limitations, the necessity has arisen to design interactive and updatable digital learning materials for teachers that have been prepared by experts and that can be accessed whenever desired. This design and development research presents a design of digital learning materials that has been drawn up on the basis of scientific processes and in the knowledge of teachers' inadequacies as regards the topic of measurement and evaluation. The learning materials produced in this research, Web-based Measurement and Evaluation Learning Modules (W-MELM), are based on the critical aspects of item writing and test development and the needs of teachers based on the literature. The ADDIE model was taken as the basis of W-MELM in the design process. Five experts were consulted in leading to the revision of the modules to make them ready for operation. The evaluation stage consisted of using a Likert-type data collection tool of 18 items to collect teachers' (n=50) opinions regarding W-MELM. As a result of analysis, the teacher's views acknowledged that W-MELM that had been designed met their needs and was an effective learning tool.

Keywords: Measurement, evaluation, assessment literacy, ADDIE, teacher training, distance education

Öğretmen İhtiyaçlarına Dönük Web Tabanlı "Ölçme ve Değerlendirme" Eğitim Seti Tasarımı

Öz

Yüz yüze hizmet içi eğitimlerin maliyet, zaman ve program gibi zorlayıcı faktörleri, ihtiyaç duyulan eğitimlerin gerekli yaygınlığa ulaşılmasına engel teşkil etmektedir. Bu sınırlılıklar nedeniyle öğretmenlere alan uzmanları tarafından hazırlanmış, istedikleri zaman erişebilecekleri, tasarım ve yayın süreci dışında bir maliyet ya da iş yükü getirmeyecek, etkileşimli ve güncellenebilir dijital eğitim materyalleri tasarlanmasının gerekliliği ortaya çıkmaktadır. Bu araştırmada, ölçme ve değerlendirme konusunda öğretmen yetersizlikleri göz önünde bulundurularak ve bilimsel temeller ışığında, öğretmen eğitimine yönelik dijital bir eğitim setinin tasarımına ilişkin bir örnek sunulmuştur. Eğitim setinde, alan yazından yola çıkılarak, madde yazma ve test geliştirmedeki kritik noktalara ve öğretmenlerin gereksinimlerine odaklanılmıştır. Eğitim setinin tasarım sürecinde ADDIE (Analiz, Tasarım, Geliştirme, Uygulama ve Değerlendirme) modeli temel alınmıştır. Tasarım sürecinde; 3 ölçme ve değerlendirme, 2 bilgisayar ve öğretim teknolojileri eğitimi alanından olmak üzere toplam 5 uzman görüşü ve eğitim setinin kullanıcıları olan 3 öğretmenin görüşü alınarak eğitim setinde son düzenlemeler yapılmıştır. ADDIE modelinin değerlendirme basamağında dijital eğitim setine ilişkin öğretmen görüşleri (n=50), 5'li Likert tipinde 18 maddeden oluşan bir veri toplama aracıyla toplanmıştır. Araştırmada kullanılan veri toplama aracı eğitim setini, içerik, öğretim tasarımı ve değerlendirme olmak üzere üç temel boyutta değerlendiren maddelerden oluşmaktadır. Verilerin analizi sonucunda öğretmen görüşlerinin, genel olarak bu üç boyutun hepsi için olumlu yönde olduğu tespit edilmiştir. Bir başka ifade ile öğretmenlerin görüşleri tasarlanan dijital eğitim setinin, ihtiyaçlarına yönelik ve etkili olduğu yönündedir.

Anahtar kelimeler: Ölçme, değerlendirme, ölçme ve değerlendirme okuryazarlığı, ADDIE, öğretmen eğitimi, uzaktan eğitim

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1 | Introduction

Measurement and evaluation (ME) are the building blocks of the education system. ME are the resources with which preparedness is ascertained, training activities are shaped, and a determination is made as to the degree to which students have reached targeted learning outcomes. Invalid measurement results lead to faulty determinations about the level to which students have acquired their learning goals, and also contribute to erroneous decisions made as from the point of measurement. When a major element of the system of education becomes dysfunctional, the system cycle breaks down as a consequence.

The results of measurements may be used in decisions of vital importance (Popham, 2005; Thorndike & Tracy Thorndike, 2014). Effective measurement in the classroom is critical to the monitoring of learning, systematic progress and achievement (Marzano, 2006; Murchan et al., 2013). Teachers play key role in ensuring the validity of ME in the classroom. Therefore, standards are developed for teacher competence in ME (American Federation of Teachers, National Council on Measurement in Education, 1990), and teachers' assessment literacy has been frequently researched in the literature (DeLuca et al., 2016; Fulcher, 2012; Mertler, 2003; Mertler & Campbell, 2005; Plake et al., 1993; Quilter & Gallini, 2000; Xu & Brown, 2016). Standards have been recently transformed and formative assessment have been focused (Brookhart, 2011; Gotch & French, 2014). Considering the standards given in the literature and the topics discussed for the assessment literacy, the subjects that a teacher should have competence in ME can be listed as follows:

1. Identifying achievement criteria clearly
2. Choosing the appropriate ME tool
3. Developing and implementing item/tool (tasks, rubrics, etc.)
4. Reliable scoring and grading
5. Presenting effective feedback and interaction
6. Using assessment to increase student motivation and achievement

Teachers must therefore have adequate knowledge and experience in the subject of ME. It has been reported in studies, however, that teachers report they experience problems in various subjects and on different scales in ME, and that they believe themselves to be inadequate in this context (Benzer & Eldem, 2013; Çakan, 2004; Gaitas & Alves Martins, 2017; Mertler, 1999, 2009; Plake et al., 1993; Popham, 2005; Şenel, Pekdağ & Günaydın, 2018; Topkapı & Yılar, 2016). Inadequacies of teachers and real-time practice problems may arise in several topics of assessment literacy. The most critical one of these problematic topics is about choosing the appropriate ME method for the construct to be measured and developing/implementing item or measurement tool (Plake et al., 1993). Functionality of following topics is highly dependent on choosing appropriate ME method and developing items/tools.

Teachers prefer the practice of copying a measurement tool instead of devising a new one. Teachers believe that composing test items is too time-consuming so they will avoid to write items and tend to copy previously composed items (Popham, 2005; Şenel et al., 2018). Another matter is that teachers use ME to help students achieve in high stake tests (Popham, 2005). As a result, teachers use only certain types of test items. Since a large majority of high stake tests are composed of multiple-choice items, teachers are more likely to use multiple-choice items (Bayat & Şentürk, 2015; Güneyli & Abbasoğlu, 2015; Şenel, 2018a). Multiple-choice items however are limited in their capacity to measure higher-level cognitive skills. It is known that knowledge and skills at each level cannot be measured with all type of test items (Anderson & Krathwohl, 2010; Gültekin, 2014). Wrong selection and usage of item type prevents the determination of whether or not students have reached the targeted skills. In other words, measurement results in this case do not provide information as to the degree to which the instruction has met its goals and formative evaluations are no longer functional. Additionally, it is reported in the literature that frequent changes

made in measurement dimensions in educational programs (Hamurcu, 2018) lead to an increase in teachers' perception of inadequacy (Benzer & Eldem, 2013; Şenel et al., 2018).

Pre-service teachers are offered ME based courses in teaching programs of education faculties. However, these courses are reported to be insufficient for real-life practices (Alkharusi et al., 2011; DeLuca & Bellara, 2013; Mertler, 2003; Wang et al., 2004). To eliminate the problems that teachers encounter in ME and to alleviate their perception of inadequacy, it is clear that there is a need for applicable and functional training programs (Plake et al., 1993; Şenel et al., 2018). Teachers who had in-service training about ME are found to have competence compared to those without training (Mertler, 2009; Plake et al., 1993; Xu & Brown, 2016). Educational institutions organize in-service training programs with the aim of improving teachers' professional competence and understanding, ensuring unity in applications and instilling the knowledge, skills and behavior required by the advances made in the field of education (Ministry of National Education [MEB], 1995). In-service training programs are known to require a significant amount of material resources as well as specialized personnel. According to the 2017-2018 Statistics for Formal Education of the Ministry of National Education (MNE), the number of teachers in Turkey working under the auspices of the Ministry is 1,030,130 (MNE, 2018). This statistic indicates that a large number of in-service training programs designed to provide face-to-face training to all teachers would mean making a major allotment of specialized personal and material resources, which would constitute a heavy burden on the economy. Planning in-service training programs for teachers during the academic year tends to disrupt the flow of education. When specialists cannot lead the training sessions, it is difficult to reach the expected level of productivity. The literature points to the need for focusing on the fundamental needs of specific in-service training programs, urging that costly training programs should be avoided (Clark & Mayer, 2003).

Due to these limitations and challenges, it is believed that interactive and updatable digital training materials for teachers that have been prepared by experts in their fields, that can be accessed whenever desired, and that will not generate costs or workloads other than what is needed in the design and publication process will be useful and functional. Digital educational materials may be considered a distance education application. Teachers tend to prefer distance education programs due to their limited available time and lack of locational flexibility (Taşlıbeyaz, Karaman & Göktaş, 2014). At the same time, it is also known that teachers may need such easily accessible learning opportunities when they face specific challenges that cannot be generalized, such as working with special groups like students with special needs (Şenel, 2018b). Similarly, web-based systems that allow individual instruction and training are developed and used (Wang et al., 2004; Wang et al., 2008).

Considering the importance of ME, teachers' inadequacies in ME and ineffective in-service training, developing educational materials for teachers is critical. Distance education and online tools are becoming more widespread throughout the world due to its ease of use and easy access (Ferdig et al., 2020). In the rapidly advancing world of technology today, it has become the duty of all educational institutions to take advantage of all the opportunities presented. It should be considered that devising effective learning materials for in-class measurement that all teachers can access at any time they wish would be a major enhancement to education. This study is aimed to develop an interactive web-based tool, present its design procedure and to identify its effectiveness by using it in in-service teacher training.

2 | Method

This study was carried out as Design and Development Research (DDR). Educational research is often inspired by theoretical frameworks, therefore they may have isolated from real problems of everyday life (Design-Based Research Collective, 2003). DDR, which was defined as systematic research into the processes of design, development and assessment (Richey & Klein, 2008), consists of two types of

research. The first type of DDR concerns focusing on the processes of designing and developing products and tools. The second type of DDR concerns the improvement, use and approval of models. The focus is on the validity and effectiveness of the technique that is being tested (Richey, Klein & Nelson; 2004). The present study is of the second type of DDR. Another field of DDR is focused on new technologies. These studies may help to create useful designs with the collaboration of engineering and method. (Wang & Hannafin, 2005). This study too concentrates on how developing technologies can be used the most beneficially in teacher training. For this, a set of digital learning materials, *Web-based Measurement* and Evaluation Training Modules (*W-MELM*) have been developed to eliminate teachers' deficiencies in ME. W-MELM are the training modules consists of 9 modules focusing on the subject of ME, which were developed in line with the aim of the research and in order to meet the needs of teachers in this respect. The strength of this material has been examined in terms of effectiveness and sustainability.

W-MELM is based on the core phases of the ADDIE (Analysis, Design, Development, Implementation and Evaluation) instructional design model and has been reported in this context. The ADDIE model is made up of five phases: analysis, design, development, implementation and evaluation (Çağıltay & Göktaş, 2013). An attempt was made to diversify the presentation and use of materials included in the developed digital learning material. It is known that diversifying presentation and materials in in-service distance education programs is an element that has an impact on motivation (Taşlıbeyaz, Karaman & Göktaş, 2014). This is because it is thought that learning materials appeal more to the senses and are expected to attract more attention in this way.

Research ethics

The data collection phase of this study were approved ethically in accordance with the decision taken at the meeting of Balıkesir University Social and Human Sciences Ethics Committee dated 11.02.2021 and numbered 2021/01.

3 | Findings: ADDIE Phases

Analysis

The learning needs of the target group should be identified in the analysis phase and the desired goals of the training should be determined, taking into consideration internal and external dynamics. A scan of the literature was first carried out in the study to identify which matters pertaining to ME most needed instruction and should be included in the training materials (Bayat & Şentürk, 2015; Benzer & Eldem, 2013; Çakan, 2004; Gaitas & Alves Martins, 2017; Güneyli & Abbasoğlu, 2015; Şenel, 2018a; Şenel et al., 2018; Topkapı & Yılar, 2016). Choosing the appropriate technic and developing/implementing test or measurement tool is pre-requisite for assessment literacy. The scores obtained by teachers who do not have competence in assessment literacy are not valid, and feedback/communication will not contribute to the quality of education. The preliminary studies conducted by the researchers indicating their realization of the need for the present study (Şenel et al., 2018) were an important resource in the process of analysis. In this preliminary work, the deficiencies and problems teachers faced in the matter of ME were collected under 11 subheadings. The issue that most frequently came up in the interviews were their deficiency in writing test items (21.86%). It could be seen that the teachers tended to copy items (18.03%) because the writing process was long and difficult. Since the subject that is most commonly addressed in the literature is the process of writing items and developing tests, "Types of Items and Test Layout" was taken as a basis for this design and development research. Based on the belief that any information presented on the use of types of items would not be complete without an explanation as to the way in which open-ended items would be scored, it was thought useful to include *rubric*. In the light of the points emphasized in the literature, the content headings to be considered in the development of W-MELM are the following:

1. General introduction to the types of items
2. True-false items

3. Matching items
4. Multiple-choice items
5. Open-ended items with short answers
6. Open-ended items with long answers
7. Rubric
8. Test Layout

Design

The teaching aims for the learning system to be developed are determined in the design phase and suitable content is selected and prepared while educational strategies are ascertained (Çağıltay & Göktaş, 2013). The output of the analysis phase consists of the aims of this stage. In the design phase, content was prepared that was in line with the target topics that had been determined. Two academic researchers, one an expert in ME, the other in educational technologies, drew up the content. In preparing the content, the direct quotes of teachers appearing in the literature were used as a resource. The content was lined up hierarchically using MS PowerPoint in such a way that each topic constituted one module. In order to keep motivation up, critical issues were addressed so that the content could be prepared in a short space of time. In the content design process, it was believed that it would be useful to draw up important information that was common to every type of item as a separate teaching tool. Because of this, a module called "Important Information" was added to the subject headings determined in the analysis phase. After the content of the digital learning materials became clear, the design phase was entered, the process of which can be summarized as the following steps:

Deciding on Visual Composition

At this point, the visual aspects of the training were considered. Color charts were scanned for this purpose. Care was given to use no more than four colors on the screen (Yalın, 2000, p.99) and a decision was made as to which main colors would be used. In the selection of colors, colors that would be motivating to both men and women were chosen. At the same time, attention was also paid to make sure that the supplementary documents used in some of the modules would be of the same color and visual fabric. These supplementary documents were prepared as downloadable files, which ensured that users would always be able to have these materials on hand to consult. This content was designed to be printable infographic material. Infographic material refers to the visual representation of information, making it easier for the user to use and understand the data. Visual design was first prepared in the form of an MS PowerPoint presentation, but later this data was transferred to the final product. Common pages were designed for each module for the purpose of standardizing and organizing the instruction.

Creating Commonly Designed Pages

All of the modules were provided with a common structure in order to ensure wholeness and interface consistency, so that users could more easily understand the pages. In this context, the introductory page to each module, the page where the aim was described, a maxim appropriate to the content, item sample pages, pages with direct quotes from teachers, Q&A pages and conclusion pages were all designed to appear in all modules.

Deciding on a Tool for Developing Content and Formatting

Research was carried out on what tools had been used in the development of digital learning material, paying attention to those that permitted the design of pages that could be freely browsed and of materials that could be used for different learning modules. It was decided that the Articulate 360 tool would be used since this e-learning software met all the requirements. Different designs suitable to the content were chosen and while 7 of the 9 modules were prepared on a page format, the remaining 2 were

developed as video content. The modules were set up on a player device. The color scheme of the player was set up to match the general visual design. A hierarchical content tree was drawn up and configured so that the user could move between the pages in any way desired. Figure 1 displays W-MELM's interface, tree-structured menu and the player.

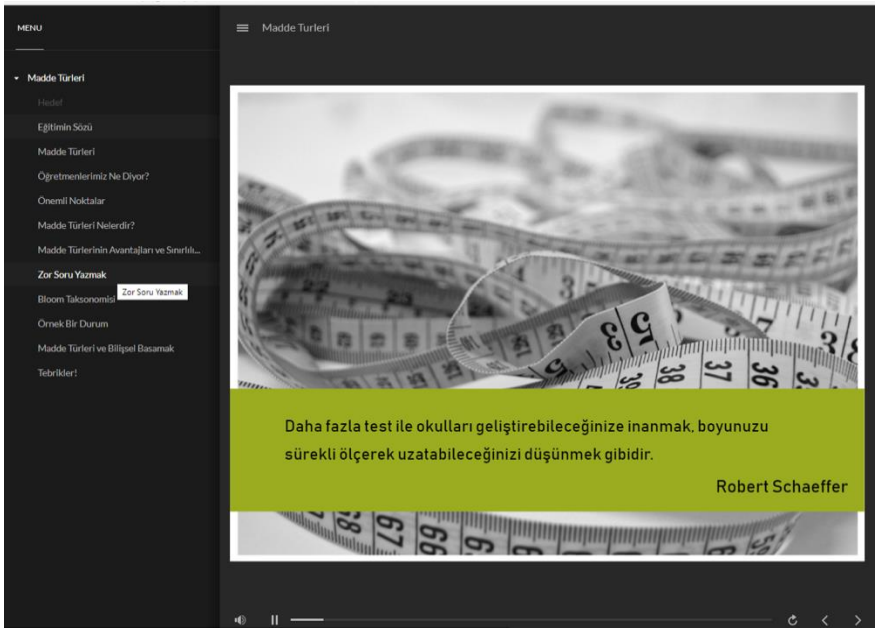


Figure 1. *W-MELM Interface: Tree-structured Menu and Player*

Development

In the development phase, the design drawn up in the previous stage is translated into an applicable product (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2014). When developing learning materials, a combination of different learning and teaching theories and approaches can be used to ensure that the instruction reaches its goal (Ally, 2004). In this study as well, benefit was drawn from Skinner's *Principles of Programmed Instruction* (Hergenhann, 1988), *Events of Instruction* (Gagne & Briggs, 1979) and *Multimedia Design Principles* (Clark & Mayer, 2003).

The first of the principles that is generally considered in the development process of digital learning materials is *Principles of Programmed Instruction*. According to Skinner (Hergenhann, 1988), the essentials of programmed instruction are to present knowledge in small increments, provide the individual with immediate feedback as to the accuracy or incorrectness of his/her learning, and allowing the individual to progress at his/her own pace. In W-MELM, each type of item was treated separately, in the question&answer screens, an answer was sought to a question on each page and gave the students immediate feedback. Additionally, the player in which W-MELM is embedded offers users a variety of features such as the ability to repeat material, go forward or backward, whichever is needed. This allows the individual to progress at his/her own pace. It can be said that W-MELM devised in this way satisfies the principles of programmed design.

Another set of principles used in the development phase is *Events of Instruction*. These principles stipulate that the learner must be informed of the goal (Gagne & Briggs, 1979). Users who know what they will be learning will prepare themselves both cognitively and affectively for the content and more easily participate in the learning process. This is why students are informed about the subject to be treated in the module at the beginning of each module.

Another theory that was of help in developing the digital learning material was *Multimedia Design Principles*. According to cognitive theory and the results of various studies, it is recommended that digital learning material is not composed solely of text but of a combination of text and visual elements (Clark &

Mayer, 2003, p.54). Priority was given in all of the phases of devising W-MELM to having a combination of text, visuals and graphical elements appear together (Figure 2).

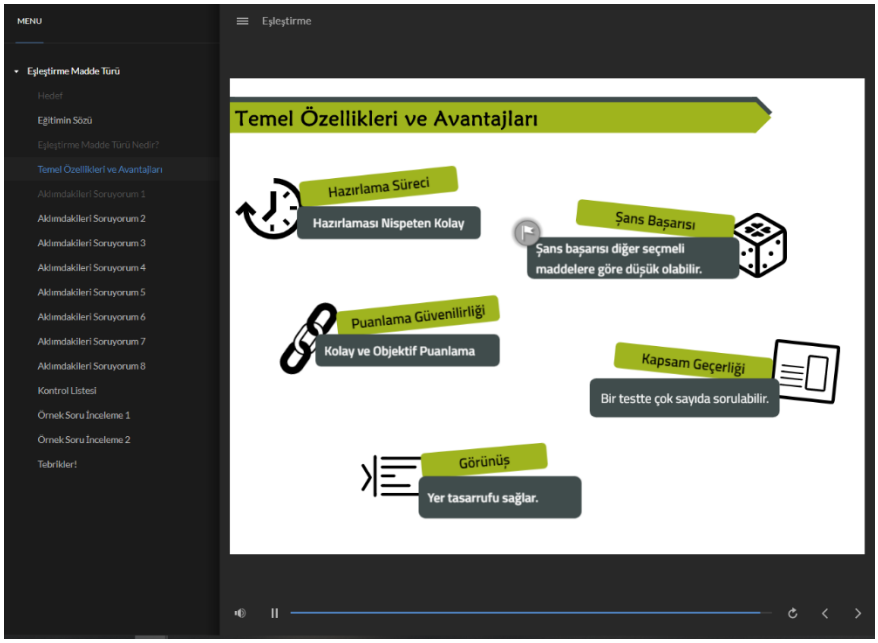


Figure 2. *The Use of Words and Graphics Together*

Another aspect of the principles of designing media is personalization. This principle is based on the knowledge that statements offered in the form of a dialog are more effective than narrative text (Clark & Mayer, 2003, p. 134). Taking this principle into consideration, the pages were designed in such a way that real-life problems were matched with a teacher’s profile (Figure 3). It is known that users can identify with this type of design and the real-life situation it presents, leading to effective learning. An effort was made on each page to provide teachers with answers to their questions about item types with as many examples of real-life situations as was possible. Making use of numerous examples in designing digital learning materials is known to enhance retention of what is learned (Clark & Mayer, 2003, p.175).

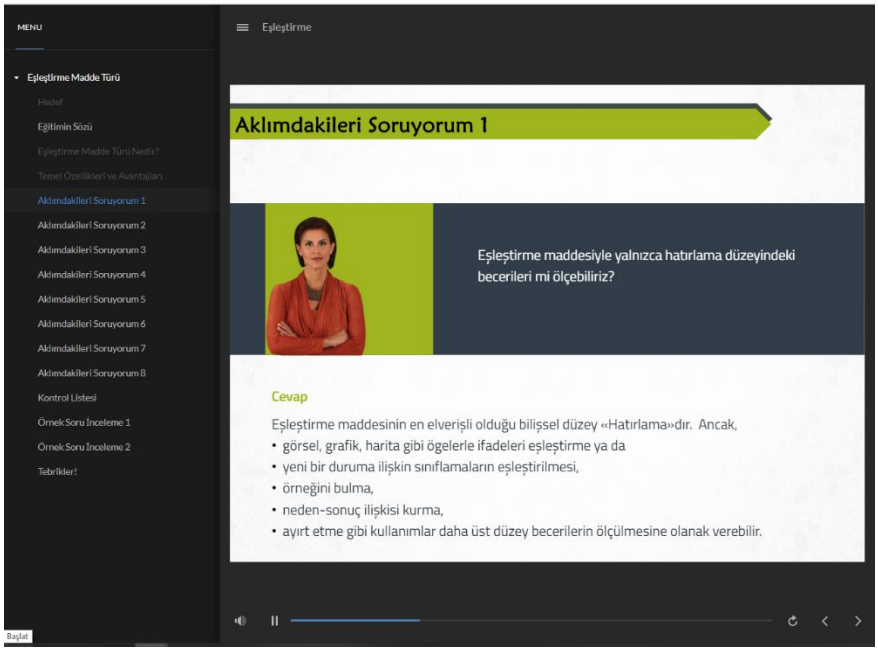


Figure 3. *Display of Quotes in the Form of Dialog*

In the sample situations pages, which were prepared under the theme of "I'm asking about what's on my mind," users are provided with the opportunity to seek answers to the questions in their minds about ME. It is believed that this ensures better learning of the type of item being discussed. Following these pages, users are directed to "Examining Sample Items" pages, where they are able to test their knowledge (Figure 4). Users on these pages are expected to correctly draw up a type of item and evaluate required items according to a checklist.

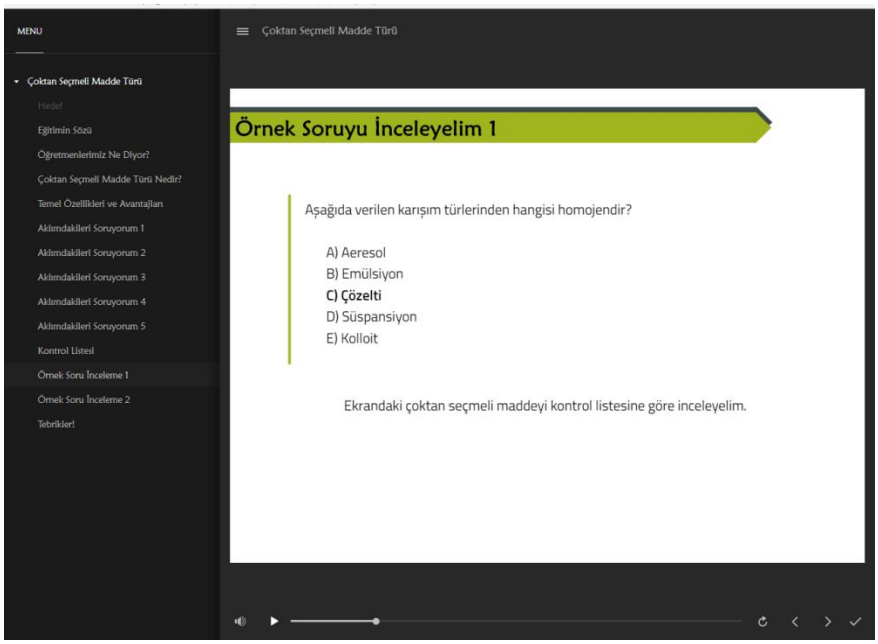


Figure 4. *Examining Sample Items*

Also added to these pages are useful downloadable documents on matters that teachers may have a need for and feel would be good to have on hand. Comparison tables or summarized information that teachers would want to keep at hand are presented here in the form of graphs (Figure 5). The design of these pages was set up on a template to preserve integrity.

Figure 5. *A Sample Downloadable Learning Document*

The testing format and critical information to learn is presented in W-MELM in the form of video content. This content was organized in the Camtasia 8 software, which facilitated sound and animation synchronization. In the development stage, five experts were consulted in the context of three measurement and evaluation, two computer and instructional technologies training fields, after which 3 teachers who were users of the training set were consulted for their opinions, leading to the revision of W-MELM modules to make them ready for operation.

Implementation

The teachers in the study group with whom W-MELM was implemented were selected with the convenience sampling technique. A total of 50 teachers in different branches were contacted. These teachers were from the branches of Chemistry (n=33), Mathematics (n=6), Science (n=3), Turkish or Turkish Language and Literature (n=3), English (n=2), Physics (n=2), and one (n=1) was a Homeroom Teacher. The teachers who were acting as raters in the study group included those who were new graduates as well as those with 35 years of teaching practice. The average seniority of the study group was 10 years ($\bar{X}$=9.96), and it can be said that they were a heterogeneous group in terms of their seniority (S=10.45).

Evaluation

An assessment form for evaluating the devised W-MELM was drawn up by the researchers who had been working in scientific studies on measurement and education technologies. In addition to the items intended to assess W-MELM, the form also included information on the seniority and branch status of the teachers. The items on the form focused on the points targeted in the development stage of W-MELM and on the needs of the teachers. The form consists of 18 items devised to understand whether or not W-MELM meets the aims of the research. The items were devised so as to focus on three fundamental dimensions. These are: (i) Whether or not W-MELM content (*Content: Items 1-5*), (ii) and the training design principles had been effectively implemented (*Instructional design: Items 6-12*), and (iii) a general assessment of W-MELM and whether it can be expanded for widespread use (Evaluation *and Conclusion: Items 13-18*). The responses are structured on a 5-point Likert-type scale (1-I definitely disagree, 2-I disagree, 3-I partly agree, 4-I agree, 5-I definitely disagree). An open-ended item was added to the end of the form for the assessor to provide any comments they may have about the study.

The teachers who were the last users of W-MELM were asked for their evaluation of the final product that emerged from the design development. The form was applied to the study group described in the implementation step. After the implementation of W-MELM, the teachers were asked to fill out the assessment form that had been created as part of the research. The Cronbach alpha coefficient of the items was found to be 0.93. Histogram chart for the total scores is presented in Figure 6.

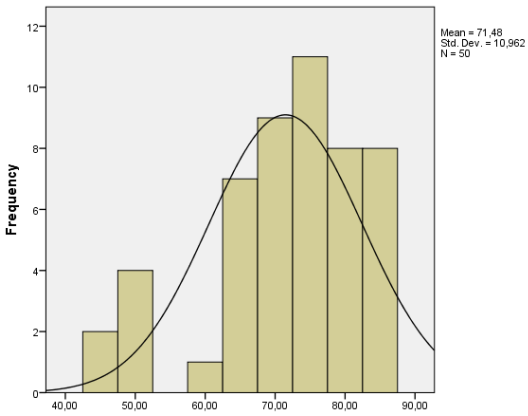
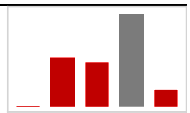
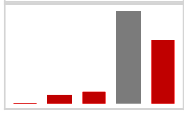
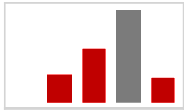
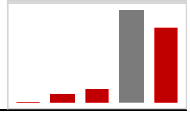


Figure 6. *Histogram Chart for the Distribution of Scores*

Descriptive statistics regarding the total scores obtained from the form were calculated. The highest score that can be obtained from the form is 90, the minimum score is 45, and the range is 42. The average of the total scores is 71.48 and standard deviation was found to be 10.96. Considering the the graph and the statistics obtained, it can be stated that the distribution is skewed to the left and tends towards positive opinions.

The $\bar{X}$ and S obtained from the responses to each item of the teachers are presented in Tables 1, 2 and 3, which display, in mini graphs, the frequencies and percentages for each response and their distribution by category. The first point that is striking in the review of the tables is that all of the items with the highest response frequency had been answered by "*I agree*" or "*I definitely agree*." Since all of the items in the form had been created as positive items of assessment regarding W-MELM, this outcome is an important indication that W-MELM had reached its targeted goal. Furthermore, the mean score for the responses to the items, varying in the range of 3.08-4.42, shows that the opinions of the large majority of the teachers varied in the range of "I partly agree (3) - I definitely agree (5)." Looking at standard deviation, it can be seen that outside of item 3, standard deviation is below 1. This reveals that the teachers' views did not deviate severely from the mean.

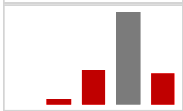
Table 1. Descriptive Statistics on the "Content" Dimension

No	Item	$\bar{X}$	S	I definitely disagree		I disagree		I partly agree		I agree		I definitely agree		Mini Graph of Distribution of Responses by Category (1-5)
				f	%	f	%	f	%	f	%	f	%	
1	I realized I made mistakes in writing up items.	3.30	1.07	2	4	11	22	10	20	19	38	5	10	
2	I learned the critical points to watch out for in writing up items.	4.06	0.93	1	2	3	6	4	8	23	46	16	32	
3	The checklists that reminded us of what features each type of item had to contain was important in the training.	4.42	0.78	0	0	1	2	5	10	14	28	27	54	
4	The questions on the "I'm asking about what's on my mind" pages were really the ones that had been on my mind too.	3.52	0.91	0	0	7	14	13	26	22	44	6	12	
5	The content addresses the goal of the instruction.	4.10	0.93	1	2	3	6	4	8	21	42	17	34	

■ Category with the highest frequency

Table 1 shows that 3 of the 5 items have a mean of over 4. The teachers stated that with W-MELM, they had learned the critical points to watch out for in writing up items ($\bar{X}_2$=4.06; S_2=0.93) and that the set addressed the goal of the training ($\bar{X}_5$=4.10; S_5=0.93). Moreover, it can also be said the teachers found the checklists to be helpful in underlining which features each type of item should have ($\bar{X}_3$=4.42; S_3=0.78). It was seen that the teachers selected the *I realized I made mistakes in writing up items* choice at a relatively lower rate ($\bar{X}_1$=3.30; S_1=1.07).

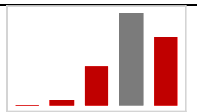
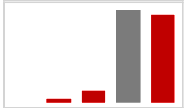
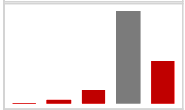
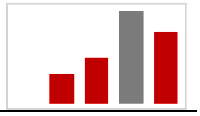
Table 2. Descriptive Statistics on the "Instructional Design" Dimension

No	Item	$\bar{X}$	S	I definitely disagree		I disagree		I partly agree		I agree		I definitely agree		Mini Graph of Distribution of Responses by Category (1-5)
				f	%	f	%	f	%	f	%	f	%	
6	The training was designed in an attractive way.	4.02	0.89	1	2	2	4	4	8	27	54	13	26	
7	The presentation of the content (sound/visuals/text) was effective.	3.96	0.90	1	2	2	4	6	12	26	52	11	22	
8	Stating in each module what we would be learning increased our motivation.	4.20	0.83	0	0	2	4	4	8	21	42	20	40	
9	Each module was tied to what was previously learned and to the other modules.	4.20	0.67	0	0	0	0	4	8	28	56	14	28	
10	The examples of items and the feedback reinforced my learning.	4.30	0.76	0	0	2	4	2	4	22	44	21	42	
11	The medium allowed me to practice what I had learned.	3.92	0.75	0	0	2	4	10	20	26	52	9	18	
12	It was effective to have the responses assessed and a result stated.	4.28	0.67	0	0	0	0	6	12	22	44	19	38	

■ Category with the highest frequency

Table 2 shows that all of the teachers' responses displayed mean scores of approximately 4 and over. This outcome indicates that W-MELM had served its educational design purpose. In particular, this suggests that the teachers' examples of items and the feedback were effective in the learning process ($\bar{X}_{10}$=4.30; S_{10}=0.76). Additionally, the teachers found it effective to have a construct where responses would be assessed in W-MELM ($\bar{X}_{12}$=4.28; S_{12}=0.67). The high mean scores for the responses to these two items may be interpreted to indicate that the teachers actually preferred to have interactive digital learning materials. In general, it can be said that the teachers found the instructional design dimension attractive and effective. Descriptive statistics of the "evaluation and conclusion" dimension of the assessment form is presented in Table 3.

Table 3. Descriptive Statistics of the "Evaluation and Conclusion" Dimension of the Assessment Form

No	Item	$\bar{X}$	S	I definitely disagree		I disagree		I partly agree		I agree		I definitely agree		Mini Graph of Distribution of Responses by Category (1-5)
				f	%	f	%	f	%	f	%	f	%	
13	I would prefer this digital instruction material to be used in in-service training.	3.96	0.97	1	2	2	4	9	18	20	40	15	30	
14	I would prefer other similar interactive instruction to be used in in-service training.	4.02	0.96	1	2	2	4	7	14	21	42	16	32	
15	This digital instruction material is more effective than face-to-face in-service training programs.	3.08	1.12	3	6	14	28	12	24	14	28	5	10	
16	Teachers should be offered online training in areas other than measurement.	4.30	0.76	0	0	1	2	3	6	22	44	21	42	
17	I would prefer in-service training to be in a format that we can always access.	4.00	0.90	1	2	2	4	5	10	27	54	13	26	
18	Since it is hard to be sure of the competence of the specialist involved in face-to-face in-service training programs, I would prefer online instruction that has been prepared by experts.	3.84	1.02	0	0	6	12	9	18	18	36	14	28	

■ Category with the highest frequency

It can be seen from Table 3 that teachers have positive opinions about making this and similar digital learning materials more widespread. It is observed that the teachers had the highest response rate on the question regarding providing teachers with online learning for other topics outside of ME ($\bar{X}_{16}$=4.30; S_{16}=0.76). At the same time, the findings show that the teachers would prefer similar in-service training programs that they could access whenever they want ($\bar{X}_{14}$=4,02; S_{14}=0,96; $\bar{X}_{17}$=4,00; S_{17}=0,90). The lowest mean score on the assessment form was in the item "*This digital learning material is more effective than face-to-face in-service training programs.*" ($\bar{X}_{15}$=3,08; S_{15}=1,12). This can be interpreted to mean that teachers also consider the advantages of face-to-face in-service training. The responses the teachers gave to the open-ended item on any more comments they would like to make clarify this point. One of the teachers in the study group said,

> This is a wonderful example of distance education for in-service training. But I also think that face-to-face education is necessary. That is, I think that the program can be produced on the basis of first offering the theoretical part of the topic to be learned in the form of face-to-face training and then the practice can start and continue for a certain period of time.

4 | Discussion & Conclusion

In this study, the deficiencies and needs of teachers in the topic of ME were considered and a scientific process was followed to design digital learning material. The dimensions of content, instructional design as well as that of evaluation and conclusion show that the teachers positively view on W-MELM and the

material satisfies the aims of the instruction. This result coincides with the literature reports positive outcomes of teachers who had ME training (Brookhart et al., 2010; Mertler, 2009; Plake et al., 1993; Xu & Brown, 2016). Additionally, results of this study draw parallel with research use web based materials to enhance assessment (Wang & Hannafin, 2005; Wang et al., 2008). Teachers who are able to choose the appropriate ME and develop/implement item or measurement tool (tasks, rubrics, etc) may be considered to have completed an important topic of assessment literacy (DeLuca et al., 2016; Fulcher, 2012; Mertler, 2003; Mertler & Campbell, 2005; Plake et al., 1993; Quilter & Gallini, 2000; Xu & Brown, 2016). Teachers can carry out the further steps in the light of valid results if the measurement practices are conducted thoroughly. Therefore, scoring, giving feedback and evaluation are latter competencies. Hereby, the skills that W-MELM focused on critical topic of teachers’ assessment literacy.

The validity and reliability of a measuring instrument is significantly dependent on whether or not the instrument contains the features that the items are required to have (Crocker & Algina, 1986; Gültekin, 2014). In this context, the checklists that were drawn up to provide guidance on whether or not the types of items in W-MELM had the required critical features received a high percentage of positive views. Also, seeing an actual listing of features of items, which is an essential factor in making valid and reliable measurements, proved to be an effective tool for the teachers.

It is known that it is important to make a needs analysis (Peterson, 2003), to follow scientific evidence and theories (Reigeluth, 1983), and to use technology effectively in the design process of digital learning material (Hooper & Rieber, 1995; Sezer, Karaoğlan Yılmaz & Yılmaz, 2013). W-MELM designed along these lines is believed to be a solution for ineffective and nonproductive face-to-face in-service training programs (Şenel et al., 2018; Uçar & İpek, 2006).

Literature emphasizes that teachers are demanding distance education now to a greater extent (Çelen, Çelik & Seferoğlu, 2013). Also, some challenging events as COVID-19 pandemic have made it necessary to conduct these trainings remotely (Ferdig et al., 2020). It is evident that distance education and qualified online materials will be needed more often in the future. The present study provides evidence that designing digital learning material is important and in fact required for today’s in-service training programs. Additionally, it can be seen that teachers actually prefer practical in-service training. Teachers not only want to be able to access effective digital learning materials whenever they wish to, they would also like to participate in face-to-face practice-oriented training. On the other hand, constantly accessible digital learning materials that were designed on the basis of scientific processes tend to be preferred because of the advantages of their being available at low cost, being based on a high level of expertise and with no time restrictions.

It was concluded in the study that a digital learning materials designed on the basis of scientific processes would be an effective tool in enhancing the qualifications of teachers in implementing classroom ME procedures. The study will provide guidance to researchers and implementers as to the processes involved in designing a digital learning material. At the same time, it might be recommended that such digital learning materials be expanded to be used in teacher training. There is a need for experimental research to explore the productivity and effectiveness of using digital learning materials in particular topics. In addition, the size of the working group in evaluation of W-MELM is limited. The effectiveness of W-MELM can be re-tested with larger groups. Reaching a wider audience may ensure the common use of the W-MELM. Views of the practitioners can be collected regularly to improve the software and content.

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Scoring Methods for Multiple Choice Tests: How does the Item Difficulty Weighted Scoring Change Student's Test Results?

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Abstract

The past studies on weighted test scoring were focused on the correlation with unweighted test scores. Yet, it is important to investigate the effect of weighted scoring on students' pass and fail rates. In the present study, it was aimed to compare students' test scores, item and test statistics calculated based on the unweighted (1 – 0) and item difficulty weighted scores (Qj – 0). The study also included a proposal for converting the weighted scores into a 100-point scale system. A teacher-made 34-item multiple-choice achievement test was conducted to a group of 431 people via learning management system. As a result of the data analysis, the McDonald's Omega internal consistency coefficients that were obtained according to the 1 – 0 and (Qj – 0) methods were obtained as .725 and .721, respectively. The Pearson's product moment correlation coefficient was .916, and the Spearman's rank-order correlation coefficient was .926 between student scores obtained according to the two methods. Furthermore, a criterion-based evaluation was made based on the two criteria (test scores of 50 and 60), and the numbers of the students who were successful and unsuccessful in the course were determined according to both scoring methods. Accordingly, it was found that more students would be considered unsuccessful in the course in the (Qj-0) scoring method; however, it was understood that this method could reveal differences among individuals more than the unweighted scoring method.

Keywords: Teacher-made test, multiple choice tests, scoring methods

Çoktan Seçmeli Testlerde Puanlama Yöntemleri: Madde Güçlüğüne Dayalı Ağırlıklandırma Öğrencilerin Test Sonuçlarını Nasıl Değiştirir?

Öz

Ağırlıklı puanlama ile ilgili geçmiş çalışmalar incelendiğinde, genellikle ağırlıklandırılmamış puanlarla olan korelasyonların incelendiği, buna karşın ağırlıklandırmanın öğrencilerin geçme – kalma oranlarına olan etkisinin araştırılmadığı görülmüştür. Bu çalışmada öğretmen yapımı çoktan seçmeli 34 maddelik bir başarı testinin 431 kişilik bir gruba öğrenme yönetim sistemi aracılığıyla uygulanmıştır. Daha sonra ağırlıklandırılmamış (1 – 0) ve madde güçlüğüne göre ağırlıklandırılmış (Qj – 0) puanlara göre madde ve test istatistiklerinin, öğrencilerin dersten geçme ve kalma durumlarının karşılaştırılması amaçlanmıştır. Aynı zamanda ağırlıklandırılmış puanların 100'lük puan sistemine çevrilmesine yönelik bir öneri de sunulmuştur. Veri analizi sonucunda 1 – 0 ve Qj – 0 yöntemlerine göre elde edilen McDonald's Omega iç tutarlık katsayıları sırasıyla .725 ve .721 olarak elde edilmiştir. İki yönteme göre elde edilen öğrenci puanları arasında ise Pearson momentler çarpım korelasyon katsayısı .916 ve Spearman sıra farkları korelasyon katsayısı .926 olarak bulunmuştur. Aynı zamanda sırasıyla 50 ve 60 puana göre ölçüt dayanaklı bir değerlendirme yapıldığında, her iki yönteme göre dersten başarılı ve başarısız sayılan öğrenci sayıları belirlenmiştir. Buna göre Qj – 0 puanlama yöntemine göre daha çok öğrencinin dersten başarısız sayılacağı bulunmuş, ancak buna karşın bu yöntemin bireyler arasındaki farklılıkları daha iyi ortaya koyabileceği anlaşılmıştır.

Anahtar kelimeler: Öğretmen yapımı test, çoktan seçmeli testler, puanlama yöntemleri

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1 | Introduction

Multiple-choice tests are widely used, from classroom measurement applications to national and even international applications. Additionally, multiple-choice tests may be decisive in most of the student's success in the course, especially when they are used to measure classroom learning (Mavis, Cole, & Hoppe, 2001; McDougall, 1997). Their many superior aspects such as application on large groups, being composed of many items, ensuring more reliable measurements with the increase of the number of items (Wilson & Wang, 1995), being convenient in terms of application and scoring, and being eligible to be graded objectively (DiBattisa & Kurzawa, 2011; Roediger & Marsh, 2005; Sax, 1989) have led to the widespread use of multiple-choice items. Moreover, including a large number of items in such tests also allows increasing the content validity (Bacon, 2003). There are also criticisms directed at multiple choice tests in contrast to the superior aspects of these tests. These criticisms focus on the view that multiple-choice test items are not suitable for measuring high-level thinking skills (Clark & Linn, 2003; Heubert & Hauser, 1999; Shepard, 2000; Walsh & Seldomridge, 2006). There are also researchers who believe that higher-level thinking skills may be measured with multiple-choice items (Brookhart, 2010). However, it should be considered that, as the cognitive level desired to be measured with such items increases, item writing also becomes more difficult (Buckles & Siegfried, 2006; Palmer & Dewitt, 2007).

The traditional method of scoring multiple-choice items is to score the correct answer (Bereby-Meyer, et.al., 2002; Kurz, 1999). In this scoring, students receive 1 point for their correct answer and 0 points for their incorrect or no answer (Akkuş & Baykul, 2001; Downing & Haladyna, 2006; Gözen, 2006; Kruz, 1999; Özdemir, 2003; Sax, 1989; Turgut, 1992; Yurdugül, 2010). This scoring is also known as 1 – 0 scoring, Bernoulli weighting or unweighted scoring (Rotou, et.al., 2002; Stocking, 1996). In this method, all items in the test are considered and rated at an equal weight (Haladyna, 1990).

One of the important criticisms of the traditional scoring method is that 1 – 0 scoring may provide an estimate of the ranking of the students taking the exam, not their level of knowledge (Kurz, 1999). Another criticism directed at this scoring method is that the 1 – 0 scoring method cannot increase the validity of the item (Merwin, 1959). Additionally, in a multiple-choice item, there is a possibility that an individual will answer correctly to the item by chance, even if they do not have the qualification measured by the item. However, in this method, it is considered that the person who gets 1 point by answering the item correctly has the qualification measured by the item completely, and the person who gets 0 by answering incorrectly or does not answer at all does not have the qualification measured by the item at all. Therefore, success by chance is not taken into account while interpreting scores obtained based on the 1 – 0 scoring method (Budescu & Bar-Hillel, 1993; Frary, 1988; Kubinger, et.al., 2010).

When multiple-choice test items are scored as 1 – 0, the answers of individuals who have the qualification measured by the item fully or those who answer the item correctly by chance are classified as correct, while all other answers are classified as incorrect (Akkuş & Baykul, 2001; Gözen, 2006; Jaradat and Tollefson, 1988; Cruise, 1999; Özdemir, 2003; Sax, 1989; Yurdugül, 2010). Additionally, those who have the qualification measured in a multiple-choice item fully or partly, those who answer the item correctly, and those who answer correctly by chance receive the same item score. Similarly, it is possible to answer an item incorrectly while partially having the measured qualification or to answer the item incorrectly due to carelessness while completely having the qualification. Therefore, there are some points where the 1 – 0 scoring method is insufficient to determine the difference between an individual who has the qualification required by the item and another individual who does not.

Different scoring methods have been developed for multiple-choice items by researchers who consider the limitations of the 1 – 0 scoring method. One of these researchers, Cooms (1953) proposed the method of elimination scoring. In this method, the options are weighted, and individuals eliminate the options that they think are wrong. The scores that an individual can get from an item vary in the range of [-(n-1), (n-1)] to indicate the number of options for the items by n. In other words, for an item with four options, the

option with the falsest information is rated as -3, and the option with the most accurate information is rated as +3. Other options are also weighted by a value in this range, according to the accuracy of the information they contain.

Following Coombs (1953), different scoring methods have also been developed. Frary (1989) considered scoring methods in two basic classes: the direct response methods and examinee judgements methods. In the direct answering method, individuals select and mark which of the options they think is the correct answer. In this method, scores based on the answer, option weighting, multiple answers, and the item response theory may be applied until the correct answer is found. In the answerer decisions method, individuals mark the options or groups of options that they think are either wrong or right among all options (Özdemir, 2003). In this method, different ways of scoring may be followed, such as scoring based on the degree of trust, dividing into subsets and scoring based on the probability of answering (Akkuş & Baykul, 2001).

Another recommendation for scoring multiple-choice test items is to weigh the items based on an objective measure. Here, psychometric properties such as the difficulty and discrimination of the item may be used as the criteria. Items with high difficulty and discrimination are given more points, while items with low difficulty and discrimination are given fewer points (Budescu, 1979). In particular, the findings of the research conducted by Gözen (2006) drew attention while examining the research on weighting based on item difficulty. In their study, the 1 – 0 scoring method was compared to the 1 – P_j and [(1 – P_j)r_{jX}] scoring methods. Comparisons were made for both short-answer items and multiple-choice items. Accordingly, significant relationships on the level of .91 were obtained between the 1 – 0 and 1 – P_j scoring methods and on the level of .92 between the 1 – 0 and [(1 – P_j)r_{jX}] scoring methods. The study by Yurdugül (2010) also compared the 1 – 0 scoring method to the method of scoring by weighing with r_jX and methods based on the Item Response Theory (IRT). Accordingly, a significant relationship on the level of .99 was found between the 1 – 0 and r_{jx} – 0 scoring methods. While the study by Gözen (2006) was conducted on 316 students, the study by Yurdugül (2010) was conducted on a group of 10000 people selected from students who participated in a national exam.

Considering the weighting methods used by Gözen (2006) and the size of the sample, this study is also similar to the study pattern of Gözen (2006). However, the aforementioned studies have focused on the relationship between weighted and unweighted scores and the effect of scoring methods on the psychometric qualities of the test. These studies did not focus on the question of how students will be affected by decisions that will be made according to absolute criteria while using different scoring methods. This study differs from related studies in that it focuses on the changes that the scoring method creates on the individual level. Additionally, the related studies did not include discussions on how weighted scores can be converted to a hundred-point system. Theoretically, the benefit of such a transformation is open to debate. However, in practice, there are situations that require the use of a hundred-point system. Therefore, in cases where weighted scoring is utilized, there is a need for research that will guide implementers to convert the total score into a hundred-point system. For this reason, when the unweighted (1 – 0) and weighted scoring methods according to item difficulty were used in the study, it was aimed to compare the psychometric characteristics of the test and examine the relationship between the success scores of individuals according to both methods. Additionally, when the criteria to be taken to succeed in the course were 50 and 60 points, it was examined how the decisions made about students changed according to both scoring methods.

2 | Method

Research Group

The research group consisted of 431 students who were enrolled in the assessment and evaluation class in the summer term of 2019-2020 at Pamukkale University, School of Education, but received distance education due to the COVID-19 pandemic and took the mid-term exam. Among these students, 126 (29.2%) were male, and 305 (70.8%) were female.

Data collection

A 34-item multiple-choice achievement test was used to collect the data. The achievement test was developed to measure the academic achievement of university students in the assessment and evaluation class in education and applied to the students as a mid-term exam. Therefore, the scope of the test included the basic concepts of measurement and evaluation, error in measurement, reliability, validity and usefulness. To determine the internal consistency of the test, the McDonald's Omega coefficient was calculated. According to the scoring method, the 1 – 0 reliability coefficient of the test was .725, which was found to be. 721 according to the scoring method weighted based on item difficulty. The results section covers more detailed discussion on the psychometric properties of the test.

The data collection process was carried out through the Moodle Learning Management System (LMS) due to the COVID-19 pandemic. The students were given 45 minutes to complete the achievement test. In order to avoid problems that may have arisen from the system while answering the test items, the students were given the right to re-enter to the system. Additionally, the items included in the test were presented to the students in groups of five. After the students answered the five items presented to them, the other five test items appeared on the screen. During the application phase, the students were able to access the item they wanted to review again within the time given to them and check their responses to the test items.

Data Analysis

Within the scope of the study, the data collected from the sample was analyzed using the ShinyItemAnalysis 1.3.4 (Martinková and Drabinová, 2016) package on R 4.0.2 (R Core Team, 2020). ShinyItemAnalysis is a software which can calculate items and test statistics. Using the ShinyItemAnalysis package, item difficulty as item statistics, the difference between the item difficulty levels for upper and lower 27% of group (gULI), item reliability (Rel), item reliability based on the item-remainder correlation (rel-drop) item-total correlation (RIT), and the item-rest correlation (RIR) statistics were calculated. Test statistics were obtained by using the Microsoft Office 365 Excel software.

Primarily, an item-score matrix was created to calculate the item-difficulty, gULI, Rel-drop, RIR and RIT statistics based on the scoring methods based on 1 – 0 and item-difficulty (the $Q_j - 0$ expression will be used later on in the report for ease of display) weighting as shown in Table 1. According to the $Q_j - 0$ scoring method, the Q Matrix given in Table 2 was created. The item-score matrix in Table 1 is two-dimensional, where the rows show answerers, and the columns show items. In the case where the item-score matrix is created with a score of 1 – 0, the row totals show the total number of correct answers or the total score ($\sum X_C$) of the answerer. The column totals ($\sum X_j$) show how many examinees answered each test item correctly.

While the equation $P_j = \frac{\sum X_j}{n}$ was used in the calculation of the difficulty level (P_j), the equation $Q_j = 1 - P_j$ was used for the wrong answering rates (Q_j) of the test items. In this study, the focus was not on the options; the weighted item statistics were calculated by considering the difficulty levels of the test items (P_j). In weighting the items, the $Q_j = 1 - P_j$ ratios of those who answered incorrectly to the relevant item were accepted as the weight ratio of the item. In the 1 – 0 scoring method, the P_j value represented

the difficulty level of the item. If this value got close to 1, the difficulty of the items would decrease; that is, the items would get easier.

According to the $Q_j - 0$ method, as the difficulty level of the item $(1 - P_j)$ gets closer to 1, the item gets more difficult. The item difficulty levels of the $Q_j - 0$ scoring method are shown in Table 2 as the matrix Q. In the Matrix Q, the rows show answerers, resulting in total scores weighted according to the $Q_j - 0$ scoring method when the row sums are added.

The conversion of the correct number of responses in the test to a score of 100 was found to be based on equation 1 compared to the 1 – 0 scoring.

$$TS_{1-0} = \frac{100}{K} d_S$$

In this equation, 100 indicates the scoring unit, K indicates the number of items in the test, and d_S indicates the number of the correct answers of the answerer. In order to calculate the total score that answerers received from the test according to the $Q_j - 0$ scoring method, the total score $\sum Q$ in the sense of raw score according to the scoring method $Q_j - 0$ was calculated using equation 2.

$$\sum Q = Q_1 + Q_2 + Q_3 + \cdots + Q_n \quad (2)$$

The standard deviation value for the answerers' Q Scores was calculated based on equation 3.

$$S_Q = \sqrt{\frac{\sum Q^2 - \frac{(\sum Q)^2}{n}}{n-1}} \quad (3)$$

In the next step, the T standard score with a mean value of 50 and a standard deviation of 10 for each answerer was calculated using values obtained from equation 2 and equation 3 by using equation 4.

$$T_Q = 50 + 10\left(\frac{Q - \bar{Q}}{S_Q}\right) \quad (4)$$

Using the calculated T standard scores, each answerer's score was converted to a distribution with the lowest value of 10 and the highest value of 100. Equation 5 was used for this conversion.

$$TS_Q = 10 + \frac{90 * (T_Q - smallest\ T_Q)}{(The\ biggest\ T_Q - smallest\ T_Q)} \quad (5)$$

Table 1. Item-Score Matrix

Examinees	TEST ITEMS																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	$\sum X_c$
1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1	1	0	22
2	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	1	0	0	0	0	1	1	0	0	1	0	1	0	0	1	1	0	1	0	18
3	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	1	1	0	0	1	1	0	1	0	21
4	1	0	0	1	1	1	1	1	1	0	0	1	1	0	0	0	1	1	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	0	17
5	1	1	1	1	1	1	1	0	1	1	0	0	1	1	0	0	1	0	0	1	1	0	0	1	1	1	1	1	0	1	1	1	0	0	22
6	1	1	0	1	1	0	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	1	1	0	0	0	1	0	1	0	20
7	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	1	0	0	0	0	1	1	1	0	22
8	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1	0	1	1	1	0	0	1	1	0	0	0	1	1	1	0	23
9	1	1	0	1	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	11
10	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	8
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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422	1	1	1	1	1	0	1	0	1	0	1	0	1	0	0	1	1	0	0	1	1	1	0	0	1	0	0	0	0	1	1	0	0	0	17
423	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	0	1	1	1	0	1	0	0	0	0	1	1	0	0	1	1	0	1	0	21
424	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	0	1	1	0	0	0	1	1	0	0	1	1	1	1	0	23
425	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	1	10
426	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	0	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	27
427	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	1	1	0	0	0	1	1	0	0	1	1	0	0	0	19
428	1	1	0	1	0	1	1	1	1	1	0	1	1	1	0	1	0	0	1	0	1	1	0	0	1	0	1	1	0	1	1	1	0	0	21
429	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	0	1	1	0	0	1	1	1	0	0	22
430	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	1	1	1	0	0	1	1	0	0	1	1	1	1	0	24
431	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	1	0	1	0	0	1	1	1	0	0	1	1	1	1	21
$\sum X_j$	312	368	353	350	312	294	401	370	281	235	217	327	390	193	295	253	355	121	138	76	302	276	76	69	149	293	274	156	44	305	408	343	348	65	
P_j	.724	.854	.819	.812	.724	.682	.930	.858	.652	.545	.503	.759	.905	.448	.684	.587	.824	.281	.320	.176	.701	.640	.176	.160	.346	.680	.636	.362	.102	.708	.947	.796	.807	.151	

Table 2. Q Matrix

Examinees	TEST ITEMS																						
	1	2	3	4	5	6	7	8	9	10	. . .	25	26	27	28	29	30	31	32	33	34	$\sum X_c$	$\sum QW$
1	.276	.146	.181	.188	.276	.318	.070	.142	.348	.000	. . .	.000	.320	.364	.000	.000	.292	053	.204	.193	.000	22	6.1625
2	.276	.000	.181	.188	.000	.000	.070	.142	.000	.455	. . .	.654	.000	.364	.000	.000	.292	053	.000	.193	.000	18	6.0906
3	.276	.000	.181	.188	.276	.000	.070	.142	.348	.455	. . .	.000	.320	.364	.000	.000	.292	.053	.000	.193	.000	21	6.4988
4	.276	.000	.000	.188	.276	.318	.070	.142	.348	.000	. . .	.000	.320	.364	.638	.000	.000	.053	.000	.193	.000	17	5.2414
5	.276	.146	.181	.188	.276	.318	.070	.000	.348	.455	. . .	.654	.320	.364	.638	.000	.292	.053	.204	.000	.000	22	7.5709
6	.276	.146	.000	.188	.276	.000	.070	.142	.348	.000	. . .	.000	.320	.364	.000	.000	.000	.053	.000	.193	.000	20	6.1300
7	.276	.146	.181	.188	.276	.318	.070	.142	.348	.000	. . .	.000	.320	.000	.000	.000	.000	.053	.204	.193	.000	22	6.4688
8	.276	.146	.181	.188	.276	.318	.070	.142	.348	.455	. . .	.000	.320	.364	.000	.000	.000	.053	.204	.193	.000	23	7.5710
9	.276	.146	.000	.188	.276	.000	.070	.000	.348	.000	. . .	.654	.000	.364	.000	.000	.000	.000	.204	.000	.000	11	3.7054
.	.	.	.	.	.	.	.	.	.	.	. . .	.	.	.	.	.	.	.	.	.	.	.	
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.	.	.	.	.	.	.	.	.	.	.	. . .	.	.	.	.	.	.	.	.	.	.	.	
422	.276	.146	.181	.188	.276	.000	.070	.000	.348	.000	. . .	.654	.000	.000	.000	.000	.292	.053	.000	0	0	17	5.1485
423	.276	.146	.181	.188	.276	.000	.070	.142	.000	.455	. . .	.000	.320	.364	.000	.000	.292	.053	.000	.193	0	21	6.6172
424	.276	.146	.181	.188	.276	.318	.070	.142	.348	.455	. . .	.000	.320	.364	.000	.000	.292	.053	.204	.193	0	23	6.4478
425	.000	.000	.000	.000	.276	.000	.070	.142	.000	.000	. . .	.654	.000	.000	.638	.000	.000	.053	.000	.000	.849	10	5.1880
426	.276	.146	.181	.188	.276	.318	.070	.142	.348	.000	. . .	.654	.320	.364	.638	.897	.292	.053	.204	.193	.849	27	9.2181
427	.276	.146	.181	.188	.276	.000	.070	.142	.000	.455	. . .	.000	.320	.364	.000	.000	.292	.053	.000	.000	.000	19	5.3851
428	.276	.146	.000	.188	.000	.318	.070	.142	.348	.454	. . .	.654	.000	.364	.638	.000	.292	.053	.204	.000	.000	21	6.7890
429	.276	.146	.181	.188	.276	.318	.070	.142	.348	.455	. . .	.000	.320	.364	.000	.000	.292	.053	.204	.000	.000	22	6.7332
430	.276	.146	.181	.188	.276	.318	.070	.142	.348	.455	. . .	.000	.320	.364	.000	.000	.292	.053	.204	.193	.000	24	7.6753
431	.276	.146	.181	.188	.276	.318	.070	.142	.348	.000	. . .	.000	.320	.364	.638	.000	.000	.053	.204	.193	.849	21	6.5779

Research ethics

The principals of research ethics were followed by the authors in the planning, data collection, data analysis, and reporting the findings phases of the current research.

3 | Findings

In order to examine whether there was difference in the item statistics calculated based on the 1 – 0 and $Q_j - 0$ scoring methods from a teacher-made test, item statistics were calculated, and these statistics are presented in Table 3.

When the item statistics given in Table 3 are examined, it is seen that there was significant differentiation between the items involved in the test in terms of their difficulty levels. When the lower – upper 27% groups method, the generalized lower – upper 27% groups method, the total matter and remaining matter correlations were examined, there was no significant difference between the item distinctiveness indices according to the 1 – 0 and $Q_j - 0$ methods.

Table 3. Item statistics obtained by 1 – 0 and $\mathbf{Q_j - 0}$ scoring methods

	Diff		SD	ULI		gULI		RIT		RIR		Omega Drop		Rel		Rel Drop	
	1-0	Q-0	1-0	1-0	Q-0	1-0	Q-0	1-0	Q-0	1-0	Q-0	1-0	Q-0	1-0	Q-0	1-0	Q-0
M1	.724	.276	.448	.322	.301	.242	.242	.341	.309	.249 [.158,.336]	.238 [.147, .325]	.725	.721	.153	.038	.111	.029
M2	.854	.146	.354	.217	.182	.205	.149	.295	.220	.221 [.129, .309]	.189 [.096, .278]	.727	.723	.104	.011	.078	.010
M3	.819	.181	.385	.294	.238	.228	.200	.362	.285	.285 [.196, .370]	.245 [.154, .332]	.723	.720	.140	.020	.110	.017
M4	.812	.188	.391	.273	.224	.195	.149	.357	.217	.278 [.188, .363]	.173 [.080, .263]	.723	.720	.139	.016	.109	.013
M5	.724	.276	.448	.399	.273	.260	.186	.371	.281	.281 [.192, .366]	.209 [.117, .298]	.723	.718	.166	.035	.126	.026
M6	.682	.318	.466	.378	.364	.298	.242	.389	.333	.296 [.207, .380]	.248 [.157, .335]	.722	.718	.181	.049	.138	.037
M7	.930	.070	.255	.168	.003	.107	.002	.359	.055	.308 [.220, .391]	.025 [-.070, .119]	.721	.717	.091	.003	.078	.001
M8	.858	.142	.349	.252	.196	.195	.140	.335	.244	.264 [.174, .350]	.215 [.123, .303]	.724	.720	.117	.012	.092	.011
M9	.652	.348	.477	.427	.315	.321	.228	.391	.290	.296 [.207, .380]	.193 [.100, .282]	.722	.719	.186	.048	.141	.032
M10	.545	.455	.499	.490	.503	.367	.330	.435	.396	.339 [.258, .420]	.269 [.179, .354]	.719	.716	.217	.090	.169	.061
M11	.503	.497	.501	.378	.259	.265	.228	.314	.238	.209 [.117, .298]	.087 [-.008, .180]	.726	.721	.157	.059	.104	.022
M12	.759	.241	.428	.385	.273	.237	.172	.397	.272	.312 [.224, .395]	.211 [.119, .299]	.721	.717	.170	.028	.134	.022
M13	.905	.095	.294	.189	.147	.112	.112	.349	.242	.290 [.201, .374]	.226 [.134, .314]	.722	.719	.102	.007	.085	.006
M14	.448	.552	.498	.112	.238	.107	.181	.108	.231	-.002 [-.096, .092]	.063 [-.032, .157]	.738	.734	.054	.063	-.001	.017
M15	.684	.316	.465	.490	.371	.330	.274	.464	.371	.377 [.293, .455]	.290 [.201, .374]	.717	.713	.216	.054	.175	.042
M16	.587	.413	.493	.252	.245	.172	.163	.265	.256	.160 [.067, .251]	.134 [.040, .226]	.729	.726	.131	.052	.079	.027
M17	.824	.176	.382	.378	.301	.256	.251	.503	.376	.436 [.356, .509]	.340 [.254, .421]	.713	.709	.192	.025	.166	.023
M18	.281	.719	.450	.182	.252	.126	.209	.189	.234	.091 [-.003, .184]	.036 [-.059, .130]	.733	.729	.085	.076	.041	.012
M19	.320	.680	.467	.336	.420	.242	.307	.291	.420	.192 [.099, .281]	.241 [.150, .328]	.728	.725	.136	.133	.089	.076
M20	.176	.824	.382	.098	.203	.065	.130	.138	.300	.054 [-.041, .148]	.111 [.017, .203]	.736	.732	.053	.094	.021	.035
M21	.701	.299	.458	.378	.434	.288	.307	.400	.399	.309 [.221, .392]	.324 [.237, .406]	.721	.716	.183	.055	.141	.044
M22	.640	.360	.480	.503	.399	.391	.298	.477	.379	.388 [.305, .465]	.283 [.194, .368]	.716	.712	.229	.065	.186	.049
M23	.176	.824	.382	.154	.266	.121	.186	.205	.321	.122 [.028, 214]	.134 [.040, .226]	.732	.729	.078	.101	.046	.042
M24	.160	.840	.367	-.028	.112	-.014	.070	.000	.158	-.081 [-.174, .014]	-.033 [-.127, .062]	.742	.739	.000	.049	-.030	-.010
M25	.346	.654	.476	.182	.301	.135	.200	.165	.277	.060 [-.035, .154]	.088 [.-.007, .181]	.735	.731	.079	.086	.029	.027
M26	.680	.320	.467	.552	.148	.386	.115	.537	.445	.457 [.379, .529]	.364 [.279, .443]	.711	.708	.250	.069	.213	.056
M27	.636	.364	.482	.580	.503	.474	.363	.530	.462	.446 [.367, .519]	.371 [.287, .450]	.712	.708	.255	.081	.215	.065
M28	.362	.638	.481	.210	.056	.158	.037	.194	.148	.088 [-.007, .181]	.092 [-.002, .185]	.733	.731	.093	.013	.042	.008
M29	.102	.898	.303	-.056	.028	-.019	.019	-.092	.016	-.158 [-.249,-.065]	-.150 [-.241,-.056]	.745	.742	-.028	.004	-.048	-.041
M30	.708	.292	.455	.273	.161	.219	.172	.249	.173	.151 [.057, .242]	.092 [-.002, .185]	.730	.726	.113	.023	.069	.012
M31	.947	.053	.225	.119	.091	.102	.084	.284	.188	.238 [.147, .325]	.181 [.088, .271]	.725	.721	.064	.002	.053	.002
M32	.796	.204	.404	.315	.301	.237	.219	.336	.305	.253 [.162, .339]	.258 [.168, .344]	.724	.720	.135	.025	.102	.021
M33	.807	.193	.395	.343	.266	.242	.214	.417	.309	.341 [.255, .422]	.266 [.176, .352]	.719	.714	.165	.024	.134	.020
M34	.151	.849	.358	.217	.259	.153	.209	.256	.365	.180 [.087, .270]	.187 [.094, .277]	.729	.724	.092	.111	.064	.057

Diff: Difficulty value obtained by dividing the mean score by the range. **gULI:** The difference between the item difficulties of the lower and upper groups. **Rel:** Item reliability, **Rel drop:** Item reliability when the item is removed **ULI:** Item differentiation according to the lower-upper groups method **RIT:** Item-total correlation **RIR:** Item-rest correlation

Fisher's Z test was intended to be used to test the significance of the difference between the item distinctiveness indices obtained by the two methods, but this test was not possible because the correlation coefficient between the item scores according to the 1 – 0 method and the item scores according to the $Q_j - 0$ method was 1.00. Instead, 95% confidence intervals were calculated for the indices, and it was decided that the confidence intervals covered each other, so, there was no significant difference between the indices. Although it seems that the distinctiveness of the items in relation to some other items was quite low, interpretation of the distinguishing indices of the items was not made as the aim of the study did not include it. The test statistics obtained according to the unweighted and weighted scoring methods are given in Table 4.

Table 4. Individual Scores and Test Statistics Obtained by the 1 – 0 and $Q_j - 0$ Scoring Methods

	Test Statistics According to 1 - 0 Scoring Method				$Q_j - 0$ Test Statistics According to the Scoring Method			
Examiners	$\sum X_C$	Z_{1-0} Standard Score	T_{1-0} Standard Score	TS_{1-0}	$\sum Q$	Z_{Q_j-0} Standard Score	T_{Q_j-0} Standard Score	TS_{Q_j-0}
1	22.00	.3798	53.7983	64.7059	6.1625	-.1819	48.18092	49.6632
2	18.00	-.5098	44.9018	52.9412	6.0906	-.2262	47.73756	48.9580
3	21.00	.1574	51.5742	61.7647	6.4988	.0255	5.25467	52.9615
4	17.00	-.7322	42.6777	5.0000	5.2414	-.7499	42.50108	4.6293
5	22.00	.3798	53.7983	64.7059	7.5709	.6866	56.86563	63.4763
6	2.00	-.0650	49.3501	58.8235	6.1300	-.2019	47.98051	49.3444
7	22.00	.3798	53.7983	64.7059	6.4688	.0070	5.06968	52.6672
8	23.00	.6022	56.0224	67.6471	7.5710	.6866	56.86625	63.4773
9	11.00	-2.0667	29.3330	32.3529	3.7054	-1.6970	33.02954	25.5648
10	8.00	-2.7339	22.6606	23.5294	3.3342	-1.9259	3.74058	21.9242
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
422	17.00	-.7322	42.6777	5.0000	5.1485	-.8072	41.9282	33.0202
423	21.00	.1574	51.5742	61.7647	6.6172	.0985	5.9848	49.0252
424	23.00	.6022	56.0224	67.6471	6.4478	-.0060	49.9402	47.1792
425	1.00	-2.2891	27.1089	29.4118	5.1880	-.7828	42.1718	33.4507
426	27.00	1.4919	64.9189	79.4118	9.2181	1,7023	67.0229	77.3683
427	19.00	-.2874	47.1259	55.8824	5.3851	-.6613	43.3872	35.5985
428	21.00	.1574	51.5742	61.7647	6.7890	.2044	52.0442	5.8974
429	22.00	.3798	53.7983	64.7059	6.7332	.1700	51.7001	5.2893
430	24.00	.8247	58.2465	7.5882	7.6753	.7509	57.5094	6.5558
431	21.00	.1574	51.5742	61.7647	6.5779	.0742	5.7424	48.5970
				$\overline{X}$ = 59.683				$\overline{X}$: 52.556
				S_D = 13.224				S_D: 15.923
			McDonald's Omega: .725				McDonald's Omega: .721	

$\sum X_C$: total number of correct answers according to 1 – 0 scoring method; Z_{1-0}: Z standard score according to 1 – 0 scoring method; T_{1-0}: T standard score according to 1 – 0 scoring method; TS: Total score according to 1 – 0 scoring method; $\sum Q$: total value of Matrix Q weighted according to $Q_j - 0$ scoring method; Z_{Q_j-0}: Z standard score according to $Q_j - 0$ scoring method; T_{Q_j-0}: T standard score according to $Q_j - 0$ scoring method; TS_{Qj-0}: Total score according to $Q_j - 0$ scoring method

When the values given in Table 4 are examined, it may be seen that the mean test scores based on the 1 – 0 and $Q_j - 0$ scoring methods were 59.7 and 52.5, respectively. One-sample t-test was performed to determine the significance of the difference between scores obtained and to determine whether the difference between the scores obtained by the two methods significantly differed from zero. Accordingly, it was found that there was a significant difference between the mean scores obtained according to the two methods (t_{430} = 22.837; p<.05). The mean score obtained by the students according to the 1 – 0 scoring method was significantly higher than the mean score they obtained according to the $Q_j - 0$ scoring

method. The McDonald's Omega internal consistency coefficients, calculated according to two different scoring methods for the test, were found to be close to each other.

After the one-sample t-test conducted to examine whether the students' achievement scores differed according to the scoring methods, the scores calculated according to the 100-point scale in Table 4 were also examined individually. This examination revealed that the scores that the students received according to the 100-point scale system differed according to the scoring methods. For example, the first student in the first place received a score of 64.71 in the 1- 0 scoring method and 49.66 in the $Q_j - 0$ scoring method. Additionally, while the total scores of the students whose correct answer numbers were equal in the 1- 0 scoring method were also equal, this did not apply to the $Q_j - 0$ method because weighting was performed according to the item difficulty. For example, in Table 4, students in the first, fifth and seventh places responded correctly to 22 items, and all three scored 64.7 points according to the 1 – 0 scoring method. However, according to the $Q_j - 0$ scoring method, the scores of these students were calculated as 49.7, 63.7 and 52.7, respectively. This result showed that the test scores of the students with the same number of correct answers differed, as the differences between item difficulty levels were taken into account in the $Q_j - 0$ scoring method. In this case, it may be stated that the first student responded correctly to easier items than the fifth- and seventh students, and the fifth student responded correctly to more difficult items than the first and seventh students. As a result, although the correct answer numbers were the same, the first student received a lower score than the fifth student.

Another situation taken into account in this study was whether there was a statistically significant relationship between the scores obtained according to the 1 – 0 and $Q_j - 0$ scoring methods. Therefore, both the Pearson's product moment correlation and Spearman's rho correlation coefficients were calculated. The degree of the relationship between the success scores from both scoring methods were found to be 0.916 according to the Pearson's product moment correlation coefficient and 0.926 according to the Spearman's rho correlation coefficient. It is seen that there was a very high and statistically significant relationship between the achievement scores obtained for both methods in the positive direction.

The correlation between the scores obtained according to the two methods was very high, which means that a student who was successful according to one type of scoring was also successful according to the other method. However, when it is decided whether a student is successful – unsuccessful in a course, it is also necessary to determine how weighted and unweighted scoring methods change the outcome of the student's evaluations. Accordingly, when the criteria for being considered successful in the course were 50 and 60 points, respectively, the numbers of students who would be considered successful and unsuccessful in the course according to the scoring methods were calculated and are given in Table 5.

Table 5. *Distribution of Students who are Considered Successful and Unsuccessful according to the 1 – 0 and* $Q_j - 0$ *Methods*

	Criteria 50	$Q_j - 0$		Criteria 60	$Q_j - 0$	
		Successful	Unsuccessful		Successful	Unsuccessful
$1 - 0$	Successful	250	91	Successful	139	101
	Unsuccessful	2	88	Unsuccessful	2	189

When the values given in Table 5 are examined, it is revealed that the numbers of the students who succeeded and failed in the course differed according to the scoring method. Compared to the $Q_j - 0$

method for the values of both criteria, it seems that the number of students who were considered successful in the course was greater in the 1 – 0 scoring method. This result suggested that the scoring methods also differentiated the decisions made about students. As mentioned earlier, the differences between the items in terms of difficulty levels were not taken into account while calculating the student scores in the 1 – 0 scoring method. In contrast, the students' scores were calculated by taking into account the fact that the items differed in terms of difficulty levels in the $Q_j - 0$ scoring method. Therefore, the success rates of the students in the test varied according to the scoring method depending on the different weight scores of the test items with different difficulty levels. A scatter plot was created to better understand how this situation changed the decisions made about the students. Figure 1 shows the scatter plot obtained after converting the students' scores received according to both the 1 – 0 and $Q_j - 0$ scoring methods into a 100-point scale system.

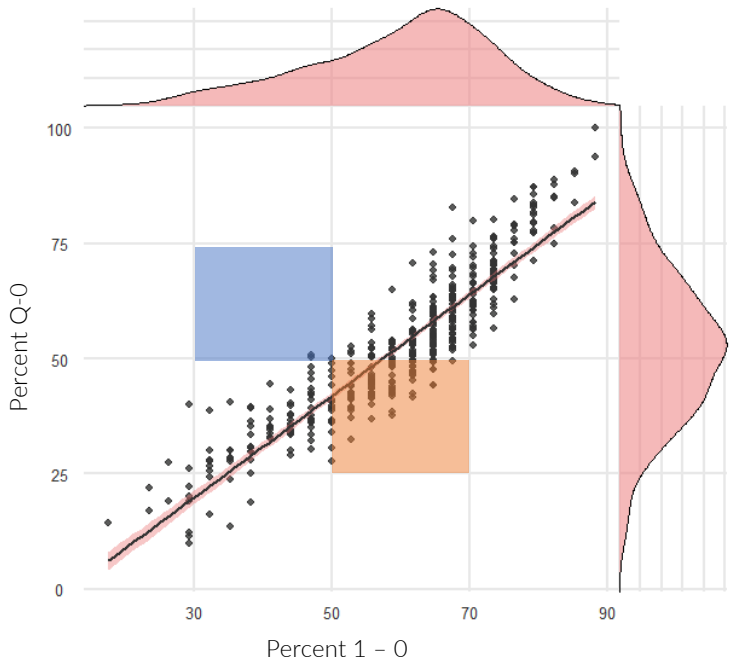

Figure 1. *Scatter plot of scores obtained according to methods 1 – 0 and Q_j - 0*

Looking at Figure 1, the difference between the areas marked with orange and blue was quite remarkable. The Orange area shows the students scoring above 50 according to the 1 – 0 scoring method but below 50 according to the $Q_j - 0$ method. The Blue Area shows those who scored below 50 according to the 1 – 0 method but above 50 according to the $Q_j - 0$ method. Although it seems that there was a high-level relationship between the two scores, it seems that while evaluating students according to absolute criteria, decisions made about students will differ based on the scoring methods. About 27% of the students who should have been considered successful according to the 1 – 0 scoring method when the criterion value was 50 points in the assessment and about 42% who should have been considered successful when the criterion value was 60 points turned out to be unsuccessful in the course according to the $Q_j - 0$ method. Additionally, when the density plots in the upper right part of Figure 1 are examined, it is understood that the scores showed a normal distribution according to the $Q_j - 0$ method, while the scores showed a skewed distribution to the left in the 1 – 0 method. In this context, it was found that the $Q_j - 0$ method could better reveal differences between individuals, given the standard deviation values of the distributions also included in Table 4.

4 | Discussion & Conclusion

In this study, it was aimed to compare the item and test statistics calculated based on the measurement results obtained according to the 1 – 0 and $Q_j - 0$ scoring methods, the test scores of the students and the decisions made about them. For this purpose, a teacher-made achievement test containing 34 multiple choice items created within the scope of the Assessment and Evaluation in Education course, which is a mandatory course in schools of education in Turkey, was applied to the study group. Based on the 1 – 0 and $Q_j - 0$ scoring methods, the students' item and test scores were calculated, and the item and test statistics obtained on the basis of these scores were compared. When the results of the item statistics were examined, it was found that there was significant difference between the items involved in the test in terms of their difficulty levels, and it was understood that the items in the test were not of equal difficulty.

According to the two scoring methods, there was a fairly high level of significant relationship between the test scores obtained. This result coincided with the research by Gözen (2006) and Yurdugül (2010), who found fairly high correlation coefficients between weighted and unweighted scores. Additionally, the study found that the McDonald's Omega reliability coefficients obtained when the reliability values were calculated based on both scoring methods were very close to each other. Supporting this finding, the study by Akkuş and Baykul (2001) stated that using different item scoring methods often does not change reliability or even increase it very little. The results of the study conducted by Yurdugül (2010) also supported the conclusion of this study on the reliability coefficient. It was found that the reliability coefficients estimated by the researcher based on the total scores obtained as a result of weighted scoring according to the item distinctiveness values and as a result of 1 – 0 scoring were very close to each other.

The results of the study on the relationship and reliability coefficients showed that there was no significant difference between the results obtained by the two scoring methods. As stated in the introduction, this study focused more on the impact of scoring methods on individuals' scores and decisions about them than on the psychometric qualities of the test. Therefore, the study sought to further examine the test scores of the individuals and the changes that occurred in the "passed – failed" decisions made about them. These reviews showed that the test scores obtained with unweighted scoring and weighted scoring based on item difficulty, the test mean and standard deviation values, and the "passed – failed" decisions made about the students differed. Budescu (1979) stated that assigning different weights to test items does not significantly affect test properties and performance. However, the results of this study revealed that when the $Q_j - 0$ scoring method was used instead of 1 – 0 scoring, there was a difference in favor of the 1 – 0 scoring method both in the test statistics and in the decisions made about the students.

In the $Q_j - 0$ scoring method, students who had the same number of correct answers on the test had different overall scores due to the different difficulty levels of the items they correctly respond to. As a result, the mean and standard deviation values of the test also changed. When the $Q_j - 0$ scoring method was used, the arithmetic mean value of the test decreased, and the standard deviation value increased. The increase in the standard deviation value indicated that weighting based on item difficulty increased the differences in the scores between individuals. This result of the study demonstrated that the $Q_j - 0$ scoring method may contribute to revealing the difference among individuals in terms of the traits are measured by the test. Similarly, Akkuş and Baykul (2001) addressed points that make it difficult to use weighted scoring methods in practice, but they emphasized that weighted scoring is useful in terms of its power to provide information about the individual.

When an absolute criterion-based assessment was performed to examine how the passed-failed decisions made about the student changed based on the scoring method, it was observed that the number

of students who succeeded or failed in the course changed according to the scoring method. About 27% of the students who should have been considered successful according to the 1 – 0 scoring method were considered unsuccessful in the course according to the $Q_j - 0$ method when the criterion value was 50 points, and about 42% of such students were considered unsuccessful in the latter method when the criterion value was 60 points.

The results of the study showed that weighted scoring based on item difficulty may contribute to revealing differences between individuals. However, another result of the study showed that the number of the students who succeeded or failed in the course changed when an absolute criterion-based assessment was performed to examine how the passed-failed decisions about the students changed according to the scoring method. It was concluded that the number of the students who failed in the course increased when weighting was performed according to item difficulty. Based on these results, as it is thought that the $Q_j - 0$ scoring method may reveal learning differences between students better than the 1 – 0 scoring method, it is recommended that weighted scoring based on item difficulty is used along with conventional scoring in order to obtain more information about the students in classroom assessments. However, at this point, it is necessary to pay attention to the fact that the number of students who will be considered unsuccessful in the course will be higher when scoring is made according to the $Q_j - 0$ method. Therefore, it is thought that the $Q_j - 0$ scoring method may be preferred to the 1 – 0 scoring method, especially in formative assessments, rather than assessment practices in which very critical decisions are made about the students. The fact that the sample was not broad enough to increase differentiation in terms of the measured characteristics was a limitation of this study. For researchers who want to conduct a similar study in a larger and wider group, it may be recommended to examine how different types of scoring lead to differences, especially on the student level, using tests that measure different content areas.

Statements of publication ethics

The ethics committee approval for present research was given by Pamukkale University Social and Humanities Ethics Committee with the issue number E-93803232-622.02-21638 and authors declare that the principals of research and publication ethics were followed.

Researchers' contribution rate

The first author contributed to the finding the problem statement and data collection. All the authors contributed to the literature review, data analysis and interpretation the results, reporting, and the checking the final form of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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An Investigation of Epistemological Beliefs of Physics Teachers According to Different Variables

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Abstract

Epistemological beliefs adopted by individuals determine their knowledge, learning and teaching orientations. For this reason, the purpose of this research is to investigate physics teachers' belief levels, as well as the questions about what effect gender, professional experience, and educational background variables have on these levels. Causal-comparative model was used to study these variables. Participants were 205 physics teachers consisting of 106 women and 99 men who work in the Central Anatolia Region of Turkey. All the data was collected with the Scientific Epistemological Beliefs Scale developed by Conley, Pintrich, Vekiri & Harrison (2004). This scale was adapted into Turkish by Özkan (2008). The data was analyzed using parametric tests. Ultimately, findings indicated that physics teachers had sophisticated epistemological beliefs. In addition, there was no statistically significant difference between female and male teachers in terms of beliefs. Educational background variable was found not to have any effect on epistemological beliefs of physics teachers. In regards to professional experience variable, teachers with less experience had more sophisticated epistemological beliefs about the source of knowledge, certainty of knowledge and justification of knowledge.

Keywords: Epistemological beliefs, physics teachers, gender, professional experience, educational background

Fizik Öğretmenlerinin Bilimsel Epistemolojik İnançlarının Farklı Değişkenlere Göre İncelenmesi

Öz

Bireylerin sahip olduğu epistemolojik inançlar, bilgiye, öğrenmeye ve öğretmeye yönelik tutumlarını belirler. Bu araştırmada fizik öğretmenlerinin epistemolojik inanç düzeyleri ve bu inançlar üzerinde cinsiyet, mesleki deneyim ve öğrenim durumu değişkenlerinin etkisi araştırılmıştır. Araştırmada, nedensel karşılaştırma modeli kullanılmıştır. Araştırmaya İç Anadolu Bölgesinde görev yapmakta olan 106'sı kadın, 99'u erkek toplam 205 fizik öğretmeni katılmıştır. Veriler, Conley, Pintrich, Vekiri ve Harrison (2004) tarafından geliştirilen ve Özkan (2008) tarafından Türkçeye uyarlanmış olan Bilimsel Epistemolojik İnanç Ölçeği ile toplanmıştır. Verilerin analizinde parametrik testlerden yararlanılmıştır. Elde edilen bulgular fizik öğretmenlerinin gelişmiş epistemolojik inançlara sahip olduğunu göstermiştir. Ayrıca epistemolojik inançlar açısından kadın ve erkek öğretmenler arasında istatistiksel açıdan anlamlı farklılık olmadığı görülmüştür. Öğrenim durumu değişkeninin de fizik öğretmenlerinin epistemolojik inançları üzerinde etkili olmadığı bulgusuna ulaşılmıştır. Mesleki deneyim değişkenin etkisi araştırıldığında ise, mesleki deneyimi daha az olan öğretmenlerin bilginin kaynağına, bilginin kesinliğine ve bilginin gerekçelendirilmesine yönelik olarak daha gelişmiş epistemolojik inançlara sahip oldukları görülmüştür.

Anahtar kelimeler: Epistemolojik inançlar, fizik öğretmenleri, cinsiyet, mesleki deneyim, öğrenim durumu

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1 | Introduction

Efforts towards acquiring knowledge began when humans had an urge to understand the world in which they live. As knowledge was revealed, it was subsequently questioned. Not only in science and philosophy, but in all disciplines, it became a common goal to find sound knowledge. Hence the discipline of questioning knowledge, in other words, epistemology was born. Epistemology is a branch of philosophy that studies the nature, borders, and rationale of knowledge. Epistemological beliefs are a personal and subjective system of beliefs regarding the nature of knowledge and how 'knowing' occurs (Hofer & Pintrich, 1997; Schommer, 1990).

Epistemological beliefs are concerned with whether knowledge is certain or mutable, where to obtain reliable knowledge, how knowledge is produced, and how knowledge is justified (Ryder et al., 1999; Schommer, 1990; Duell & Schommer-Aikins, 2001). An individual's epistemological beliefs determine their viewpoint about what knowledge is, how it is produced, and how knowing, learning and teaching processes take place (Cano & Cardelle-Elewar, 2004; Deryakulu, 2004; Paulsen & Wells, 1998; Tezci & Uysal, 2004).

There is another perspective different from the framework of the epistemological belief as "epistemological resources". According to this perspective, individual's beliefs about his own knowledge and learning are defined as personal epistemology (Lising & Elby, 2005). Some researchers have claimed that successful science education will be achieved by replacing students' personal epistemology with scientific epistemology (King & Kitchener, 1994; Strike & Posner, 1985). However, according to Hammer and Elby (2003), these epistemologies are not concepts that need to be overcome. Instead, they suggest the definition of "epistemological sources" for student epistemologies. According to them, epistemological sources are different from misbeliefs and misconceptions. They define epistemological sources as epistemologies that are developed in students' daily lives and "knowledge in pieces" that can be built (Bang & Medin, 2010; diSessa, 2006). They emphasized the importance of recognizing students' epistemological resources for science teaching and making it easier for students to use them appropriately. In their studies (Hammer & Elby, 2002; Hammer & Elby, 2003), they grouped these sources as "knowledge as propagated stuff", "knowledge as free creation", and "knowledge as fabricated stuff". They explained these sources as follows:

- Knowledge as propagated stuff: It is knowledge that transfer from a source to a recipient ("Mommy told me").
- Knowledge as free creation: It is knowledge that emerge spontaneously from the mind of the child such as story, game or character.
- Knowledge as fabricated stuff: It is knowledge that inferred or developed from other knowledge.

According to Schommer (1993), epistemological beliefs are represented in two different ways. Individuals with naive beliefs hold the view that an absolute truth exists, and knowledge is certain. These individuals believe that the possessor of knowledge is the authority, and knowledge can be shared with learners solely by this authority. This belief entails reliance on the innate ability of students in the matter of quick learning. Individuals with sophisticated beliefs on the other hand are those that believe knowledge is relative and mutable. They consider knowledge to be constructed by individuals through resources such as wisdom, intuition, and observation. In this notion, learning efforts of students are valuable and learning ability can be improved (Deryakulu & Büyüköztürk, 2002).

Therefore, scientific epistemological beliefs bear significance in education. There are various studies correlating epistemological beliefs with learning and academic success (Brownlee et al., 2001; Cano, 2005; Demirel, 2014; Demirli et al., 2010; Deryakulu, 2004; Koç-Erdamar & Bangir-Alpan, 2011; Özkan, 2008; Sapancı, 2012; Schommer & Dunnell, 1994; Windschitl & Andre, 1998). Moreover; Brownlee et al., (2001) proved in their studies that teachers with sophisticated beliefs are more successful in their jobs.

Epistemological beliefs are not an innate or immutable personal characteristic; they are rather psychological constructs that are developed over time. Studies indicate that epistemological beliefs can be affected by several factors. In this study, the main variables such as gender, educational background, and professional experience were included. The results of the literature are presented by grouping as studies consisting of students, prospective teachers, and teachers.

Studies about the effect of gender on epistemological beliefs have produced diverse results. Studies conducted with students mostly indicate that female students have more sophisticated beliefs in comparison to male students. Considering the studies conducted at primary schools (Islıcık, 2012; Neber & Schommer-Aikins, 2002; Özkal, 2007; Özkan & Tekkaya, 2011; Topçu & Yılmaz Tüzün, 2009), high schools (Aydemir et al., 2013; Kurt, 2009; Schommer, 1993; Schommer & Dunnell, 1994), and at university level (Deryakulu & Büyüköztürk, 2005; Enman & Lupart, 2000; Terzi, 2005), it is seen that female students have higher scores. Some studies have shown that male students have higher levels of epistemological beliefs (Chai et al., 2006; Wood & Kardash, 2002). On the other hand, there are a few studies pointing out that gender has no effect on epistemological beliefs (Chan & Elliott, 2002; Chan & Sachs, 2001; Conley et al., 2004; Karabulut & Ulucan, 2012; Trautwein & Lüdtke, 2007).

In the findings of the studies conducted with prospective teachers, it is seen that there is a significant difference in favor of women (Aksan, 2006; Aypay, 2011b; Chai et al., 2006; Ertugay, 2019; Oğuz, 2008; Öngen, 2003; Yılmaz, 2014) and in favor of men (Meral & Çolak, 2009; Yılmaz & Şahin, 2011). Also, it was found that gender does not have a significant effect on epistemological beliefs for prospective teachers (Balcı, 2009; Chan, 2003; Rakıcıoğlu, 2005; Terzi, 2005). In the studies in which the working group was formed by the teachers, most studies reveal that epistemological beliefs do not differ according to gender (Kaya & Ekici, 2017; Karhan, 2007; Phan, 2008). Apart from this, while some studies have obtained results in favor of female teachers (Akyıldız, 2018), some studies show that the results are in favor of male teachers (İçen & Akpınar, 2016).

Considering the studies examining the effect of the educational background on epistemological beliefs, studies revealed that students at higher educational levels have more sophisticated beliefs (Eren, 2006; Hofer & Pintrich, 1997; Kurt, 2009; Law et al., 2008; Mason et al., 2006; Schommer, 1993; Schommer et al., 1997; Schommer, 1998). Also, Jehng et al. (1993) found that postgraduate students' epistemological beliefs are more developed than those of undergraduate students.

Various findings were found in the studies in which the sample of prospective teachers was formed. While some of the studies have demonstrated that epistemological beliefs become sophisticated as the grade level of prospective teachers increases (Chai et al., 2006; Karabulut & Ulucan, 2012; Meral & Çolak, 2009; Yılmaz & Şahin, 2011), some of them have results revealing the opposite (Aypay, 2011b). There are also studies that conclude that the epistemological beliefs of prospective teacher candidates do not vary according to the grade level (Balcı, 2009; Öngen, 2003; Rakıcıoğlu, 2005). Only one study examining the relationship between teachers' education levels and epistemological beliefs was found. In this study (Karhan, 2007), a significant difference was found between university graduate teachers and non-university graduate teachers in favor of university graduate teachers.

In the literature, studies examining the epistemological beliefs of teachers show that epistemological beliefs differ according to professional experience. In these studies, it was examined that teachers who have worked for a longer time have more sophisticated beliefs (İçen, 2012; İçen & Akpınar, 2016; Karhan, 2007; Kaya & Ekici, 2017; Özdemir & Köksal 2014). When the results of these studies were examined according to the dimensions of the scales used, it was found that teachers with more experience had a firmer belief that teacher is the source of knowledge and that learning is a student's innate trait. Yılmaz (2014) determined in her study that teachers with more experience believed that learning depends on effort and that learning should take place instantly. Kaya and Ekici (2017) found that young teachers

believe that learning depends more on ability. In the studies, while there was no significant difference in beliefs about the source of knowledge (İçen & Akpınar, 2016), it was observed that teachers with more experience had more developed beliefs than younger teachers in terms of beliefs about the certainty of knowledge (İçen & Akpınar, 2016; Karhan, 2007; Kaya & Ekici, 2017). On the other hand, Chai et al. (2006) concluded that professional experience does not affect epistemological beliefs.

Nowadays, the way knowledge is presented is as important as the knowledge itself in the field of teacher education. Donaghue (2003) stated that beliefs play an equally important role as orientations in teachers' adoption of new approaches, techniques, and classroom activities. Driscoll (2012) underlined that epistemological beliefs determine the way teachers utilize different teaching strategies. Therefore, teachers' scientific epistemological beliefs should always be taken into account (Kaleci & Yazıcı, 2012; Tümkaya, 2012). Studies show that teachers with naive beliefs tend to regard knowledge as immutable and certain; and they also believe that teacher possesses knowledge, learning is an innate ability, and learning quickly or not depends on the student (Schommer, 1998). However, it has been reported that teachers with sophisticated epistemological beliefs think that knowledge is developed over time, it can also change over time, and students construct knowledge themselves. (Howard et al., 2000). Studies indicate that there is a correlation between teachers' epistemological beliefs and (1) planning and implementing all learning-teaching processes (Eren, 2006; Aypay, 2011a), (2) improving efficiency in learning environments (Eren, 2009), and (3) structuring educational classroom activities (Öngen, 2003). Taking all of these findings into consideration, it is clear that which epistemological beliefs teachers adopt has an effect on how students develop their own epistemological beliefs. Moreover, teachers' beliefs also impede reforms in education (Demir, 2012).

Considering how critical the role of epistemological beliefs in learning-teaching process is, it is important to understand these beliefs; in particular, those that affect how teachers shape learning environments (Chan & Elliott, 2002) and adopt new teaching approaches (Sinatra & Kardash, 2004). In the limited number of studies that focus on teachers' epistemological beliefs, samples were social studies teachers (Kaya & Ekici, 2017) and teachers that work in elementary schools (Findlan, 2006; Kahramanoğlu & Özbakış, 2018; Karhan, 2007; Özdemir et al., 2018; Özdemir & Köksal, 2014). For this study, participants were chosen among physics teachers. It is thought that the study will contribute to the literature as both the selection of physics teachers as the study group and the teachers having doctorate level are included in the educational background variable. In the scope of this study, answers to following questions were sought:

1) What are the scientific epistemological belief levels of physics teachers?

2) Do scientific epistemological beliefs of physics teachers vary depending on gender?

3) Do scientific epistemological beliefs of physics teachers vary depending on professional experience?

4) Do scientific epistemological beliefs of physics teachers vary depending on educational background?

2 | Method

In this study, causal-comparative model was used to determine epistemological beliefs of physics teachers and the effect of gender, professional experience, and educational background on these beliefs. Causal-comparative research investigates whether or not a current situation or phenomenon differs depending on one or more variables (Sönmez & Alacapınar, 2013). Causal-comparative research studies also aim to determine the reason of an emerging or existing situation or event, the variables that affect these reasons, or the effects themselves; without interfering with current conditions or participants (Büyüköztürk et al., 2009; Büyüköztürk, 2011; Cohen & Manion, 1998). In this study, the dependent variable (epistemological beliefs of teachers) was grouped on the basis of independent variables (gender,

professional experience, and educational background), and then the source of difference among these groups was explored.

Participants

Simple random sampling method was used to choose the sample. The sample consisted of physics teachers working in the Central Anatolia Region of Turkey. 205 physics teachers could be contacted with and volunteered to participate in the study. 106 (52%) of the participating physics teachers were female and 99 (48%) were male. 93 (45%) of these physics teachers worked in Ankara, 51 (25%) in Kayseri, 25 (12%) in Kırşehir, 20 (10%) in Nevşehir, and 16 (8%) in Konya.

In terms of the place of work; 80 (39%) of them worked in Anatolian high schools, 45 (22%) in vocational high schools, 38 (19%) in science high schools, 25 (12%) in Anatolian religious vocational high schools, and 17 in regular high schools. In regards to professional experience; 99 (48%) of the participants had 1-10, 47 (23%) had 11-20, 59 (29%) had 21 or more years of professional experience. With respect to educational background; 129 (63%) of the participants had a bachelor's degree, 59 (24%) had a master's degree, and 26 (13%) had a doctorate degree. Teachers ranged in age from 25 to 52 years (X= 38.6; SS= 2.54).

Physics teachers comprising the sample were asked if they had ever taken classes on knowledge philosophy (nature of science, history of science, philosophy of science, etc.) since it was thought that it might have had an impact on their epistemological beliefs, 142 (69%) of them declared that they had taken such classes over the course of their undergraduate education, 16 (8%) during postgraduate education, and 13 (6%) during both undergraduate and postgraduate education.

Collection and Analysis of Data

Scientific Epistemological Belief Scale (SEBS) developed by Conley et al. (2004) was used to determine physics teachers' scientific epistemological beliefs. This scale was adapted into Turkish by Özkan (2008). It is a 5-point Likert type scale (5= strongly agree, 1= strongly disagree) and has 26 questions.

SEBS has four dimensions: source, certainty, development and justification of knowledge. High scores in a dimension of this scale implies a high level of belief in the relevant factor (İlhan et al., 2013). Source of knowledge dimension determines if individuals believe in an outer authority as the source of knowledge (Özkan & Tekkaya, 2011). If individuals score a high point in this dimension, then they believe that knowledge is constructed by the learner. Certainty of knowledge dimension measures beliefs regarding the existence of an absolute truth. High scores in this dimension represent beliefs in the existence of multiple truths. Development of knowledge evaluates beliefs regarding the mutable nature of knowledge. Individuals that score high in this dimension believe that knowledge is not immutable; it can change, and individuals are able to develop their knowledge. Finally, justification of knowledge dimension determines whether individuals accept knowledge as-is or judge it in a critical manner based on evidence and expert opinion. High scores in this dimension point to a belief that knowledge is created by a critical review of evidence.

The dimension of the source of knowledge consists of 5 items, the dimension of certainty of knowledge consists of 5 items, the dimension of development of knowledge consists of 6 items, and the dimension of justification of knowledge consists of 9 items. The minimum scores that can be obtained from these dimensions are (5, 5, 6, 9) and the maximum scores (25, 25, 30, 45), respectively. The items in the dimension of the source of information and the certainty of information in the scale were reverse-coded during data entry, so that the high scores from the scale reflect sophisticated (high) epistemological beliefs.

Confirmatory factor analysis resulted in a good model fit (χ2/df=1.44, CFI=0.95, TLI=0.93, and RMSEA=0.04). Cronbach's Alpha coefficients of the scale were calculated as .68, .66, .71, and .82 at dimensions.

The type of tests to be conducted were determined prior to analysis of data. The data was normally distributed and equal variances were observed, thus parametric tests were used in this study.

3 | Findings

Findings related to epistemological belief levels of physics teachers

Pursuant to the descriptive analysis results of the participating physics teachers' SEBS scores, mean scores were as follows: (3.81±3.66) for the source of knowledge dimension, (3.79±3.19) for the certainty of knowledge dimension, (3.99±3.47) for the development of knowledge dimension, and (4.21±5.76) for the justification of knowledge dimension. According to these results, physics teachers have the most sophisticated epistemological beliefs in the justification of knowledge dimension Contrarily, certainty of knowledge dimension involves the least sophisticated beliefs. Descriptive analysis results were reported in Table 1.

Table 1. Physics teachers' SEBS scores

Dimension	N	Min	Max	Total mean	SS	Mean
Source of knowledge	205	10	25	19.06	3.66	3.81
Certainty of knowledge	205	10	25	18.97	3.19	3.79
Development of knowledge	205	8	30	23.93	3.47	3.99
Justification of knowledge	205	11	45	37.87	5.76	4.21
Total	205	48	140	111,42	14,27	3,95

Epistemological belief levels were calculated separately for each dimension, taking into account the lowest and highest scores and standard deviations. The level criteria is determined as in Table 2 and the results are presented in Figure 1.

Table 2. Level determining criteria of SEBS

Score ranges of SEMS dimensions	Low level (Naive)	Medium level (Less sophisticated)	High level (Sophisticated)
Source of knowledge (5≤x≤25)	5≤x<11.33	11.33≤x<17.66	17.66≤x≤25
Certainty of knowledge (5≤x≤25)	5≤x<11.33	11.33≤x<17.66	17.66≤x≤25
Development of knowledge (6≤x≤30)	6≤x<13.67	13.67≤x<21.34	21.34≤x≤30
Justification of knowledge (9≤x≤45)	9≤x<20.50	20.50≤x<32.05	32.05≤x≤45

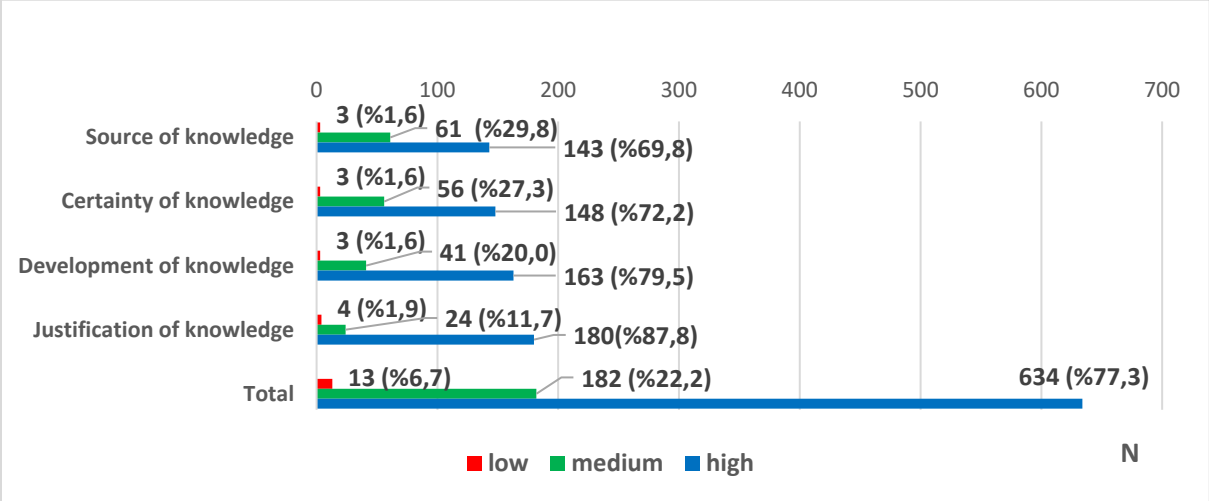

Figure 1. *Epistemological belief levels of physics teachers*

Answer to the first question of this study (epistemological belief levels of physics teachers) is displayed in Figure 1. According to Figure 1, physics teachers have sophisticated beliefs on all dimensions of SEBS.

Gender-related findings

Independent samples t-test was performed to find out whether physics teachers' scientific epistemological beliefs differ by gender. Relevant results can be found in Table 3.

Table 3. Independent samples t-test results concerning the gender-based comparison of physics teachers' SEBS scores

SEBS dimensions	Gender	N	X	sd	t	df	p
Source of knowledge	Female	106	19.16	3.478	.410	203	.682
	Male	99	18,95	3.882			
Certainty of knowledge	Female	106	19.19	3.154	1.033	203	.303
	Male	99	18.73	3.238			
Development of knowledge	Female	106	23.84	3.002	-.371	203	.711
	Male	99	24.02	3.936			
Justification of knowledge	Female	106	38.43	5.193	1.442	203	.151
	Male	99	37.27	6.311			
Total	Female	106	112.26	13.13	.880	203	.380
	Male	99	110.51	15.43			

The results of the independent samples t-test presented in Table 3 indicates that mean score of SEBS dimension of female and male participants suggest a certain score difference between the two genders. Female participants have a higher score than male participants in all dimensions but for the development of knowledge dimension, female scores are lower than the scores of men (X_{female}=23.84±3.002, X_{male}=24.02±3.936). Nevertheless, there is not a significant difference in physics teachers' scores (t=.880, p=.380) for females (X=112.26±13.13) and males (X=110.51±15.43).

Professional experience-related findings

One-way ANOVA test was used to detect if there is any difference in the epistemological beliefs of physics teachers with different years of professional experience. The analysis demonstrated that epistemological beliefs of physics teachers show significant difference depending on professional

experience in all dimensions but the certainty of knowledge dimension [F = 2.606; 6.268; 3.142, p < .05]. Levene test results showed homogeneity of variance in each dimension (p= .829; .451; .622; .517). Results are shown in Table 4.

Table 4. ANOVA results on SEBS sub-dimensions regarding physics teachers' professional experience

SEBS dimensions	Source of Variation	Sum of squares	sd	Mean square	F	p	Significant difference*
Source of knowledge	Between-group	102.918	3	34.306	2.606	.045	(11-20) – (21+)
	Within-group	2646.379	201	13.166			
	Sum	2749.298	204				
Certainty of knowledge	Between-group	178.187	3	59.396	6.268	.000	(1-10) – (11-20) (11-20) – (21+)
	Within-group	1904.574	201	9.475			
	Sum	2082.761	204				
Development of knowledge	Between-group	49.954	3	16.651	1.385	.248	
	Within-group	2415.948	201	12.020			
	Sum	2465.902	204				
Justification	Between-group	304.798	3	101.599	3.142	.026	(11-20) – (21+)
	Within-group	6499.904	201	32.338			
	Sum	6804.702	204				
Total	Between-group	2233,831	3	744,610	-	,011	
	Within-group	39346,904	201	195,756			
	Sum	41580,735	204				

*Values in bold represent the group that the difference is in favor of.

The results of the one-way ANOVA test presented in Table 4 indicated that the mean scores of the physics teachers on the dimension of SEBS statistically varied according to the variable of professional experience. Tukey's HSD test was carried out to identify the source of these differences. The results of this test demonstrated that:

- In regard to the source of knowledge dimension, the mean scores of the physics teachers with 11 to 20 years of experience ($\bar{X}$= 20.17±3.59) were significantly higher than that of those with 21 years of experience or more ($\bar{X}$= 18.27±3.59).
- In regard to the certainty of knowledge dimension, the mean scores of the physics teachers with 1 to 10 years of experience ($\bar{X}$= 19.42±3.60) were significantly higher than that of those 11 to 20 years of experience ($\bar{X}$= 17.51±2.92). Also, the mean scores of the physics teachers with 11 to 20 years of experience ($\bar{X}$= 20.13±2.88) were significantly higher than that of those with 21 years of experience or more ($\bar{X}$= 18.86±2.87).

- In regard to the justification dimension, the mean scores of the physics teachers with 11 to 20 years of experience ($\bar{X}$=37.49±5.75) were significantly higher than that of those with 21 years of experience or more ($\bar{X}$= 37.00±5.95).

Educational background-related findings

One-way ANOVA test was performed to determine whether there is any difference in the epistemological beliefs of physics teachers with different educational backgrounds. Results are shown in Table 5.

Table 5. ANOVA results on SEBS sub-dimensions regarding physics teachers' educational background

SEBS dimensions	Source of Variation	Sum of squares	sd	Mean square	F	p
Source of knowledge	Between-group	35.005	2	17.503	1.303	.274
	Within-group	2714.292	202	13.437		
	Sum	2749.298	204			
Certainty of knowledge	Between-group	40.203	2	20.101	1.988	.140
	Within-group	2042.558	202	10.112		
	Sum	2082.761	204			
Development of knowledge	Between-group	31.245	2	15.622	1.296	.276
	Within-group	2434.658	202	12.053		
	Sum	2465.902	204			
Justification	Between-group	54.527	2	27.264	.816	.444
	Within-group	6750.175	202	33.417		
	Sum	6804.702	204			
Total	Between-group	35,005	2	17,503	1,303	,274
	Within-group	2714,292	202	13,437		
	Sum	2749,298	204			

The results of the one-way ANOVA test presented in Table 5 indicated that there is not a significant difference in the total SEBS scores of the physics teachers (F= 1.303; p>.05). According to the dimensions of SEBS, in regard to the source of knowledge dimension (F= 1.303; p>.05), the certainty of knowledge dimension (F= 1.988; p>.05), the development of knowledge dimension (F= 1.296; p>.05) and the justification dimension (F= .816; p>.05) did not vary according to the physics teachers' educational background.

4 | Discussion & Conclusion

This study examined the epistemological belief levels of physics teachers who work in the Central Anatolia Region of Turkey, and whether gender, professional experience and educational background have any effect on these beliefs. In the studies in which epistemological beliefs were examined in the literature, it was found that teachers had sophisticated beliefs in some subjects, but they could have naive beliefs in other subjects. To illustrate, it has been determined that teachers mostly have sophisticated beliefs about the commitment to learning (İçen, 2012; Kaleci & Yazıcı, 2012; Karhan, 2007; Kaya & Ekici, 2017; Murat, 2018; Yılmaz, 2014), but naive beliefs about the certainty of knowledge (Akyıldız, 2014; Bacanlı Kurt, 2010; Karhan, 2007; Murat, 2018). In this study, analyses aiming to determine the epistemological belief levels of physics teachers proved that physics teachers have sophisticated beliefs in all SEBS dimensions. The most sophisticated epistemological beliefs were observed in the justification of knowledge dimension. This

result indicates that physics teachers do not accept knowledge unconditionally. On the contrary, it might be interpreted as they have a critical perspective on knowledge and tend to look for evidence from different sources in the presence of new knowledge. Considering that it is effective in shaping the educational environment, this result is very promising for the future.

To answer the second research question of this study, the existence of any significant difference in epistemological beliefs of physics teachers of different genders was investigated. Analyses showed that there is no statistically significant difference between female and male teachers in terms of epistemological beliefs. Results of this study are comparable to the findings of Izgar and Dilmaç (2008), İçen (2012) and Kaya and Ekici (2017), which indicate that the gender variable has no effect on teachers' epistemological beliefs. One can see diverse gender-related outcomes in the literature. Teachers who graduate from the same department of education faculties are expected to have similar epistemological beliefs. However, the reason for the different results in different studies may be the effect of different variables such as age, environment, and culture (apart from the variable that was investigated). In new studies, the effect of gender variable on epistemological beliefs can be examined together with the other variables.

The third question of this study was the following: Do epistemological beliefs of physics teachers vary depending on professional experience? Analyses conducted in line with this purpose resulted in a significant difference in the source of knowledge dimension of SEBS. Between physics teachers with (11-20) years and (21 and more years) of professional experience, this difference was in favor of those with less experience. In the certainty of knowledge dimension, teachers with (1-10) years of experience were significantly different in comparison to teachers with (11-20) years. Also, teachers with (11-20) years of experience were significantly different in comparison to teachers with (21 and more years) of experience. Similarly, the justification of knowledge dimension indicated a significant difference in favor of less experienced teachers, between those with (11-20) years and (21 and more years) of experience. Therefore, teachers with less experience are found out to have more sophisticated beliefs about the source, certainty and justification of knowledge. Such beliefs were seen to become more superficial as the amount of professional experience grew. Studies of Findlan (2006), Karhan (2007), and Özdemir and Köksal (2014) produced similar findings. This might have been caused by the curriculum implemented in schools until recently. Up until 2005, dominant approach in Turkey was behavioral education; knowledge was certain and absolute, teacher was the possessor of knowledge, and he/she was also responsible for sharing this knowledge with students (Özdemir & Köksal, 2014). Growing up with this educational philosophy and also working in accordance with it may have caused the teachers to develop similar epistemological beliefs. After 2005, this positivism-based approach was slowly replaced with a student-centred curriculum in which teachers guide students to aid them in acquiring knowledge. This situation was most likely reflected on the findings of this study.

In respect to educational background, there is no significant difference between epistemological beliefs of physics teachers in relation to different backgrounds. Yet, the study of Kaya and Ekici (2017) on social sciences teachers indicated that teachers holding a master's degree have more sophisticated beliefs than those with a bachelor's degree. This situation brings to mind a difference in interpretation: Some researchers think that epistemological beliefs do not only consist of knowledge-related beliefs. According to these researchers (Brownlee et al., 2002; Clarebout et al., 2001), beliefs associated with learning process should be addressed as epistemological beliefs. Likewise, Schommer (1990) stated that these beliefs have a multi-dimensional structure which encompasses the learning beliefs related to processes of acquisition and utilization of knowledge. In parallel with this opinion, Demir (2012) found in a study with prospective teachers that teachers who have taken scientific research methods class adopt higher epistemological beliefs than those who have not. Most of the physics teachers who took part in this study have taken courses about knowledge acquisition (scientific research methods, nature of science, history of science, etc.) at the time of their undergraduate education. It seems clear that the fact that these courses are not preferred at the master's and doctoral level explains this result. However, the low number of studies on this change in the literature and the fact that the samples are generally composed of students and

prospective teachers indicate that evidence is insufficient to form a general opinion at this point. It would be appropriate to include the effect of educational status in new studies with teachers.

On the other hand, according to the epistemological resource defined by Hammer and Elby (2002), everyone creates their own personal epistemological belief. "Knowledge as propagated stuff", "knowledge as free creation" and "knowledge as fabricated stuff" are unique to the individual. Different beliefs may develop even in individuals who have the same lives. This explains the different results obtained with the same scales and similar samples in the literature. In this case, it is clear that more detailed research is needed for explaining the development of epistemological beliefs. Designing new studies with methods such as case study and phenomenology that examine small samples in depth may explain the reasons why similar samples point to different epistemological beliefs. Similarly, more detailed information about the development of epistemological beliefs can be obtained with studies that would extend over a longer period, such as longitudinal studies.

The findings of this study are limited to the findings obtained from the SEBS and the SEBS was applied only to physics teachers. In new studies, the epistemological beliefs of teachers working in other branches can be examined. In addition to quantitative data, qualitative data collection methods such as interview and observation can be used to explain the reasons for the quantitative findings. In addition, the relationships of teachers with variables such as their epistemological beliefs and their behavior in the classroom environment and their teaching methods and techniques can be examined.

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Investigating the Interrelationships among Science and Mathematics Achievement, Attitude towards STEM, and Gender

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Abstract

This study aimed to investigate the interrelationships among high school students' science and mathematics achievement, attitude towards STEM and gender. The participants of the study were 446 public high school students (240 females, 206 males) from two cities in Turkey. They were 10th, 11th, and 12th grade level students selected from two different kinds of schools which are Anatolian Religious High School and Anatolian High School. The Structural Equation Modeling (SEM) was used to determine the relationships among the variables of the study. It was found that mathematics achievement and science achievement are significantly and positively associated with students' mathematics attitude, and science attitude, but negatively related to students' attitude towards engineering and technology. On the other hand, 21st-century skills were not found to be significantly associated with both mathematics achievement and science achievement. The results also indicated that female students had higher mathematics and science achievement scores than male students. However, male students had more interest in engineering departments. The results of the study also imply the importance of the indirect effect of attitude towards STEM on the relationship between students' achievement and gender.

Keywords: Gender, mathematics attitude, science attitude, STEM attitude, Structural Equation Modeling

Fen ve Matematik Başarısı, STEM'e Yönelik Tutum ve Cinsiyet Arasındaki İlişkilerin İncelenmesi

Öz

Bu çalışma, lise öğrencilerinin fen ve matematik başarıları, STEM'e yönelik tutumları ve cinsiyetleri arasındaki ilişkileri incelemeyi amaçlamaktadır. Türkiye'nin iki farklı şehrindeki devlet okullarından toplam 446 lise öğrencisi (240 kız, 206 erkek), bu çalışmanın katılımcılarını oluşturmaktadır. Katılımcılar, Anadolu İmam Hatip Lisesi ve Anadolu Lisesi'inde okuyan 10., 11. ve 12. sınıf öğrencilerinden seçilmiştir. Çalışmada ele alınan değişkenler arasındaki ilişkiler Yapısal Eşitlik Modellemesi (YEM) kullanılarak incelenmiştir. Matematik ve fen başarısının öğrencilerin matematik ve fen tutumları ile anlamlı ve pozitif ilişkili olduğu ancak öğrencilerin mühendislik ve teknolojiye yönelik tutumları ile negatif ilişkili olduğu bulunmuştur. Öte yandan, 21. yüzyıl becerileri hem matematik başarısı hem de fen bilimleri başarısı ile anlamlı düzeyde ilişkili bulunmamıştır. Sonuçlar ayrıca kız öğrencilerin erkek öğrencilere göre daha yüksek matematik ve fen başarı puanlarına sahip olduklarını, diğer taraftan erkek öğrencilerin ise kız öğrencilere göre mühendislik bölümlerine daha fazla ilgisi olduğunu göstermiştir. Çalışmanın sonuçları ayrıca öğrencilerin STEM'e yönelik tutumlarının başarı ve cinsiyet ilişkisi üzerindeki dolaylı etkisinin önemini işaret etmektedir.

Anahtar kelimeler: Cinsiyet, fene yönelik tutum, matematiğe yönelik tutum, STEM'e yönelik tutum.

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1 | Introduction

Attitude is defined as "a learned predisposition or tendency on the part of an individual to respond positively or negatively to some object, situation, concept, or another person" (Aiken, 1970, p.551). Attitude towards mathematics or mathematics attitude can be defined as a tendency to involve in or avoid mathematics including feelings and beliefs related to the importance of mathematics performance (Ma & Kishor, 1997). Attitude towards mathematics contains behavior, beliefs, and emotional responses concerning mathematics (Moenikia & Zahed-Babelan, 2010). Similarly, attitude towards science consists of favorable or unfavorable attitude towards science, scientists, and scientific method (Aiken & Aiken, 1969; Gardner, 1975; George, 2000; Schibeci, 1977).

In certain previous studies, there was a significant relationship between the attitude and achievement of students in both mathematics and science (Abosalem, 2014; Akpinar, Yildiz, Tatar & Ergin, 2009; Singh, Granville & Dika, 2002). For instance, Akpinar, Yildiz, Tatar and Ergin (2009) found a strong relationship between attitude towards science and science achievement. Moreover, Singh, Granville and Dika (2002) found a low direct relationship between attitude towards mathematics and mathematics achievement. They also found a medium indirect relationship between attitude towards science and science achievement. On the other hand, researchers had different claims from the studies that investigated the relationships between gender and attitude towards STEM, as well as gender and mathematics and science achievements. Although in some studies, there was no significant difference in achievement and attitude towards STEM of males and females (e.g. Arhin & Offoe, 2015); in some studies, statistically, significant differences were found between the groups (e.g. Brown & Kanyongo, 2010; Mahoney, 2010; Urunibrahimoglu, 2019). Thus, additional research is required to conduct further analysis to understand how attitude towards STEM, and gender are related to the mathematics and science achievement of the students.

In the current study, the interrelations among the students' mathematics and science achievement, attitude towards STEM, and gender were investigated. Thus, the following research questions were examined using structural equation modeling:

Research questions

1. How is gender related to high school students' attitude towards STEM components, and their science and mathematics achievement?

2. How is high school students' attitude towards STEM components related to their science and mathematics achievement?

In the following parts, the studies on the relationships among science attitude and achievement; mathematics attitude and achievement; attitude towards engineering and technology, and achievement; 21st century skills and achievement; and STEM attitude and gender are presented in detail.

2 | Literature Review

Attitude towards science and achievement

In related literature, many studies found that attitude towards science or science attitude was positively correlated with science achievement (e.g. Liu, Horton, Olmanson & Toprac, 2011; Papanastasiou & Zembylas, 2002; Turhan, Aydogdu, Sensoy & Yildirim, 2008). For instance, Papanastasiou and Zembylas (2002) examined senior high school students' science attitude (involving attitude towards physics, chemistry, biology, and earth science) and their relationship with science achievement. They found that attitude towards science significantly predicted science achievement. Moreover, Ozel, Caglak, and Erdogan (2013) examined the relationship of attitude with science achievement of Turkish students who

participated in the Programme for International Student Assessment (PISA) 2006 by using linear structural modeling. Aligned with the previous studies, the researchers concluded that attitude significantly (either positively or negatively) affected the science achievement of students. Bidegain and Mujika (2020) examined the relationship between science attitude and science achievement using data from 72 countries participating in PISA 2015. They found that the relationship was negative for all types of attitude (self-efficacy, interest in science, participation in science activities, and enjoyment of science) across countries. Besides, positive non-linear relationships between science attitude and achievement were determined for high science performance values.

Researchers also conducted studies on the middle and primary school level. For instance, Turhan et al. (2008) found a high positive significant relationship between 8th grade students' attitude towards science and their science achievement levels. Similarly, Liu et al. (2011) found a significant positive relationship between sixth grade students' motivation towards science and science learning. Furthermore, Akpinar et al. (2009) supported earlier findings since they found a significant correlation between attitude towards science and science achievement at the primary school level.

Attitude towards mathematics and achievement

Attitude towards mathematics is seen as a key component of mathematics achievement (Moenikia & Zahed-Babelan, 2010). There are many research studies that support a positive relationship between mathematics attitude and mathematics achievement (e.g. Choi & Chang, 2011; Ma & Kishor, 1997; Moenikia & Zahed-Babelan, 2010; Saha, 2007). Ma and Kishor (1997) performed a meta-analysis of 113 studies about the relationship between attitude towards mathematics and mathematics achievement. The researchers also noted that the meta-analysis results implied a strong relationship between attitude towards mathematics and mathematics achievement. Furthermore, Moenikia and Zahed-Babelan (2010) found attitude towards mathematics as a statistically significant predictor of high school students' mathematics achievement.

The relationship between mathematics attitude and achievement was also investigated on international scales such as PISA and the Trends in International Mathematics and Science Study (TIMSS) in some studies. Barut (2020) examined the data from PISA 2012 to investigate the relationship between affective factors concerning mathematics and mathematics literacy levels across Brazil, Norway, Singapore, and Turkey. According to their results, mathematics-related affective variables significantly affected students' mathematics literacy achievement. Besides, Choi and Chang (2011) used the data from TIMSS 2007 to find the effect of attitude towards mathematics on 8th grade students' mathematics achievement. Having a positive attitude towards mathematics and being male were among predictors that were significantly related to participants' mathematics achievement. Similarly, Geesa, Izci, Song, and Chen (2019) used data from TIMSS 2015 to predict fourth grade students' mathematics achievement in South Korea, Turkey, and the United States from the variables of home resources and attitude towards mathematics. According to their results, home resources and attitude towards mathematics were found to be significant predictors of mathematics achievement.

Attitude towards engineering and technology and achievement

There are various studies conducted about engineering and technology attitude of students within STEM (Guzey, Moore, Harwell & Moreno, 2016; Hall, 2018; Mahone, 2010; Tseng, Chang, Lou & Chen, 2011) or engineering attitude separately (Koycu & Vries, 2016; Pearson & Miller, 2012). Koycu and Vries (2016) studied attitude towards engineering and students' concept of engineering (their interest and opinions about the importance, difficulty). They found that upper secondary school children generally have a positive attitude towards engineering. Besides, Tseng et al. (2011) investigated a project-based learning (PBL) design to reveal students learning attitude towards STEM components and their change depending on the project-based learning activity. They found that students' attitude towards engineering and attitude towards technology were both significant and positive. Also, they found that students' attitude towards

engineering changed significantly, and positively. Moreover, Pearson and Miller (2012) made an analysis based on the 20-year cumulative record of the Longitudinal Study of American Youth examining the records of 3062 young adults. They found out that mathematics achievement in secondary school affected engineering motivation positively. Hence, they stated mathematics as the gateway to pursue an engineering career.

Attitude towards 21st century skills and achievement

21st century skills include communication, collaboration, creativity/inventive thinking, critical thinking, and technology/innovation (Achzab, Budiyanto & Budianto, 2018; Arevalo & Ignacio, 2018; Shannon, 2015). There are various studies about 21st century skills and their relations with some variables. For instance, the study conducted by Arevalo and Ignacio (2018) examined the relationship between century skills and science achievement in 10th graders. They found out that there was a direct relationship between 21st century skill constructs and science achievement. However, studies about the relationship between attitude towards 21st century skills and achievement are limited. Due to limited studies, there is a need for further studies about the relationship between attitude towards 21st century skills and achievement.

Gender, STEM attitude, and achievement

There is a gender difference in the choices of STEM-related professions as a career path. For instance, Akgunduz (2016) investigated students' interest levels in STEM professions by analyzing the top thousand students' university placement in STEM-related departments between 2000 and 2014. The results suggested that there was a gender difference in the placement rates of students in the STEM fields and male students composed the majority of placement in STEM fields. Engineering departments contained the highest rate of students among STEM fields whereas fundamental sciences and education faculties had relatively lower students. Similarly, Ugras (2019) found a statistically significant difference in middle school students' interest levels towards STEM professions in terms of gender favoring male students. On the other hand, according to Karakaya et al. (2018) females had more interest in STEM.

Mahoney (2010) stated that high school male students had significantly more positive attitude towards STEM especially for the technology and engineering components when compared to the female students. Moreover, Ugras (2019) found a significant difference in the dimensions of engineering and technology favoring male students among middle school students. Besides, Unfried, Faber, and Wiebe (2014) conducted a study on 4th to 12th grades and found out that males had significantly more interest in engineering and technology than females. Their findings also suggested that males' engineering and technology attitude were more positive than females' attitude. On the contrary, Urunibrahimoglu (2019) found that females' attitude levels were higher for the engineering component whereas males developed a more positive attitude for science and mathematics.

The findings from the literature have contradictory results in terms of the relationship between gender and mathematics achievement. Some of the studies indicated that there is no significant difference in mathematics achievement of males and females (e.g. Lindberg, Hyde, Petersen, & Linn, 2010). Arhin and Offoe (2015) examined the performances of females and males in the high school level. The researchers concluded that there was no significant difference between the two genders in the mathematical problem-solving processes. On the contrary, some of the studies showed that females outperformed in mathematics (Brown & Kanyongo, 2010; Bulut, 1994; Robinson & Lubienski, 2011). Erdogan, Baloglu, and Kesici (2011) stated that the performances of males and females might change for particular areas of mathematics. Thus, they conducted research with high school students on both mathematics and geometry. They concluded that in both branches of mathematics, females performed better compared to males. Similarly, Clewell and Campbell (2002) claimed that the gender gap changes with the topic. For instance, females performed better in computation in primary and middle school years. As a result, in the previous studies, the

researchers examined the males' and females' performance in different topics of mathematics, and they found inconsistent results. Thus, there is a need for further research to clarify the gender issue of the relationship between gender and mathematics achievement.

Similar to mathematics achievement, for science achievement the findings from previous studies differ. As some of the previous studies related to mathematics achievement, females were also more successful in science. Bezci and Sungur-Vural (2013) conducted a large-scale study with Turkish elementary school students and they found females were more successful than males in science. On the other hand, some of the studies claimed that males' science achievement was higher than females at primary and middle school level (Altınok, 2005; Bacharach, Baumeister & Furr, 2003). Moreover, Bruschi and Anderson (1994) noted that through high school years the males are more successful than females. It is seen that there was no consensus on the results of the relationship between gender and science achievement. Thus, further research might focus on this relationship.

In the literature, it is concluded that gender is related to all components of STEM. Many researchers stated that males developed more positive attitude towards STEM (Akgunduz, 2016; Ugras, 2019). However, in some of the studies, researchers noted there were differences within the STEM components in terms of gender (e.g. Urunibrahimoglu, 2019). On the other hand, males' attitude levels were higher for the engineering component than females. As a result, the gender differences need to be investigated separately for each of the components of STEM and our model was developed accordingly. Moreover, in the previous studies students' science and mathematics achievement were examined with attitude towards different components of STEM. The findings from these studies indicated that attitude towards mathematics and mathematics achievement (Barut, 2020; Choi & Chang, 2011) and also attitude towards science and science achievement were highly correlated (Liu, Horton, Olmanson & Toprac, 2011). Moreover, Aravalo and Ignacio (2018) noted that 21st century skills constructs were directly related to the science achievement of the students. As another component of STEM, engineering attitude was highly correlated with mathematics achievement of the students (Pearson & Miller, 2012). Therefore, attitudes towards STEM components have relationships with science and mathematics achievement as shown in our model. In conclusion, based on the literature review above, a following conceptual model is proposed and tested in the present study (see Figure 1).

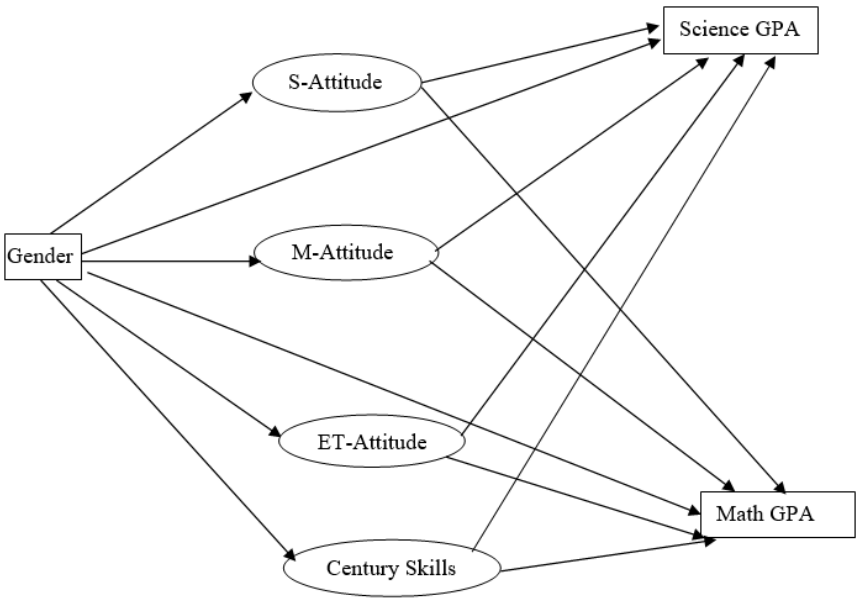

Figure 1. *The Proposed Model of The Study. S-Attitude* attitude towards Science, *M-Attitude* attitude towards Mathematics, *ET-Attitude* attitude towards Engineering, *Century Skills* attitude towards 21st Century Skills, *Science GPA* grade point average of science, and *Math GPA* grade point average of mathematics

3 | Method

Research design

A correlational research design was used to determine the relationships among the variables. Thus, Structural Equation Modeling (SEM) was conducted to investigate the relationships among the STEM Attitude, mathematics achievement (MGPA), science achievement (SGPA) with gender. The Structural Equation Modeling (SEM) is used for testing a set of dependence relationships among a series of constructs represented with multiple observed variables. (Malhotra, Lopes, & Veiga, 2014). The use of SEM enables researchers to test their theoretical models considering inter-relationships among constructs and observed variables; increases the accuracy of data analysis by taking account into measurement errors of the variables in the model; and examines direct and indirect relations among constructs (Hu & Bentler 1999; Schumacker & Lomax, 2010; Weston & Gore, 2006). In the current study, our model was tested with LISREL 8.8.

Participants

The participants of this study were 446 students from five public high schools in two cities in Turkey. They were selected by a convenient sampling method since these schools were close to researchers' working areas that provided them easy access. The data were collected from an Anatolian Religious High School (54.3%) and Anatolian High Schools (45.5%). Both schools have the same curriculum and science-based courses. However, the former school also has more religious-based elective courses. In the selected sample, 53.5% of the participants were females while 45.9% were males. Students were selected from 10th, 11th, and 12th grade levels. Since students' last year mathematics and science achievement scores (biology, chemistry, and physics) were used, 9th grade students were not included in the sample. The percentages show diversities in terms of grade levels (35.6%, 40.5%, 23.6% of the participants were 10th, 11th, 12th grade level, respectively). Moreover, since students select their study area at the end of the 10th grade, they take more science-based courses according to their study area in their 11th and 12th grade levels.

Data collection tools

In this study, Demographic Information Form and Attitude Towards STEM Scale were used. *The demographic information form* was used to get knowledge about participants' school ID, gender, school type, grade level, and last year mathematics and science achievement scores.

Attitude towards STEM scale. This scale was used to get information about participants' attitude towards "Mathematics", "Science", "Engineering and Technology", and "21st Century Skills". Attitude towards STEM Scale is a 5-point Likert scale (from certainly disagree to certainly agree) and consists of 37 items under four sub-themes mentioned above. *"I am sure of myself when I do science."*, *"I am the type of student who does well in mathematics."*, *"I believe I can be successful in a career in engineering."*, and *"I am confident I can set my own learning goals."* are some example items about each theme. The original version of this scale was developed by The Friday Institute for Educational Innovation (2012) for measuring middle school students' STEM attitude. Then, Ozcan and Koca (2019) conducted a study to establish the validity and reliability of the Turkish version of this scale. The Cronbach's alpha coefficient was found to be .91 for the whole scale, .86 for mathematics factor, .87 for science factor, .86 for engineering and technology factor, and .88 for 21st century skills factor. Thus, it can be said that the scale has good reliability considering the threshold value of .70 (Pallant, 2001). Besides, to determine the relationship between the whole scale and its four factors, correlation coefficients were calculated. It was found that those correlation coefficients ranged between .62 and .82 that showed a positive strong correlation. Based on the analyses the researchers made, they claimed that the Turkish version of the scale has a good construct validity and has a factor structure similar to that of the original scale (Ozcan & Koca, 2019).

Data analysis

In the data analysis process, male students were coded as "1" and female students were coded as "0". Then, recoding and initial data screening procedures were applied. Missing value analysis was done in IBM SPSS 25.0. Since the percentage of missing values for each variable was greater than 5% (Pituch & Stevens, 2016), 446 cases from 515 remained after the data screening process. Then, the pattern of the remaining missing values was analyzed. Since there was not a statistically significant result (p=1.000 >.05) according to Little's MCAR test (based on EM correlations), the pattern of missing values for the concerned variables was random. Then, LISREL 8.80 was used for testing the proposed model presented in Figure 1. Since the assumption of multivariate normality among the observed variables was met, the maximum likelihood estimation based on the covariance matrix was used in the analysis. Root mean square error of approximation (RMSEA); Chi-square/degrees of freedom (χ^2/df), standard root mean square residual (SRMR), Comparative Fit Index (CFI) and Normed Fit Index (NFI) fit indices were used to evaluate whether the model fitted the data. The threshold values ($2 < \chi^2/df \leq 3$; $.05 < RMSEA \leq .08$; $.05 < SRMR \leq .10$; $.90 \leq NFI < .95$; $.90 \leq CFI < .95$) suggested by Schermelleh-Engel, Moosbrugger, and Müller (2003) were considered to assess whether the model has an acceptable fit. The effect size for explained variances (R^2) on dependent variables was assessed based on threshold values ($R^2 \leq .01$, small effect size; R^2 around .09, medium effect size; $R^2 \geq .25$; large effect size) suggested by Cohen and Cohen (1983). Finally, the magnitude of factor loadings (λ) was evaluated using the threshold value (λ >.32 corresponding to about 10% variance explained of an indicator variable) suggested by Pituch and Stevens (2016).

Research ethics

At the beginning of the study, *Informed Consent Form* were distributed to all of the participants. This form informed the participants about the aim of the study and the procedure of the research. Besides, this form also provided the participants with relevant information about the rights of them such as being able to withdraw from the research at any time. Thus, participation to study was taken voluntarily. For the sake of anonymity, a number was assigned to every participant and the data analysis was done after this procedure.

4 | Findings

Assumptions of the SEM

The required assumptions of SEM were checked to conduct a reliable SEM analysis before carrying out the analysis. These are sample size, normality and linearity, outliers, residuals, and multicollinearity and singularity (Pallant, 2001; Tabachnick & Fidell, 2013). Firstly, SEM requires a large sample size. Kline (2005) provides a guideline regarding the sample size (N) in SEM techniques (N < 100, small; N between 100 and 200; medium; N > 200, large). The sample size of the current study was appropriate for reliable SEM analysis because the participants of the study included 446 cases. Secondly, normality and linearity assumption were checked. As seen in Table 1, the data were normally distributed considering the skewness, kurtosis, and 5% trimmed mean values. Thirdly, there were no influential univariate and multivariate outliers (Tabachnick & Fidell, 2013). Besides, Table 1 indicates the descriptive statistics and reliability coefficients of each variable in the study. It is found that all values were greater than .70 which indicated the scores on the scales were reliable (Pallant, 2001). When we calculated the mean scores of the measured variables considering the five-point Likert scales, they were all greater than the mid-point of the scale. For example, there were eight items for the Mathematics Attitude part of the scale. Thus, the mean score for each item was found 3.36 which is higher than 3.

Table 1. Descriptive Statistics and Cronbach's Alphas of the Measured Variables

Measured variables	Number	Mean	S. D.	5% Trimmed mean	Skewness	Kurtosis	Cronbach's alpha
1. Mathematics	446	26.91	6.013	27.09	- .44	.53	.82
2.Science	446	30.23	7.478	30.47	- .46	.28	.91
3.Engineering	446	32.64	7.741	32.99	- .57	.17	.90
4.Century Skills	446	41.64	7.166	42.05	- .99	2.34	.87
5.Math GPA	446	67.15	18.48	67.81	- .47	- .22	-
6.Science GPA	446	66.30	14.18	66.53	- .34	.21	-
7.Gender	446	1.47	.50	1.46	.14	-1.99	-

Table 2 indicates the inter-correlations among observed variables in the model. It was found that the inter-correlations among the measured variables were less than .90, thus there was no multicollinearity problem (Pallant, 2001). The correlations among the observed variables changed from .002 to .798. The most related variables were Math GPA and Science GPA (.798), while the least related variables were Engineering Attitude and Science GPA (.002).

Table 2. Correlations among the Measured Variables in the Study

Variables	1	2	3	4	5	6	7
1.Mathematics	1						
2.Science	.367	1					
3.Engineering	.303	.345	1				
4.Century Skills	.294	.281	.468	1			
5.Math GPA	.589	.253	.004	.106	1		
6.Science GPA	.528	.341	.002	.118	.798	1	
7.Gender	-.002	-.014	.268	-.068	-.184	-.117	1

Measurement MODEL of attitude towards stem

The measurement model of the Attitude Towards STEM involves a four-factor structure measured with 37 items. The CFA was run to test this factor structure on the data of the present study. The fit indices of the CFA analysis were in the acceptable level, according to the recommended cutoff values for goodness of fit indices proposed by Schermelleh-Engel et al. (2003), except for χ^2/df which was bigger than 3 ($\chi^2(623, N = 446) = 1994.21$, $\chi^2/df = 3.2$; *NFI* = .91, *CFI* = .94, RMSEA = .07 (90 % *CI* = .067, .073), SRMR = .07). Therefore, the suggested modifications from the LISREL output were conducted with letting error terms of a few items to be correlated in the same sub-scales. Since those items probe the same component, the association between them was reasonable. After those modifications, the measurement model of STEM-attitude with four components moderately fit the data ($\chi^2(611, N = 446) = 1265.65$, $\chi^2/df = 2.07$, *NFI* = .94, *CFI* = .97, RMSEA = .05 (90 % *CI* = .045, .053), SRMR = .06). All items were significantly loaded to the hypothesized constructs as seen in Table 3. That is, the measurement model of the STEM-attitude was confirmed in the present study, which provided evidence for the construct validity of the scores on the Attitude Towards STEM Scale.

Table 3. The Completely Standardized Factor Loadings with t-values and the Explained Variances (R^2)

	Completely Standardized Factor Loadings (t values)	*t*-values	R^2
Math 1	.49	9.91	.24
Math2	.38	7.43	.14
Math 3	.55	11.21	.30
Math 4	.64	13.60	.41
Math 5	.52	10.48	.27
Math 6	.51	10.41	.26
Math 7	.67	13.77	.46
Math 8	.78	16.95	.61
Science1	.71	16.68	.50
Science2	.81	20.26	.66
Science3	.78	19.23	.62
Science4	.72	16.97	.52
Science5	.77	18.54	.59
Science6	.71	16.82	.51
Science7	.76	18.42	.58
Science8	.48	10.20	.23
Science9	.62	14.11	.39
Engineering1	.72	16.80	.52
Engineering2	.73	16.93	.53
Engineering3	.64	14.50	.42
Engineering4	.72	16.61	.51
Engineering5	.70	16.05	.49
Engineering6	.71	16.53	.51
Engineering7	.76	18.20	.58
Engineering8	.55	11.93	.30
Enginnering9	.69	15.75	.47
Century Skill1	.52	11.04	.27
Century Skill2	.65	14.45	.42
Century Skill3	.62	13.74	.39
Century Skill4	.65	14.28	.42
Century Skill5	.73	16.98	.54
Century Skill6	.52	11.17	.28
Century Skill7	.69	15.71	.48
Century Skill8	.69	15.57	.47
Century Skill9	.42	8.64	.18
Century Skill10	.55	11.73	.30
Century Skill11	.61	13.51	.38

THE RESULTS OF THE MODEL TESTING

After the justification of the measurement model of STEM-attitude, students' science GPA, mathematics GPA, and gender (being male) were integrated into the measurement model to test the proposed SEM given in Figure 1. The SEM analysis revealed that the structural model fitted the data ($\chi^2(710, N = 446) = 1489.995$, $\chi^2/df = 2.10$, *NFI* = .93, *CFI* = .96, RMSEA = .05 (90 % *CI* = .046, .053), SRMR = .06). The tested model with the explained variances (R^2), standardized path coefficients, and insignificant paths with dashed lines was given in Figure 2. In the model, STEM attitude and gender explained 35% of the variance on science achievement and 40% of the variance on math achievement. The effect size for the explained variances of the achievement variables corresponds to a large effect size to the cut off values recommended by (Cohen & Cohen, 1983). That is, the model explained a significant amount of variance in mathematics and science achievement.

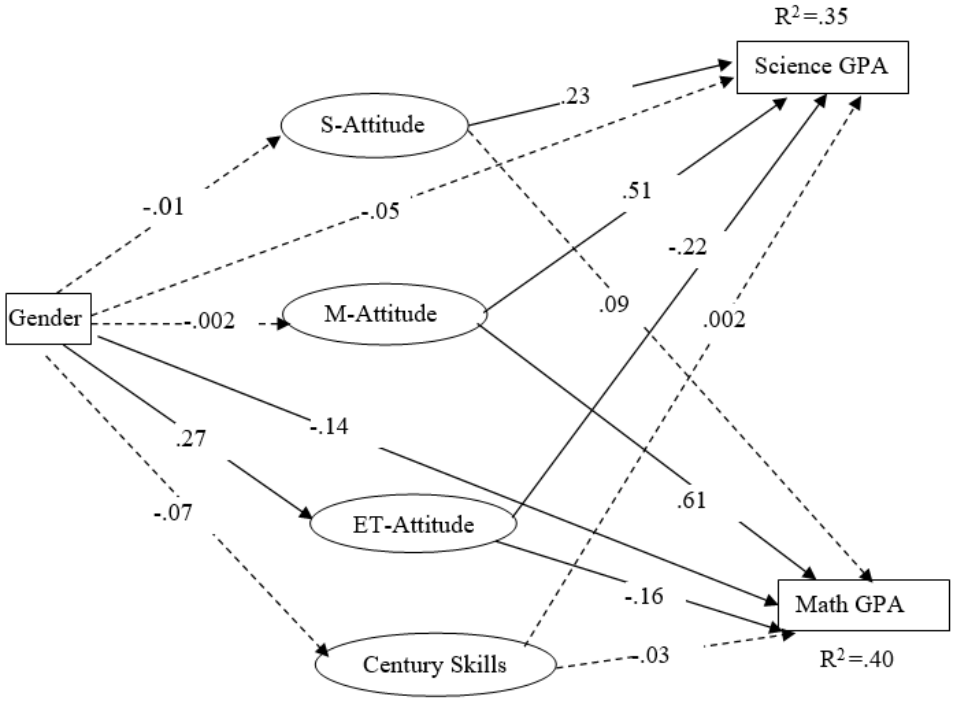

Figure 2. *The Tested Model in the Present Study*. *S-Attitude* attitude towards Science, *M-Attitude* attitude towards Mathematics, *ET-Attitude* attitude towards Engineering, *Century Skills* attitude towards 21st Century Skills, *Science GPA* grade point average of science, and *Math GPA* grade point average of mathematics

THE RELATIONS OF GENDER TO SCIENCE AND MATHEMATICS ACHIEVEMENT AND STEM ATTITUDE

In the proposed model, gender was hypothesized to be directly related to all variables. As mentioned before, since, on the gender variable, 1s represent males and 0s represent females, the interpretation of the results related to the gender variable is based on being males. According to model testing results, gender significantly related to mathematics achievement ($\beta = -.14$, $p < .05$). The negative sign of the path coefficient suggests that female students had significantly higher mathematics achievement scores than male students. The indirect relation of gender through STEM attitude was insignificant ($\beta = -.04$, $p > .05$) but this negative indirect effect increased the path coefficient for the total effect of gender on math achievement ($\beta = -.18$, $p < .05$). In other words, STEM attitude led to observing a little bit more gender differences in mathematics achievement.

The direct relations of gender to science achievement were not significant (β = -.05, p > .05). The indirect effect of gender through STEM attitude was not significant (β = -.07, p > .05) but it caused the total effect of gender on science achievement to be significant (β = -.12, p < .05). That is, gender differences in STEM attitude led to significant gender differences in science achievement as well.

The relation of gender to STEM attitude

As seen in Table 4 and Figure 2, gender was directly associated with attitude towards engineering and technology (β = .27, p < .05). The male students demonstrated higher attitude towards engineering and technology than female students. On the other hand, the direct relations of gender to attitude towards science (β = -.01, p > .05), attitude towards mathematics (β = -.002, p > .05), and century skills (β = -.07, p > .05) were not significant. That is, male and female students demonstrated similar attitude towards mathematics, science, and century skills in the current study.

Table 4. Direct, Indirect, and Total Relations of Gender to Achievement and Attitude towards STEM

Variables		MGPA			SGPA			Mat	Sat	Eat	Cat
		Direct	Indirect	Total	Direct	Indirect	Total	Direct	Direct	Direct	Direct
Gender	β	-.14	-.04	-.18	-.05	-.07	-.12	-.002	-.01	.27	-.07
	t	-3.3	-1.17	-3.95	-1.24	-1.78	-2.49	-.046	-.28	5.32	-1.32

The relations of the components of STEM attitude to science and mathematics achievement

Mathematics attitude was significantly related to both mathematics achievement (β = .61, p < .05) and science achievement (β = .51, p < .05). Similarly, science attitude was significantly related to science achievement (β = .24, p < .05) while it was not significantly associated with mathematics achievement (β = .09, p > .05). Engineering and technology attitude were significantly and negatively related to both mathematics achievement (β = -.16, p < .05) and science achievement (β = -.22, p < .05). Finally, the non-significant relations were observed between attitude towards century skills and mathematics achievements and science achievement.

Table 5. The Relations of the Components of STEM-attitude to Science and Mathematics Achievement

Variables		MGPA	SGPA
Mat	β	.61	.51
	t	8.32	7.48
Sat	β	.09	.23
	t	1.87	4.54
Eat	β	-.16	-.22
	t	-2.81	-3.73
Cat	β	-.03	.002
	t	-.67	.03

5 | Discussion & Conclusion

In the current study, the researchers focused on different factors which are attitude towards Science, Mathematics, Engineering, 21st Century skills, students' gender, and their science and mathematics achievements by the use of SEM. It was found that the proposed model explained a significant amount of variance in mathematics and science achievement. These results are in parallel with the literature examining relations between science attitude and science achievement (e.g. Liu et al., 2011; Papanastasiou

& Zembylas, 2002; Turhan et al., 2008), mathematics attitude and mathematics achievement (e.g. Choi & Chang, 2011; Ma & Kishor, 1997; Saha, 2007), and also gender and science and mathematics achievement (e.g. Brown & Kanyongo, 2010), and gender and STEM attitude (e.g. Unfried et al., 2014).

In our testing model, it was found that gender had a significant direct relationship with mathematics achievement in the favor of females. Although the findings in the literature have contradictory results in terms of the relationship between gender and mathematics achievement, some studies showed that females outperformed in mathematics (Brown & Kanyongo, 2010; Bulut, 1994; Robinson & Lubienski, 2011). For example, Clewell and Campbell (2002) in their study concluded that the gender gap changes with the topic since females performed better in computation in primary and middle school years. Besides, Erdogan et al. (2011) in their study worked with high school students on both mathematics and geometry and they noted that in both branches of mathematics, females performed better compared to males.

On the other hand, the direct relation between gender and science achievement was not significant in this study. However, the indirect effect via STEM attitude caused the total effect of gender on science achievement to be significant. In the literature, it was seen that even in some studies females are more successful than males in science (Bezci & Sungur-Vural, 2013), some studies indicated that males' science achievement was higher than females (e.g. Altınok, 2005; Bacharach et al., 2003) in primary and middle school level. Thus, the results of the study are consistent with the results of the previous studies.

When the relationship between gender and STEM-attitude was examined, it was found that gender was directly associated with attitude towards engineering and technology. The male students demonstrated higher positive attitude towards engineering and technology than female students. Mahoney (2010) found that male students have a significantly more positive attitude towards STEM, particularly for the technology and engineering components, when compared to female students. The results were also parallel with Akgunduz's study (2016) that gender affects students' choices of STEM-related professions in which male students compose the majority of placement in STEM fields. Besides, in our model, we found that male and female students demonstrated similar attitude towards mathematics, science, and century skills in the current study. These findings support the results of other studies. For example, Unfried et al. (2014) in their study found that attitude towards mathematics did not change according to gender. However, males had significantly more interest in science fields, engineering, and technology than females. Their findings also suggested that males' engineering and technology attitude were more positive than females' attitude.

In the current study, it is found that mathematics attitude was significantly related to both mathematics achievement and science achievement. According to the meta-analysis study of Ma and Kishor (1997) in which they examined 113 studies, there was a strong relationship between attitude towards mathematics and mathematics achievement. The study of Moenikia and Zahed-Babelan (2010) showed that mathematics' attitude was a statistically significant predictor of high school students' mathematics achievement. The research of Barut (2020) in which he analyzed the data from PISA across Brazil, Norway, Singapore, and Turkey, indicated that mathematics-related affective variables significantly affected students' mathematics literacy. Moreover, according to the results of the studies conducted by Choi and Chang (2011) and Geesa et al. (2019) in which they used the data from TIMSS 2007 and TIMMS 2015 respectively, the positive attitude towards mathematics was found one of the strong predictors that were significantly related to participants' mathematics achievement. Also, the results of the previous studies show that there is a strong and statistically significant relationship between attitude towards mathematics and mathematics achievement (Babelan, 2010; Barut, 2020; Geesa et al. 1997; Moneikia et al. 2011; Song & Chen, 2019). Therefore, the results of the study correspond with the results of the previous studies. However, in the literature, there is not encountered with results showing the relationship between mathematics attitude and science achievement.

Moreover, in the current study, it is found that science attitude was significantly related to science achievement. However, it was not significantly associated with mathematics achievement. In the literature, researchers found that science attitude predict students' science achievement (Papanastasiou & Zembylas, 2002; Ozel, Caglak & Erdogan, 2013). Also, the previous results show that there is a significant and positive relationship between attitude towards science and science achievement (Akpinar et al., 2009; Bidegain & Mujika, 2020; Liu et al. 2011; Turhan et al. 2008). Therefore, the findings from this study aligned with the literature.

Furthermore, in this study, it was found that engineering and technology attitude significantly and negatively affected both mathematics achievement and science achievement. According to the research conducted by Pearson and Miller (2012), in which they made an analysis based on the 20 – year cumulative record of the Longitudinal Study of American Youth, examining the records of 3062 young adults, mathematics achievement in secondary school affected engineering motivation positively. In other words, success in mathematics is the starting point of an engineering career. However, to our knowledge, there is no study directly investigating the effect of engineering and technology attitude on mathematics and science achievement. Hence, there is a need for further studies examining these relationships and our study might contribute to the literature in terms of indicating how engineering and technology attitude related to mathematics and science achievement.

Finally, in the study, non-significant relations were observed between attitude towards century skills and mathematics achievement and science achievement. However, according to the results of the study conducted by Aravalo and Ignacio (2018) in which they examined constructs (digital age literacy, inventive thinking, effective communication, and high productivity) and overall, of 21st century skills' relation to science achievement in 10th grade students, they found out that there is a direct and positive relationship between century skills and science achievement. Since there has been a limited number of studies addressing the relationships between century skills and science and mathematics achievement, there is a need for more research to investigate how century skills are associated with mathematics and science achievement.

This study points out the importance of the indirect effect of STEM attitude on the relationship between gender and achievement. The difference in engineering and technology attitude between males and females increased the gender difference in science and mathematics achievement. The possible explanation of this result might be that the negative tendency of female students towards technology and engineering areas led them to study science and mathematics more compared to male students or vice versa. Therefore, addressing gender differences in engineering and technology attitude can also contribute to gender equality in science and mathematics achievement.

In our study, our model explained the factors that affect students' mathematics and science achievement. Since each component of STEM attitude related to both science and mathematics achievement, the teachers might benefit from the findings of the study to increase students' achievement. When students have difficulties in science and mathematics, the tasks that might develop positive STEM attitude can be used in the classroom to support students' achievement. Furthermore, since there is a very limited number of research studies investigating the relationship between engineering and technology attitude and mathematics and science achievement, and the relationship between 21st century skills and mathematics and science achievement, further comparison studies are needed to test whether similar relations to those observed in the current study will be found by other researchers.

Finally, as one limitation of this study, it should be noted that the schools participating in the current study were selected conveniently; thus, they might not represent the population in all related characteristics. Therefore, the replication studies in other settings are recommended to ensure generalizability of the results observed in this study. Another limitation is that two types of schools namely, Anatolian Religious High School and Anatolian High Schools were included in the study, which also

decreases the external validity of the study. Future studies can also consider other school types such as science and vocational high schools.

Statements of publication ethics

The research has no unethical problem, and no research and publication ethics have been observed.

Researchers' contribution rate

There is an equal contribution to the study.

Conflict of interest

There is no conflict of interest.

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The Investigation of Teacher Candidates' Learning Approaches and Engagement in a Hybrid Learning Environment According to RASE Model

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Abstract

This study aimed to investigate whether teacher candidates' learning approaches and engagement levels predicted their achievement in the Curriculum Development course in a hybrid course in Turkey. This study was designed according to the RASE (Resources/Activity/Support/Evaluation) model. In this study, data were collected from 129 teacher candidates through the 'Learning Approaches Questionnaire' and 'Engagement Questionnaire'. The achievement scores of teacher candidates were obtained at the end of the semester according to their course grades. To answer the research question, the Multiple Linear Regression analysis was employed. The results of the study showed that while the deep learning approach of teacher candidates was significantly and positively related to engagement variables, the surface learning approach was related to engagement variables negatively. However, it was revealed that the surface learning approaches and behavioral engagement of teacher candidates significantly predicted the achievement in the hybrid Curriculum Development course. It can be concluded that the learning environment is important for learning outcomes. It can be suggested that besides providing different active learning opportunities, teacher candidates should be assessed by the level of applications conducted in the hybrid learning course to improve deep learning and all types of engagement levels.

Keywords: Agentic engagement, behavioral engagement, cognitive engagement, deep learning approach, surface learning

Hibrit Bir Öğrenme Ortamında Öğretmen Adaylarının Öğrenme Yaklaşımları ve Katılımlarının RASE Modeline Göre İncelenmesi

Öz

Bu çalışma, öğretmen adaylarının öğrenme yaklaşımlarının ve katılım düzeylerinin Türkiye'de hibrit olarak tasarlanan Eğitimde Program Geliştirme dersindeki başarılarını yordayıp yordamadığını araştırmayı amaçlamıştır. Bu çalışma RASE (Kaynaklar/Etkinlik/Destek/Değerlendirme) modeline göre tasarlanmıştır ve 129 öğretmen adayından 'Öğrenme Yaklaşımları Ölçeği" ve "Katılım Ölçeği" aracılığıyla veriler toplanmıştır. Öğretmen adaylarının başarı puanları ders notlarına göre yarıyıl sonunda alınmıştır. Araştırma sorusunu yanıtlamak için Çoklu Doğrusal Regresyon analizi kullanılmıştır. Araştırmanın sonuçları, öğretmen adaylarının derin öğrenme yaklaşımının katılım değişkenleri ile anlamlı ve pozitif yönde ilişkili, yüzeysel öğrenme yaklaşımının katılım değişkenleri ile negatif yönde ilişkili olduğunu göstermiştir. Ancak öğretmen adaylarının yüzeysel öğrenme yaklaşımları ve davranışsal katılımlarının Eğitimde Program Geliştirme dersindeki başarıyı önemli ölçüde yordadığı ortaya çıkmıştır. Öğrenme ortamının öğrenme çıktıları için önemli olduğu sonucuna varılmıştır. Öğretmen adaylarına farklı aktif öğrenme fırsatları sağlamanın yanı sıra, derin öğrenmeyi ve her türlü katılım düzeylerini geliştirmek için hibrit derslerde yapılan uygulamalar ile değerlendirme önerilebilir.

Anahtar kelimeler: Aracı katılım, davranışsal katılım, bilişsel katılım, derin öğrenme yaklaşımı, yüzeysel öğrenme

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1 | Introduction

In the 21st century, the economy demands more university graduates and self-improving workers. Many high school graduates are not accepted by universities but want to obtain a college degree to have better job opportunities. Besides, the professional life after university precludes many university graduates from participating in some programs or seminars to improve themselves more, which would provide them recognized qualifications (Baepler et al., 2014). In order to meet the needs of the economy and these learners, many universities, through the help of fast-growing computer-mediated communication and technology, design online learning program alternatives such as MOOCs (massive open online courses), flipped classrooms, and hybrid/blended learning (Zhou & Zhang, 2018). In this sense, many practitioners believe in hybrid learning (HL) complements the advantages of traditional and online learning to achieve optimal learning. According to HL, students can participate in some learning tasks via rich computer-mediated communication technologies even when they cannot physically be in classes. In this way, higher education courses and seminars become more accessible to a large number of people (Nieuwoudt, 2020; Tay, 2016; Zhou & Zhang, 2018).

Moore and Gilmartin, (2010) stated that the online part of HL allows learners to access the content whenever and wherever they want and the reduced amount of face-to-face lectures provide time for learners to search for topics by themselves or with their peers, rather than depending on the lecturer to provide all the answers in class. While HL allows students to have more time to prepare, participate in different in-class activities, and reflect on others' explanations in the online part, on the other hand, traditional instruction mostly provides insufficient time for students to search, frame their responses to the questions asked in class and synthesize their ideas, which often result in shallow, less critical contributions and surface learning (Baepler et al., 2014; Cheng & Chau, 2014). Zhou and Zhang (2018) stated that HL is one of the important directions of teaching reform and it is closely linked with the use of a deep learning approach. Ward (2019) expressed that HL is related to increased motivation and engagement in learning, and decreased off-task behaviors. Moreover, it provides individualized and self-directed learning opportunities in which learners can access learning materials at their convenience (Moore & Gilmartin, 2010; Tay, 2016). Additionally, Hara, Bonk, and Angeli (2000) stated that HL provides a permanent memory of learners' thoughts for reflection and debate. In this way, after posting comments, learners access them later as a model of expected answers. These posts can be used by instructors to identify discourse patterns and track the development of learners both within a single online discussion session as well as over extended periods.

In HL, as learners engaged in multiple and various in-class and online activities, learning is facilitated (Baepler, et al., 2014; Cheng & Chau, 2014; Nieuwoudt, 2020). Thanks to both online learning and face-to-face parts, learners have the opportunity to receive help and feedback from instructors and peers during the HL process to construct personal interpretation, which fosters engagement in tasks (Cheng & Chau, 2014; Redmond et al., 2014; So & Bonk, 2010). In other words, as learners engage in learning tasks more, their performance improves more in HL environments. Moreover, HL supports learners to manage the content through in-class group tasks and online discussions, thus promoting deep and meaningful learning. Learners' participation and engagement with course materials and tasks both in face-to-face and online parts in terms of the number of postings contribute to the learning process in a positive way (Cheng & Chau, 2014; Nieuwoudt, 2020).

Despite many advantages of the HL as stated previously, there are some disadvantages as well. For instance, the removal of time constraints may result in the procrastination of learners to complete tasks in a determined period which causes an overload of packed content to learn in a short time before the date of submission (Hara et al., 2000; Tay, 2016; Ward, 2019). In other words, easy access could also mean procrastination or less prioritization since online content is available somewhere. As a result, as stated in

Tay (2016)'s study, learners leave it there until they need to use it. These issues may result in a decrease in learners' behavioral, cognitive, emotional, and agentic engagement. However, Kuh (2009) stated engagement as one of the important factors for student learning. Moreover, as for the online part of HL, the limited inclusion of visual communication cues such as gestures, smiles, or tone of voice might result in the decrease of learners' emotional engagement. However, if students exhibit low engagement during the HL process, including in-class activities and online discussions, the advantages of HL mentioned previously might be less apparent (Hara et al., 2000). Moreover, the engagement of learners with academic activities at a low level was expressed as the main reason for dissatisfaction, negative experience, underachievement and dropping out of course (Finn & Rock, 1997; Fredricks, Blumenfeld, & Paris, 2004; Kuh, 2009; Skinner & Pitzer, 2012).

Moore and Gilmartin (2010) reflected on their experiences when they included traditional face-to-face teaching by saying that they felt the lack of encouragement and deep learning among learners which resulted in superficial engagement with ideas and concepts. However, when they included an online learning environment using Blackboard to provide resources to students, they also felt that the structure of online courses prevented deep learning in which learners experienced very few opportunities for interlinking or cross-referencing information. The findings of their study revealed the disconnection between the content outcomes, which in turn showed the necessity of integrating face-to-face classes with online learning settings to achieve the optimal learning that will enable learners to become highly engaged and achieve deep learning.

Besides, although HL has been increasingly included in the teaching-learning process, the changes in pedagogies implemented in HL have been limited. It was revealed that many HL courses focus on content delivery through PowerPoint presentations (So & Bonk, 2010). However, simply turning the classroom presentations into online presentations or the inclusion of innovative digital technologies without providing students quality instruction along with the higher emotional, behavioral, cognitive, emotional and agentic engagement in different activities as also stated by Lim and Morris (2009), may result in students' procrastination of learning and decrease in their motivation to get prepared for the course, read online posts and taking part in-class activities. For this reason, to eliminate the unfavorable effects of HL, it is essential to provide learners with successful designs to initiate deep learning as well as increase their engagement in purposeful effective HL environments. In the current study, the RASE (Resources/Activity/Support/Evaluation) model has been integrated. This model includes both active applications through the use of technology and student-centered active instruction to help instructors design more effective courses to enable TC to obtain increased engagement, deep learning, and achievement. It can be seen that learning approaches and learner engagement are some of the variables that should be investigated in HL environments. Moreover, Bedenlier et al. (2020) revealed the results of their systematic review study including 42 peer-reviewed arts and humanities articles indexed in four international databases, and found that majority of research related to engagement of learners has been conducted in language learning. For the aforementioned reasons, in this study, the aim was to redesign an educational sciences course, Curriculum Development, to enhance the engagement and learning of TC. Also, the learning approaches and engagement levels of teacher candidates (TC) have not been investigated comprehensively in HL environments in Turkey. This current study also aimed to address this important gap.

Learning Approaches

In the literature, deep and surface learning approaches have been examined in different courses and grade levels (Biggs, 1991; Biggs & Tang, 2007; Cope & Staehr, 2005; Dolmans et al., 2016; Entwistle & Entwistle, 1991; Gordon & Debus, 2002; Wilson & Fowler, 2005). Learners who adopt deep learning approaches learn critically without accepting everything as correct when they are presented, find evidence by using reliable resources, extract their understanding, link new ideas and concepts to previous ones (Biggs, 1991; Dolmans et al., 2016; Entwistle & Entwistle, 1991). For this reason, they exhibit more

engagement and interest in learning activities (Floyd et al., 2009). Furthermore, as reported in the literature, deep learners use learning strategies, monitor, and reorganize their learning process by following the feedback from other students (Biggs & Tang, 2007; Cope & Staehr, 2005; Entwistle & Entwistle, 1991).

On the contrary, surface learners prefer low levels of cognitive activities and want to make the minimum effort to fulfill a task (Gordon & Debus, 2002). For this reason, they tend to memorize the details of information and accept new concepts and ideas without offering interpretation, justification, or criticizing them (Biggs et al., 2001; Dolmans et al., 2016; Entwistle & Entwistle, 1991; Loyens et al., 2013; Redmond et al., 2014).

It is accepted that deep learning approaches lead to the achievement of high-quality educational outcomes, learning, and engagement (Biggs, 1991). While deep learners reflected at higher critical thinking stages, those who accepted the surface learning approach reflected mostly at the starting stage of reflective thinking (Leung & Kember, 2003). The results of many studies showed that deep learners obtained higher academic achievement, grade point average (GPA), or self-rated academic progress than surface learners (Buckley et al., 2010; Cope & Staehr, 2005; Loyens et al., 2013; Nieuwoudt, 2020; Minbashian et al., 2004).

In the literature, it was revealed that even though learners have a general predisposition for either a deep or surface approach for learning, their learning approaches were influenced by the contextual situations (Ilhan-Beyaztas & Senemoglu, 2015). While learners who perceived the learning environment favorable in terms of learning goals and teaching-learning processes promoted the use of deep learning approach and the others who perceived heavy workload and inappropriate assessment caused the initiation of surface learning (Wilson & Fowler, 2005). Similarly, Cope and Staehr (2005) found a statistically significant increase in the ratio of students' deep learning usage in the fifth year of their study since their workload in terms of the course content were gradually decreased each year, and much more students perceived that they had enough time to apply deep learning approaches. Also, learners use surface learning approaches when the perceived value of the course is low. On the contrary, deep learning strategies are applied when learners perceived the value of the course content high and engaged in the learning process (Floyd et al., 2009).

The association between students' learning approach preferences and curriculum designs was revealed (Dolmans, et al., 2016). Zhou and Zhang (2018) stated that both traditional classroom teaching and instruction including only online learning, mostly result in a simple mechanical rote learning and the use of surface learning approach which seriously prevents learners' deep understanding of knowledge and the development of higher-order thinking skills such as critical thinking, problem-solving, and innovative thinking. On the other hand, deep learning is accepted as one of the talents approved in the training of 21st-century learners. Therefore, it is of great importance to promoting deep learning of learners in contexts that are combined with face-to-face and online parts. In the literature, it was stated that developing deep learning approaches is claimed to enhance students' engagement with their subject and vice versa (Floyd et al., 2009). Hence, this study investigated the associations among learning approaches and engagement levels of TC in an HL environment by providing a flexible learning environment in terms of learning time and place.

Learner Engagement

The multifaceted, complicated, dynamic, and context-dependent nature of engagement was defined in many ways (Ben-Eliyahu et al., 2018; Kuh, 2009; Steen-Utheim & Foldnes, 2018). The engagement of learners was explained in a continuum from disengagement to engagement (Xerri et al., 2017). Formerly, it was described through observable behaviors such as participation in academic, social, or extracurricular activities (Ben-Eliyahu, et al., 2018; Bowden et al., 2019; Finn & Rock, 1997; Reeve, 2013; Reeve & Tseng, 2011). In learning environments, including an online part, engagement was linked to time spent on a

webpage or duration of eye-screening and willingness to interact with other learners and instructors to solve issues related to the course (Henrie et al., 2015). It is also defined as the energy and effort that learners make during the learning process, which is observable through several behavioral, cognitive, or affective indicators (Bedenlier et al., 2020; Bond, et al., 2020; Skinner & Pitzer, 2012). Reeve and Tseng (2011) explained that engagement included four different dimensions: behavioral, emotional, cognitive, and agentic.

Learners' behavioral engagement is about their satisfaction, persistence, and achievement in time-on tasks and teaching practices (Jamaludin & Osman, 2014; Kahu, 2013; Kuh, 2009). Also, it includes different observable actions such as asking questions, doing school work, and contributing to class discussions (Connell, Spencer, & Aber, 1994; Finn & Rock, 1997; Skinner & Belmont, 1993). The results of some studies have revealed a positive correlation between behavioral engagement and achievement (Connell, Spencer, & Aber, 1994; Marks, 2000). Henrie et al. (2015) also showed that 77% of the reviewed articles included the indicators of behavioral engagement such as the number of participation, assignments completed, frequency of log-in sessions, and other on-task behaviors. It can be stated that as TC participated more, they obtained higher grades since they took part in activities conducted in class and online part of the course and tried to complete their responsibilities well, which was corroborated in the literature (Connell et al., 1994; Marks, 2000; Reeve, 2013; Reeve & Tseng, 2011). In the study conducted by Bond et al. (2020), behavioral engagement was explained as the most frequently reported dimension of engagement, which included participation in learning tasks, interaction with peers and the instructor, and involvement in different learning activities.

Emotional engagement encompasses positive and negative reactions in the teaching-learning process. Emotionally engaged learners show positive feelings like interest, enthusiasm, and enjoyment towards the courses, subjects, tasks, and learning process rather than anxiety, anger, or apathy (Skinner & Belmont, 1993). Besides, Bowden et al. (2019) added that positive emotions were also correlated with behavioral engagement. Bond et al. (2020) revealed that emotional engagement was at the highest level when learners interacted with their peers and the instructor, and when synchronous collaboration tools were included in the online part of learning. There is not sufficient research about the emotional engagement and achievement of learners (Fredricks et al., 2004). While some studies showed correlations among achievement, emotional and behavioral engagement (Connell et al, 1994; Jamaludin & Osman, 2014; Reeve, 2013), they are not enough to allow an examination of the unique contribution of emotional engagement on academic outcomes as a result of combining different types of engagement.

Cognitively engaged learners think strategically, self-regulate their learning processes by planning, organizing, monitoring and evaluating their learning, try to master the knowledge by using different strategies such as the rehearsal, summarizing and elaboration (Pintrich & De Groot, 1990; Reeve & Tseng, 2011; Zimmerman, 1990). Learners who use deep learning strategies are engaged more cognitively, exert more mental effort, create more connections among ideas, so they achieve a greater understanding of ideas (Floyd et al., 2009). The relationship between achievement and one aspect of cognitive engagement-strategy use has been documented (Fredricks et al., 2004).

Finally, agentic engagement is about learners' proactive and constructive contributions during instruction by explaining what they prefer via asking questions, communicating with teachers by making suggestions, expressing their thoughts, level of expressed interests or requesting a demand and assistance through feedback, recommending a goal or objective, and so on (Jamaludin & Osman, 2014; Reeve & Tseng, 2011). Therefore, it can be said that agentic engagement encourages learners to look for opportunities to increase their interest in the lesson and enrich the instruction rather than just passively receiving as it is given.

It was stated that engagement functions as a student-initiated pathway to important outcomes such as skill development, academic progress, retention, achievement and institutional performance (Cheng, & Chau, 2014; Connell et al., 1994; Jamaludin & Osman, 2014; Kahu, 2013; Kuh, 2009; Marks, 2000; Reeve,

2013; Skinner & Pitzer, 2012; Steen-Utheim & Foldnes, 2018). Similarly, Collaço (2017) expressed that high levels of student engagement positively contributed to GPA and students' perception of their overall academic experience. The correlation between engagement types and achievement varies depending on how achievement is assessed. While behavioral engagement is likely to be associated with teacher grades and scores on tests, the links with cognitive engagement are more likely to become obvious when tests measure synthesis, analysis, and deep-level understanding of content (Fredricks et al., 2004) which make it difficult to draw firm conclusions confirming that engagement positively influences achievement. The results of some studies showed that while behavioral engagement predicted the achievement (Bond et al., 2020; Bowden et al., 2019; Henrie et al., 2015; Marks, 2000; Reeve, 2013; Reeve & Tseng, 2011; Skinner & Pitzer, 2012), this was not true for either emotional engagement or cognitive engagement (Ben-Eliyahu et al., 2018; Bowden et al., 2019; Marks, 2000; Reeve, 2013). In addition, Jamaludin & Osman (2014) demonstrated emotional engagement as one of the important factors when compared to other types of engagement for achieving active learning in a flipped learning environment which is a type of blended learning. However, Bedenlier et al. (2020) expressed emotional engagement as the least observed dimension in their systematic review study. Moreover, the results of studies revealed that that deep learners engaged in courses and obtained higher academic achievement than surface learners (Cope & Staehr, 2005; Minbashian, et al., 2004; Nieuwoudt, 2020). The results of some studies revealed an insignificant relationship between the deep learning approach and academic achievement (Duff, Boyle, Dunleavy & Ferguson, 2004; McParland et al., 2004). Although Ke and Xie (2009) found that around 87% of the adult participants obtained higher scores in the deep approach dimension than in the surface approach dimension, the content analysis of online discussions mostly reflected the surface learning approach. It can be seen that the findings of the studies about the effectiveness of learning approaches in terms of engagement, learning, and achievement are not clear. It can be said that the relationship between engagement and achievement is still an issue open to discussions. Also, knowing the fact that there are differences between the learning approaches and engagement of TC and the discovery of these differences can help instructors to design the instruction effectively, and to reach more qualified learning outcomes. For this reason, the current study aimed to better understand the learning approaches and engagement levels of TC in an HL environment. To achieve this aim, the following research question was proposed:

How well the learning approaches and engagement levels of TC in the Curriculum Development Course predict their achievement?

2 | Method

This study was conducted in the Curriculum Development course which is an elective course at a public university in Turkey.

Participants of the Study

Data were collected from 129 TC according to the purposive sampling method (Cohen et al., 2007; Creswell, 2012). Among the 129 TC, 88 (68.2%) of them were female and 41 (31.8%) of them were male and 39 (30.2%) of them from Psychological Counselling and Guidance Department; 20 (15.5%) of them from Elementary School Mathematics Teaching Department; 21 (16.3%) of them from Turkish Language Teaching Department; 22 (17.1%) of them from Social Sciences Teaching Department and 27 (20.9%) of them from Classroom Teaching Department.

HL Process

In this study, the RASE (Resources, Activity, Support, and Evaluation) model was implemented as shown in Figure 1. It was based on different theoretical concepts such as constructivist learning environments,

engaged learning, active learning, technology-based learning environments, interactive learning environments, collaborative learning, etc. (Churchill et al. 2013). The focus of the model is the content and the resources which were included during instruction but seem not quite sufficient to fully achieve learning outcomes. According to this model, instructors are expected to include active learning approaches such as experiments, case based-learning, problem-solving to achieve learning outcomes, and provide help and support whenever learners need it. The support may come from both instructors through the use of technological tools or from peers in collaboration with other students to solve arising difficulties. Finally, learners should be guided about their progress and ensure that learning outcomes are being achieved through formative and summative evaluation.

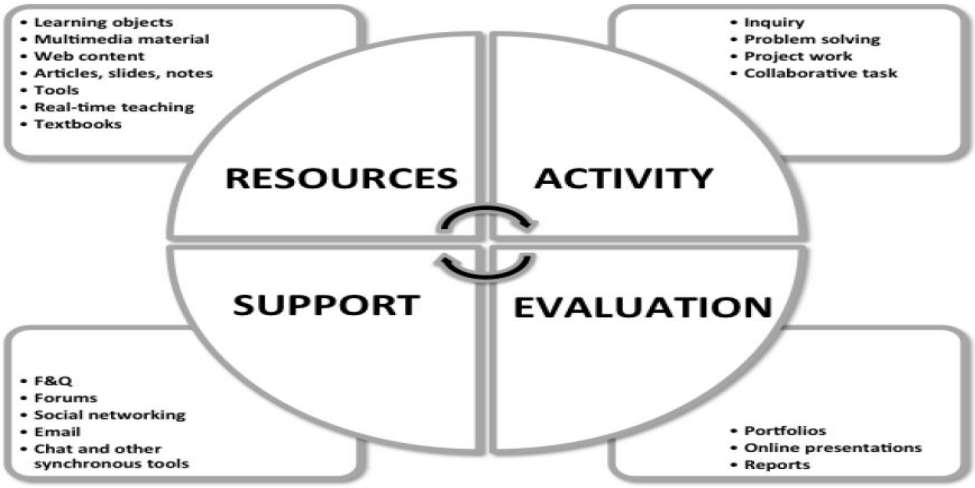

Figure 1. *Figure 1. RASE model (Churchill et al., 2013).*

In this study, textbooks, PowerPoint slides, real-time teaching, and online discussion forums were included as resources. As for the activity dimension, authentic cases where students discussed and reflected on real-life scenarios, daily news, or ill-defined cases were chosen. Moreover, TC prepared a sample lesson plan after learning the topics of the course. Weekly reflections of TC were evaluated so that they can receive timely feedback to reflect on and take further actions towards achieving more coherent learning outcomes. In this process, TC were provided with support and feedback from both their peers and instructors. While providing support is decreasing the course workload and increasing deep learning, behavioral, cognitive, emotional, and agentic engagement was aimed since effective instruction can be provided in this way. Finally, TC were evaluated according to their weekly reflections, the quality of lesson plans, and the final exam. The summary of procedures conducted during the HL process was shown in Table 1.

Table 1. The Procedures Conducted during the HL Process to improve Deep Learning and Engagement

Deep Learning	Behavioral engagement	Emotional engagement	Cognitive engagement	Agentic engagement
Participation in asynchronous Edmodo discussions	Participation in class activities and asynchronous Edmodo discussions	Positive relations with the instructor and peers	Meaningful contribution to asynchronous Edmodo discussions	Requesting help or feedback from peers and instructor
Asking thought-provoking questions during online discussions	Number of quality posts	Willingness and interest to participate in online and class discussions	Asking thought-provoking questions during discussions	Expressing a preference or making a suggestion
Preparation of a sample lesson plan	Responding to peers' ideas	Satisfaction with course tasks	Preparation of a sample lesson plan	Contribution to online discussions or seeking clarification
Taking part in the question-answer part in the classroom	Asking questions to peers and instructor related to course issues	Feeling the sense of belongingness to online community	Learning from peers through online discussions and group activities	Express their ideas, thoughts and needs
Participation in cooperative learning activities in the classroom		Taking responsibility for learning towards one another in both online and in-class part of the HL	The use of deep learning approaches-such as reflective and critical thinking	Recommending a goal or objective to be pursued
Reflecting on posts critically		Enthusiasm	Self-regulation of study habits	Communicate likes and dislikes
Searching for the content in many resources			On task attention	

In the current study, during the face-to-face part of the course, instructor presentations and the question-answer part were included besides cooperative learning activities. TC formed learning groups spontaneously which included 4-6 members, and they usually worked semi-autonomously but supervised by the instructor. In this way, it was thought that this group learning process might contribute to the fostering of the use of a deep learning approach and increase the behavioral, cognitive, emotional, and agentic engagement of TC.

Moreover, class time also included online question-answer plays, Kahoot, to check whether TC learned the basics of each topic. Each play included 6-7 questions as shown in Figure 2. At the end of the face-to-face part of the course, TC were informed about the discussion topic of the week and directed to online discussions which were to be completed after class time. In other words, they learned the topic during the face-to-face part of the course and then they practiced their learning through online discussions.

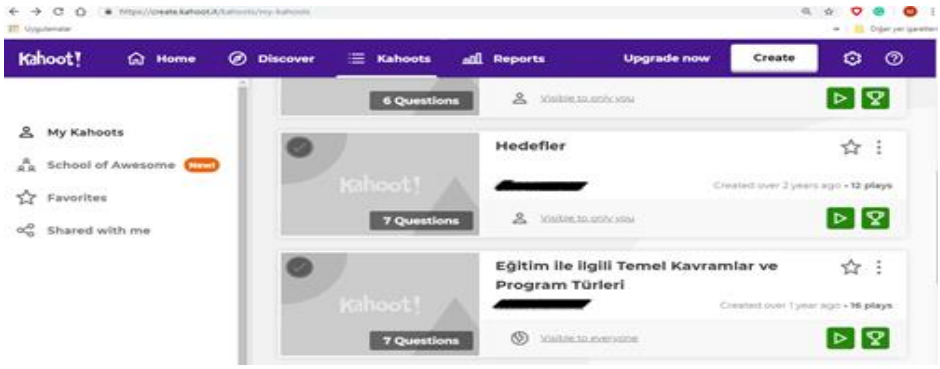

Figure 2. *Kahoot application*

Out of class time, TC were expected to take part in asynchronous Edmodo discussions as shown in Figure 3. Some researchers stated that due to digital technologies, especially the existence of discussion forums, the behavioral engagement of learners has increased (Bond, et al., 2020). Also, behavioral and cognitive engagement of TC aimed to be enhanced through active learning opportunities which included asking thought-provoking questions during Edmodo discussions. Besides, Redmond et al. (2014) explained that discussing cases, open-ended questions, or problems was important to promote deep and meaningful learning in HL environments. Moreover, by designing a caring environment and providing TC with communication opportunities both among their peers and also with their instructor, an increase in emotional and agentic engagement was aimed.

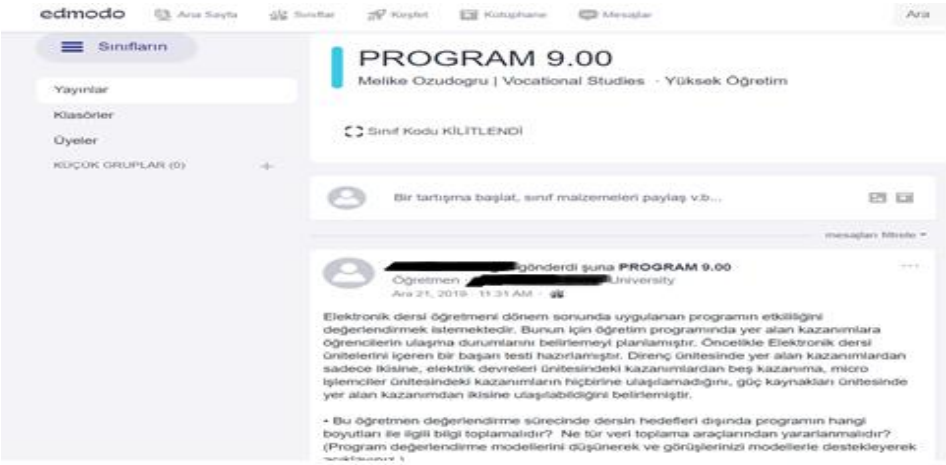

Figure 3. *Asynchronous Edmodo discussions group*

Besides, many studies have found associations between the learning approaches and course grades in online discussions (Buckley et al., 2010). Hence, TC discussed cases that reflected real-life classroom events or news related to the course topic (see Appendix 1). In this way, they obtained the opportunity to talk and discuss the planning of instruction, basics of curriculum development, needs assessment techniques, content organization, variables for the effective teaching-learning process, curriculum evaluation types, etc. TC were expected to share their ideas with other students, take responsibility towards one another in both the online learning and in-class part of HL, which in turn expected to increase their emotional engagement levels and motivate them to complete the tasks.

Furthermore, as stated by Handelsman et al. (2005), class materials are some of the components that represent student emotional engagement; thus, in the current study, the discussion board, Edmodo, included properties to increase emotional engagement, such as the like button, which is thought to contribute to learning. Moreover, the instructor supported TC during both face-to-face and online learning tasks through feedback and helped them to learn from their mistakes apart from peer collaboration to support cognitive and agentic engagement. Also, agentic engagement was fostered through various forms of communication such as private conversations conducted between TC and the instructor through the

online discussion board, Edmodo, as stated by Reeve (2013). Moreover, TC were allowed to contribute to both in-class and online discussions by expressing their preferences, ideas, thoughts, likes, dislikes, needs, and making suggestions, recommending the instructor a goal or objective to be pursued, as well as requesting assistance in terms of solving problems.

Data Collection Process and Materials

This study was conducted in the 2019 fall semester after obtaining Institutional Ethics Committee permission. Although the operating course time was 10 weeks (except orientation week, two-week midterm exams, and national holidays), the HL was carried out for six weeks at a public university in Turkey. In this study, data were collected through the 'Learning Approaches Questionnaire' and 'Engagement Questionnaire', which were explained below. The achievement scores of TC were obtained at the end of the semester according to their course grades.

The results of many studies showed that the number of posts made a significant direct contribution to the final mark in different courses (Nieuwoudt, 2020). Redmond, et al. (2014) stated that when the online discussion posts were directly or indirectly related to the assessment process, it was more likely to increase the interaction and engagement of learners in the online discussion forums. This will in turn increase learning. Hence, TC were awarded 30% of their course grade for the quality and quantity of their postings on Edmodo. The number of postings of PsT was obtained from Edmodo system logs, and course grades were obtained from the instructor. The instructor conducted a final exam which was a multiple-choice test including the goals and objectives at the knowledge, and comprehension levels according to Bloom's Taxonomy. Course grades of TC varied from 0 to 100. Altogether, TC posted 1547 times during those six weeks. This total posting number comes from four different classes. The Edmodo contributions consisted of 435 posts (class 1), 371 posts (class 2), 218 posts (class 3), and 523 posts (class 4). Furthermore, while 20% of the course grades were awarded for the effectiveness of TC's sample lesson plans, which were evaluated using a rubric, and 50% of their grades were awarded for the final exam, which was implemented by the course instructor.

Learning Approaches Questionnaire

The Learning Approaches Questionnaire was used to investigate the learning approaches of TC. The questionnaire was developed by Biggs, et al. (2001) and adapted to the Turkish by Onder and Besoluk (2010). It is a Likert-type 5-point (from always to never) questionnaire comprised of 20 items in two different factors (deep learning and surface learning). While the reliability coefficient of the deep learning dimension is .78, the surface learning dimension is .74.

Engagement Questionnaire

The 'Engagement Questionnaire (EQ)' was developed by Reeve & Tseng (2011) and used to assess student engagement in terms of behavioral, emotional, cognitive, and agentic dimensions. In this study, a five-point-Likert type self-report instrument with 22 items was implemented after conducting its adaptation studies. The adaptation study of the scale was conducted by Ucar and Sungur (2018) for middle school science students. In this adaptation, the items included the "in science class" statement which was added after each item. However, in this study, the participants were TC. Therefore, a new adaptation study was conducted.

For the confirmatory factor analysis of the scale, 385 sophomore TC who took the Curriculum Development course in the fall semester of 2019-2020 education year from two state universities in Turkey were included. Among these 385 TC, 259 (67.3 %) of them were female and 123 (31.9%) of them were male.

AMOS 24.0 maximum likelihood calculation was used to test whether the model is suitable for the data. CFA proposed the following model fit indices: The chi-square value (*χ2/df*=531.38/200= 2.66; p=.000) showed the fitness of the model to the data (Hair et al., 2014). *CFI*= .93; *NFI*= .90; *RFI*= .87, *IFI*= .93, *AIC*= 681.38, *ECVI*= 1.77 and RMSEA=.06. The standardized path coefficients ranged from 0.58 for item 20 to 0.85 for item 8.

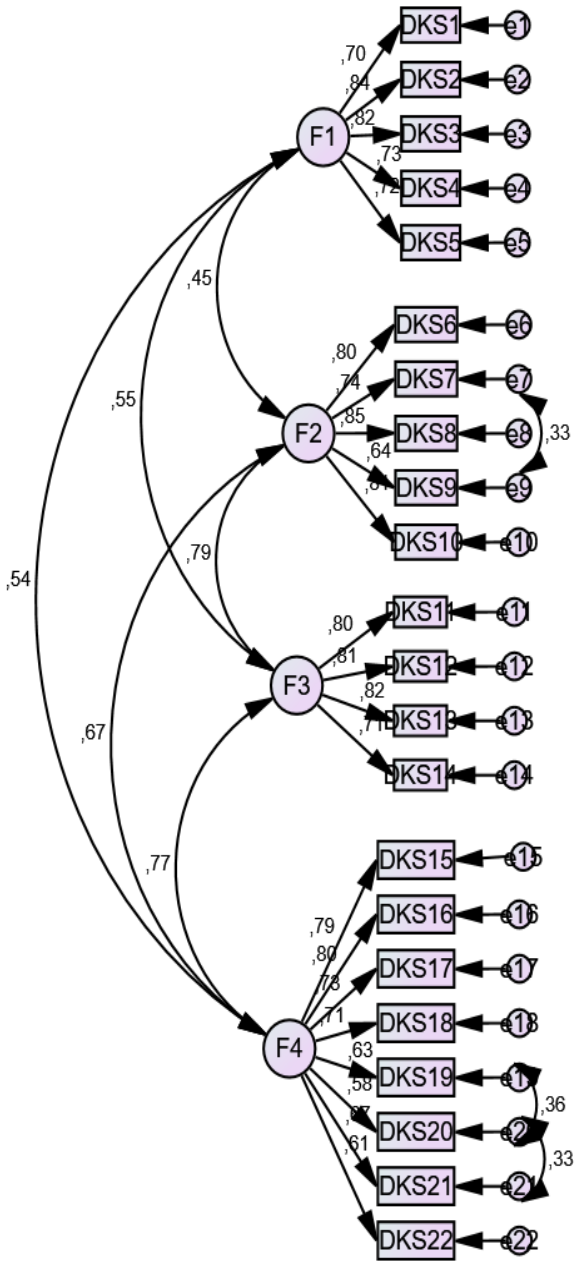

Figure 4. *Standardized path coefficients for the four-factor model of engagement questionnaire.*

Finally, as shown in Figure 4, the EQ consisted of four factors. The reliability coefficients across the factors of the scale were shown in Table 2, which showed adequate internal consistency (Hair et al., 2014). As a total, the reliability coefficient of Cronbach's alpha was found .93.

Table 2. The Item Numbers, Reliability Coefficients across the Factors of the Engagement Questionnaire

Factors-Sub-Scales	Item Numbers	Reliability Coefficients
Agentic Engagement	1, 2, 3, 4, 5	.87
Behavioral Engagement	6, 7, 8, 9, 10	.88
Emotional Engagement	11, 12, 13, 14	.86
Cognitive Engagement	15, 16, 17, 18, 19, 20, 21, 22	.89

Data Analysis

To answer the first research question, the Multiple Linear Regression (MLR) analysis was employed (Field, 2009; Tabachnick & Fidell, 2007). In this study, firstly, the assumptions of MLR were checked to ensure there is no violation of the assumptions of normality, linearity, homoscedasticity, multicollinearity, and influential observations. It was seen that none of the cases had undue influence over the regression parameter. Then, descriptive statistics, correlations among variables as well as regression parameters were revealed. The alpha level was determined as .05 as stated by Field (2009) and analyses were conducted using the SPSS 22.

3 | Findings

In order to answer the research question, the Multiple Linear Regression (MLR) analysis was employed. In this sense, firstly, the correlations among variables were investigated and presented in Table 3.

Table 3. The Correlations and Descriptive Statistics among Achievement and Predictor Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Course grade (1)	1.00						
Deep Learning (2)	.09	1.00					
Surface Learning (3)	-.27***	-.22**	1.00				
Agentic Engagement (4)	.19*	.47***	-.038	1.00			
Behavioral Engagement (5)	.24**	.66***	-.30***	.36***	1.00		
Emotional Engagement (6)	.09	.75***	-.33***	.45***	.69***	1.00	
Cognitive Engagement (7)	.17*	.67***	-.17*	.55***	.56***	.71***	1.00
Mean	72.50	33.85	26.78	17.63	18.71	14.84	29.85
SD	9.21	5.68	5.88	3.69	3.12	2.78	4.64

* $p < .05$, ** $p < .01$, *** $p < .001$.

In this study, the outcome variable was academic achievement, while the learning approaches and types of engagement were predictor variables. According to Table 2, the correlation between academic achievement and surface learning was r= -.27, behavioral engagement was r= .24, agentic engagement was r= .19, and cognitive engagement was r= .17. The highest correlation was between emotional engagement and deep learning (r= .75). All engagement variables were significantly (moderately or highly) related to other engagement variables. Moreover, while the deep learning approach of TC was significantly and positively related to engagement variables, the surface learning approach of TC was negatively related to engagement variables. It can be seen in Table 4, all predictors were entered into the model to test whether the model was significantly better at predicting the outcome.

Table 4. Summary of Multiple Hierarchical Regression Analysis for Variables Predicting the Course Achievement of TC in an HL Environment

	B	*SE B*	*β*	*t*	Sr^2	R^2	*ΔF*
	72.23	7.51		9.62***		.16	3.98***
Deep Learning	-.23	.22	-.14	-1.02	-.09		
Surface Learning	-.43	.14	-.27	-3.04**	-.25		
Agentic Engagement	.45	.25	.18	1.80	.15		
Behavioral Engagement	.88	.36	.30	2.48*	.21		
Emotional Engagement	-.95	.50	-.29	-1.92	-.16		
Cognitive Engagement	.30	.26	.15	1.17	.10		

* p < .05, ** p < .01, *** p < .001.

In order to test whether the model was significantly better at predicting the outcome, F-ratio was checked (Field, 2009) and it was found F (6, 122) = 3.98 (p<.001). It can be said that the model was significant in predicting the outcome variable. As shown in Table 3, the variables explained 16% of the variance in academic achievement. When the t-statistics were checked to control whether the predictor variables contributing to the model significantly as suggested by Field (2009), it was found that surface learning t(122)=-3.04, p< .003 and behavioral engagement t(122)=2.48, p< .01 significantly predicted the achievement of TC in a hybrid Curriculum Development course. In other words, it can be said that when TC tended to use surface learning approaches more, their achievement decreased. Also, when TC behaviorally engaged in the learning process in this hybrid course, such as posting on the Edmodo or class discussions, their achievement increased more.

4 | Discussion

In the current study, it was revealed that the surface learning approaches of TC significantly predicted the achievement in the hybrid Curriculum Development course. According to results, surface learning was negatively related to achievement (Buckley, et al., 2010; Cope & Staehr, 2005; Ekinci, 2009; Minbashian, et al., 2004). It can be deduced that the more TC preferred surface learning approaches, the lower their achievement. According to the results of the study, some of the TC might have made a minimum effort, applied low levels of cognitive strategies, especially during the online discussions to fulfill their responsibilities, which might have decreased their course achievement. As Dolmans et al. (2016) also stated, instead of learning critically, linking new ideas and concepts, and associating new knowledge with previous knowledge, TC may have completed their tasks in class and online case discussions by copying and pasting from the internet or textbooks just to have good grades or memorize some part of the knowledge to pass the final exam, which in turn might have affected their deep learning levels. It was stated by Zhou & Zhang (2018) that while surface learners tend to memorize and understand mechanically, deep learners try to understand the content according to Bloom's high-level educational goals with an emphasis on analysis, synthesis, and evaluation. This study revealed that TC mostly didn't dwell on their understanding of learning to critically learning new content and integrating new knowledge into the original cognitive structure, as it is emphasized by deep learning.

Another reason for this result might be due to time problems and workload caused by other projects. For these reasons, some TC might not have participated willingly in in-class and online discussions due to perceived workload as also mentioned in the literature (Cope & Staehr, 2005; Tay, 2016; Xerri, et al.,

2017). Similarly, Zheng & Guo (2019) explained that learning behaviors of deep and surface learners are not completely different in HL environments, and some essential differences were reflected during the active behaviors in class, the interactional editing behaviors on the learning platform, and the meaning negotiation on cognitive aspects of the course. Besides workload, some of the students might have felt that memorizing the material was important to demonstrate their understanding to maximize exam grades, as also revealed in the study conducted by Entwistle and Entwistle (1991) which included students from the Psychology, Zoology, Biochemistry, Accountant, and Medicine Departments of Edinburgh and Oxford Universities. In this way, the surface learning approaches of TC significantly predicted their achievement in the hybrid Curriculum Development course.

Besides, the reason why the deep learning approaches of TC did not predict their achievement, may be related to the exam type. In the literature, many studies found no significant correlations between the learning approaches (deep and surface) and measures of academic performance which were assessed through multiple choice exams (Loyens et al., 2013). Wilson and Fowler (2005) stated that whether the use of a deep learning approach leads to learning becoming less clear because of the moderating effect of the assessment choice involved. Learners may change their learning approaches from the surface to deep or vice versa to suit the assessment demands of their courses. Minbashian, et al. (2004) found that an increase from low levels to moderate levels of deep approach use of psychology students was associated with greater reproduction of information during the exam. As a result, it can be concluded that, if the assessment processes of the course included essay-type open-ended questions requiring TC to reflect on, consolidate, relate and communicate ideas rather than just answering multiple-choice exams, the use of the deep learning approach might have predicted the achievement of TC.

Also, the implementation period of HL might be short, which might also be one of the reasons that a deep approach did not predict their course achievement. As stated by Colak (2015), learning approaches cannot be changed by implementing them through short-term activities, especially in the context of an education system based on traditional exams. Similarly, Gordon and Debus (2002) included self-monitoring and goal-setting applications and repeatedly challenged TC to examine their learning approaches in their longitudinal study to facilitate their shift from surface learning approaches to deep approaches starting from enrolment to graduation. They reported a reduction in the reported surface approaches and a delayed increase in the deep learning approaches. Besides, Dolmans, et al. (2016) stated that curriculum-wide implementation has a more positive impact on students' deep approach compared to a single course implementation. It can be concluded that by taking into consideration the results of these studies, the short-time, single course applications may not be effective for changing students' approaches to learning from the surface to deep.

According to results, behavioral engagement predicted the achievement of TC, which was revealed by many studies (Bond, et al., 2020; Bowden et al., 2019; Henrie, et al., 2015). It can be stated that as TC participated more, they obtained higher grades since they took part in activities conducted in class and online part of the course and tried to fulfill their responsibilities successfully, which was corroborated in the literature (Bedenlier et al., 2020; Bond et al., 2020; Marks, 2000; Reeve, 2013). Besides, as stated in the literature, curriculum design and task characteristics might have influenced the behavioral engagement of TC. Similarly, Fredricks et al. (2004) and Skinner and Pitzer (2012) stated that engagement increases in contexts where the tasks are authentic, there are opportunities for collaboration, the use of diverse talents is present, opportunities for learners to conceptualize, execute, and evaluate their understanding are provided. In this way, learners consider that the content or tasks to be completed are meaningful, valuable, and worthy of their effort, which in turn increases all types of learner engagement. In the study conducted by Tay (2016), teacher participants stated that they recalled what they had watched in the animated videos. They explained how animated videos helped, made the concepts simpler and easier to follow in comparison to longer PowerPoint presentations which were less engaging. For this reason, in the current study, the

design of HL and the activities conducted both in the class and online part might have influenced the behavioral engagement of TC positively.

In the current study, agentic, emotional, and cognitive engagement of TC did not predict the achievement. Different from the current study, in the study conducted by Yang (2011), the results of the study revealed that Freshman English learners' engagement is enhanced through the interactions between learners and instructors in a situated learning environment. While through synchronous and asynchronous communication, the learners exhibited emotional engagement in expressing their thoughts and opinions regarding the drama in the discussions, they cognitively engaged in acquiring knowledge of English vocabulary and sentences with the help of scaffoldings. They also used deep thinking strategies when their essays were revised. However, the reason for the findings of the current study, as expressed by Ben-Eliyahu, et al. (2018) while learners might be behaviorally active, take part in tasks or conduct the course responsibilities, they might not be cognitively or emotionally engaged in the tasks. This could have resulted from TC's lack of enthusiasm, enthusiasm, and enjoyment for the course topics, online discussion cases, course tasks, and learning process, which could have affected their emotional engagement. In terms of emotional engagement, Tay (2016) also revealed that less positive emotional engagement of TC is observed due to some technical problems including the painful access to the discussion forum. In the current study, such kinds of technical issues or slow internet speed might have also affected the emotional engagement levels of TC. In parallel to the expressions of Bedenlier et al. (2020), in the current study, TC might have felt lower emotional and cognitive engagement due to workload that stemmed from both the face-to-face classroom environment and online environment where they had to spend much more time to learn the content. Moreover, the amount of instructor feedback as well as the postings of others might be perceived as not enough, as well as untimely, and might have resulted in weak emotional engagement. Also, Henrie et al. (2015) found that while emotional engagement is considered important to measure at the K12 level, it becomes less effective as students get mature. Yet, emotions do not cease while being critical to learning considering the learners in university and they influence a broad variety of cognitive processes that contribute to learning, such as perception, attention, memory, decision making, and cognitive problem-solving. Skinner and Pitzer (2012) stressed the importance of emotional engagement as a crucial variable that fosters behavioral and cognitive engagement to cultivate high-quality learning.

Moreover, another reason for the findings of the current study might be that TC may not find the instruction cognitively challenging, as also stated by Marks (2000). Moreover, as stressed by Skinner and Pitzer (2012), cognitive engagement encompasses attention, concentration, focus, absorption,, and a willingness to go beyond what is required; however, as explained previously, TC mostly preferred surface learning, memorization and receiving knowledge passively just as presented to them instead of thinking critically, asking questions to peers and the instructor, or demanding explanations from them, which might have also affected their cognitive and agentic engagement negatively. In addition, Henrie et al (2015) stated that cognitive engagement is about the use of cognitive strategy such as studying course material in-depth, inserting self-regulatory or meta-cognitive strategies such as planning, and seeking the information at appropriate places and doing extra work beyond what was presented by the instructor. Furthermore, according to Kuh (2009), engagement was the amount of time and effort that learners devoted to activities; however, if this spared time was not used effectively, it may not be linked to expected learner outcomes.

5 | Conclusion Suggestions

It can be concluded that the learning environment is important for learning outcomes, students' preference for learning approaches, and engagement levels. The way instructors structure the teaching-learning context and learning conditions, directs the nature of the relationship between learners, context, and tasks. Learners who normally select some parts of learning material and memorize them, find out that this strategy will not work in active learning environments, so use deep learning approaches. On the other hand, learners, who normally interact deeply, may decide to utilize a surface learning approach in a module

that is overloaded with content and assessed by the multiple-choice type or close-ended questions. Moreover, it can be suggested that besides providing different active learning opportunities, TC should be assessed by the level of applications conducted in the HL course to improve deep learning and all types of engagement levels. In other words, while TC took part in online discussions, reflected on the course content, thought critically and prepared sample lesson plans which require higher cognitive skills such as analysis and synthesis, they were assessed through an instructor-prepared multiple-choice type final exam, which mostly included knowledge and comprehension type questions. In these assessment methods, they might have used surface learning approaches to memorize some terms and concepts related to curriculum development course rather than deep learning approaches requiring the grasp of key concepts, understanding their relationship to other information, and how the information applies in other circumstances instead of just memorizing to avoid failure.

In Turkey, students do not always attend university because of their curiosity to learn about a particular subject or to be excel in a particular profession and contribute to the economy by doing the job they have ambition for. Rather, they obtain a qualification for a job which may even not be their first choice as an area to study. For this reason, they are extrinsically motivated and they must have mostly used surface approaches for learning. It is suggested for politicians, educational reformers, and other related people that learners should be guided to be more inner-motivated and to achieve their ambitions, not just to obtain an ordinary job that would provide a secure future for them.

In order to facilitate deep learning, promote engagement, and increase achievement, some more suggestions for teaching in the blended environment were provided. To increase the behavioral, cognitive, emotional, and agentic engagement of TC, instructors may pay more attention to the learners and encourage them by asking questions or interacting personally to arouse their passion for becoming active both in the face-to-face part of the course and online discussions. Moreover, as stated by Kuh (2009) the more students study a subject, the more they know about it, practice, and get feedback from other learners and instructors on their tasks such as their online reflections or collaborative tasks, the deeper they understand and learn the subject. For this reason, to increase behavioral, emotional, cognitive, and agentic engagement, instructors may provide frequent feedback regarding the posting of learners, in-class tasks and assignments. Moreover, to initiate the cognitive engagement of TC, the instructor may ask higher-order questions to direct them to search and think critically. Furthermore, as suggested by Reeve and Tseng (2011) learners should be encouraged to take purposive roles in their learning and make an intentional, proactive, and constructive contribution such as asking 'Can we conduct this?, 'Is it appropriate to implement this strategy when the classes are crowded?', etc. during the instruction which may contribute to agentic engagement positively. In other words, expressing their preferences, asking questions, and letting the teacher know what they like, need, and want may contribute to the agentic engagement.

In the current study, all engagement types were investigated through a self-reflective scale, however, as suggested by Yang (2011), behavioral engagement can be measured by counting the number of posts, system queries, overall usage of the communication platform whereas the emotional engagement can be assessed through in-class observations, analysis of posts including salutations and other affective implications, and last but not least, the cognitive engagement may be assessed through the analysis of participants' posts qualitatively according to the level of critical thinking, making inference, judgement, explanation, elaboration, etc. Finally, the findings of the current study might be investigated through further research by involving interviews and observations which ask questions like how TC choose and use learning approaches or engage in courses. Also, investigating TC from other universities with larger sample sizes, to enhance the generalizability of findings beyond the instructional and assessment policies and practices of one institution may be suggested.

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APPENDIX

Sample Case

You have heard the news about reactions towards the students with autism in the media. (https://www.hurriyetdailynews.com/school-principal-suspended-after-parents-protest-autistic-children- minister-148479)

1. If you were the teachers of these students, how would you determine their needs who need special education and by using which one of the need assessment techniques? (Explain your ideas by stating the reasons).

2. Which curriculum design would you prefer if you were a curriculum designer? (Explain your ideas by stating the reasons).

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Analysis of Case Problems by STEM Activities in Children's Stories and Their Effect on Problem-Solving Skills

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Abstract

The development of the problem-solving skills comes into prominence in case the condition of being faced with more difficult and more complicated problems is reflected in education. A mixed method was used in the method of the study with a view to the analysis of the case problems in children's stories by the STEM education and examining its effect on the problem-solving skills. The quantitative data, which benefited both from the qualitative and quantitative methods, was derived as the pre-test and the final test data from the problem-solving skills scale (PSSS), developed by Oğuz and Köksal Akyol (2015). In the collection of the qualitative data, the material and teacher evaluation forms -developed by researchers- were used. According to the findings of the results of this study, the use of the STEM activities in the analysis of the case problems of stories, enhanced the problem-solving skills of children (p <.001).

Keywords: Children's stories, problem-solving skills, STEM education

Çocuk Hikayelerindeki Problem Durumlarının Stem Etkinlikleri ile Çözümlenmesi ve Problem Çözme Becerileri Üzerindeki Etkisi

Öz

Çağımızda yaşadığımız sorunlar gittikçe zorlaşmakta ve daha karmaşık hale gelmektedir. Gittikçe zor ve karmaşık sorunlarla karşılaşacak olma durumunun eğitime yansıması halinde problem çözme becerilerinin geliştirilmesi durumu ön plana çıkmaktadır. STEM eğitimiyle çocuk hikâyelerindeki problem durumlarının çözümlenmesi ve problem çözme becerileri üzerindeki etkisini incelemek amacıyla hazırlanan çalışmada karma yöntem kullanılmıştır. Nicel ve nitel yöntemlerden faydalanılan araştırmanın nicel verileri, Oğuz ve Köksal Akyol (2015) tarafından geliştirilen problem çözme becerisi ölçeğinden (PÇBÖ) ön test ve son test verileri olarak elde edilmiştir. Nitel verilerin toplanmasında ise araştırmacılar tarafından geliştirilen materyal ve öğretmen değerlendirme formları kullanılmıştır. Elde edilen bulgulara göre; hikayelerde yer alan problem durumlarının çözümlerinde STEM etkinliklerinin kullanılması çocuklardaki problem çözme becerilerini arttırmış (p <.001), aynı zamanda özgün ve yaratıcı ürünler ortaya koyarken, muhakeme etme ve fikir alışverişinde bulunma davranışını göstermişlerdir. Bu çalışma, okul öncesi eğitimde STEM etkinliklerinin uygulanmasına yönelik eğitim etkinlikleri ve uygulanan STEM etkinliklerinin de problem çözme becerileri üzerindeki etkisini belirlemeye yönelik örnekler sunmaktadır.

Anahtar kelimeler: Çocuk hikayeleri, problem çözme becerileri, STEM eğitimi

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1 | Introduction

Problem-solving Skill

The problem-solving skill is a behavior and a process used in various strategies and cases. When the history of problem-solving is taken into account, Polya (1945) characterizes it as defining a problem, planning, and looking behind; Mayer (1977) states that problems involve goals and obstacles, and identifies them as the solving skills to overcome to reach the necessary condition after the present condition, whereas Bourne, Dominowski & Loftus (1979) frame it as a three-stage process comprised of preparation, production, and evaluation. According to Siegler's (1996) overlapping waves theory, it is defined as the strategy which obtains positive feedback in cases of encountering problems.

Children generally learn new problem-solving strategies by observing problem-solving examples of other people. There are differences between the children who learn strategies by observation and the children who learn the strategy by explanation. When explanations are given, it becomes easy for children to apply the learned strategies (Crowley & Siegler, 1999). To actualize that case, children have to acknowledge the process of problem-solving and they have to interpret the existing information. It has been shown that children's problem-solving skill, which is effective in different fields, is very variable (Siegler, 1996). It has been discussed that the investigation of children's variability could lead to significant explorations from the standpoint of clarifying the potential sources of change in different education environments (Siegler, 2002; Siegler & Araya, 2005). Different methods could be made use of for the application of the strategies used for solving present problem cases.

One of the strategies used in children's problem-solving skills is verbal skills to question the process. In this strategy, which is considered as a sort of reporting, children should recognize the alterations with their problem-solving skills, they should evaluate the situation, and they should have verbal reasoning (Ericsson & Simon, 1984, 1993: Farrington-Flint et al., 2009). Instead of solving familiar problems with repetition during retesting, they can use the recall of existing solutions from memory (Farrington-Flint et al., 2008). Another strategy in problem-solving skills might be categorization, it is found that problem solvers who are experts in the field of algebra can categorize with a strong internal control formula (Hinsley et al., 1977). In addition to that, they have the skill to transfer the present strategy in case of a similar problem they encounter; yet, when the constant transfer of those skills is taken into consideration, the necessity of how their problem-solving skills can be developed becomes more of an issue (Mayer, 1998).

The most obvious means to develop the performance of problem-solving is perhaps teaching basic skills. While teaching these basic skills, the problem-solving skills could be developed with the learning programs such as Bloom's (1976) taxonomy of "educational objectives" (Mayer, 1998). The Problem-Solving Model is defined as the identification and relational explanation of a problem by Popper (1972). Şahin (1998) addresses the stages of problem-solving as the comprehension of the problem, the collection of previously acknowledged information and data, the presentation of probable solutions and hypotheses, the evaluation of probable solutions, the trial, and the examination of probable solutions including their outcome. One of the models based on problem-solving skills is the developmental/ecological/problem-solving model (DEP). This model is eclectically formed, and it investigates school, family, and the needs of the school with a systematic diagram in its orbit, and it presents an education model with a basis of field (Simon et al., 2014).

Problem-Solving Skill in Preschool Education

In the period of preschool education, which is the first stage of education, it is a significant step to use problem-solving skills. In order for those skills to develop, environments, in which developmental homework and learning by doing and experiencing, should be allowed. Children also use their cognitive skills when exploring the strategies, they have developed against the problems they encounter (Berk,

2009). Children can try many ways to solve the problems they encounter in daily life, e.g., trial and making mistakes, retrying or reusing the strategies they have developed against the problems they have encountered previously (Siegler, 1995). Starting at an early age, children try to solve problems they encounter in games, life skills, and in many areas in daily life (Aydoğan & Ömeroğlu, 2004). Being a systematic education for developing problem-solving abilities, preschool education helps them develop their abilities such as analysis, synthesis, multi-oriented thinking (Zembat & Unutkan, 2005).

The problem-solving skill makes the child improve himself and provides the opportunity for him to think creatively, develop various points of views, and support expressive language skills. As of early age, problem-solving skills should be allowed for gains up to such an important degree (Oğuz & Köksal Akyol, 2012). Beginning from school starting age, the skills and various evaluation scales of children are investigated in England. One of these skills is the problem-solving skill (Snowling, Hulme, Bailey, Stotdhard & Lindsay, 2011). The problem-solving skill is connected to three components consisting of skill, cognitive ability, and desire. Each component is connected and related to the other. The problem-solving skill should be encouraged by education and children should be ensured to command their cognitive skills (Mayer, 1998). Especially, children's problem-solving skills could be developed through rich stimuli, science and nature activities, and in environments where they are assured that they can test and express their ideas through experiments (Güven, 2004). When the preschool education program of the Ministry of Education – relating to the indicators, explanations, and gains with cognitive development – is taken into account, the statements stating 'problem-solving for problem cases' and the statements stating 'solving problems with each other' are given a place. In addition to that, the statement, stating the necessity of the development of the problem-solving skill in the preschool education environment and learning centers, is also given a place (Ministry of National Education, 2013).

STEM and Problem-Solving Skill

STEM education, as an often and lately debated approach of education, has emerged as a result of the harmonious combination of science, technology, engineering, and mathematics with the education curriculum, among all progressing education levels, starting from the preschool period. STEM education is aimed at children's learning through exploring research, learning, and experiences of problem-solving with interdisciplinary techniques. The STEM education is seen as an important tool for leadership in the economic development and scientific field (Lacey & Wright, 2009) for improving children's thinking skills (Minstrell & Van Zee, 2000), project-based learning (Starkman, 2007), and the problem-solving skills (Morrison, 2006). The STEM activities, which have been used for children to gain those skills up to such an important degree, could pave the way for fast development in many areas, as a result of being used in the preschool education period – the period when the essential building blocks of the mind are formed (Balat & Günşen, 2017).

With the development of technology, innovations are also needed for the education system. Industry 4.0, which will fulfill the needs for the industrial revolution, and the collaboration, communication, creativity, and the development of critical thinking skills – identified as 4C among the required high-level thinking skills of individuals – are closely related to STEM education (Akgündüz et al., 2005). Children are required to interpret, relate, question, and find a solution to use their scientific information for the solution of problem cases (Goossen, 2002).

One of the main problems of STEM education, which is one of the methods of interdisciplinary learning in all of the processes starting from preschool education – the first stage of education – up to higher education, is the integration of the teaching program (Uğraş, 2017). Unfortunately, it has been known that STEM education is not grasped very well by educators, and even those who see it of vital importance, fail to demonstrate a clear vision of it (Brown et al., 2011). Teachers could have concerns for the reason that the STEM education embodies four disciplines with its performance, and regarding the skill of gathering as a result of those disicplines' interrelation (Williams, 2011). The training which will strengthen the

integrated teaching skills of teachers and candidates of teachers within in-service education and faculties of education, and the studies for enhancing the STEM education skills, are inadequate (Ministry of National Education, 2016). A Successful STEM education, (Science, Technology, Engineering, and/or Mathematics), teaches the interaction between the performance of effects, cognition, and ideas by the students in the class (House et al., 2014). As a result of the STEM education, children give meaning to what they have learned by doing and experiencing, and concerning their search for a means of a solution when they are faced with a case (Wang, 2012), each lesson, within itself, transforms into a model of learning through doing and experiencing by interdisciplinary teaching (Brown, 2014). In the result of the study, which targets the problem-solving strategies of 6-year-old children and their success level of problem-solving, the children are found to have made use of the modeling strategy and that they have needed prepared materials for it (Altun, et al., 2001). It is also known by teachers that the activities of science and nature, which are performed in the institutions of preschool education, are binding for children's problem-solving skills (Akaya, 2006). In the problem-solving skills, since experiences – that come through slices of life at an early age – encourage individuals to communicate with the environment and form cognitive relations, their support with special education programs appears to be significant (Aydoğan, 2004). For this reason, this study was done so that the STEM activities in the preschool period would contribute to the development of children's problem-solving skills.

2 |Method

In this part, the information relating to the data, the data collection process, the method of data collection, the tools for data collection, the study group is given including the design of the study, which has intended to determine if the problem-solving cases in stories, following their performance by the STEM education, affect the problem-solving skills of the children of the preschool period.

Research Design

In the research, a mixed-method, consisting of qualitative and quantitative research methods, was used to specify the effect of STEM education on problem-solving skills. In the mixed design, instead of choosing only one of the qualitative and quantitative approaches, the conclusion of their cooperation targets a more comprehensive study by obtaining more data relating to the research problem. The mixed-method falls into various designs in itself. The exploratory sequential mixed design is a design that primarily includes the analysis of the results of the quantitative research, and next, its reconfiguration to explain it in detail with the qualitative research (Creswell, 2017). In the exploratory sequential mixed design, during the quantitative stage of the study, the problem-solving skills scale (PSSS) was used as a pre-test and a final test, whereas to support the quantitative results with far-reaching qualitative data, the visual data examination method was used in document examination.

Study Group

To specify the study group, transformative mixed method design was selected. In the transformative method, the sequential data was collected to help make changes (Creswell, 2017). The PSSS was performed to children between 60 and 72 months, and the children who received 18 points and below formed the study group of the research. The study group consists of 5 females, 4 males, and 9 children in total, moreover, the average age is 68 months. The Gender and age information of the children included in the study is given in Table 2. When the demographic qualities of the children included in the study group are taken into consideration, it is seen that 5 females and 4 males from the group and the average age is 68.

Table1. Demographic Qualities of Study Group

Order No	Gender	Age
1	Male	67 Months
2	Female	74 Months
3	Female	72 Months
4	Female	71 Months
5	Male	66 Months
6	Male	71 Months
7	Female	60 Months
8	Female	72 Months
9	Male	59 Months
		$\bar{x}$ = 68 Months

Data Collection Tools

The quantitative data of the study was received by the Problem-Solving Skill Scale (PSSS). The Problem-Solving Skill Scale (PSSS) was developed by Oğuz and Köksal Akyol (2015) to specify the problem-solving skills of the children continuing nursery school. After the calculation of the content validity index values, the validity index was found 0.99 and the reliability coefficient for the whole scale was found .86. The correlation coefficient as a result of the test-retest method was found .60, which means that these results did not differ statistically as a consequence of the first and the last performance [$t(39)=1.63$, $p>0.05$].

The qualitative data of the study was received by the material and the teacher evaluation forms directed towards the evaluation of the items and the process developed by researchers. The forms were organized as the grading score key. The teacher evaluation form consists of the items such as resolution for curiosity, development of a hypothesis, verification, and revision of problems depending on the subject. The material evaluation form consists of the items such as target suitability, the accuracy of the information, drawing attention, robustness, and ease of use.

Data Collection

Twice per week during 4 weeks, 8 Selected stories were read to 9 children in total from the age group of 5-6 years; the problem cases were interrupted and they were asked to find a means of solution with the STEM activities. The environment, in which the STEM activities would be performed, was formed with the selection of the material by researchers. During the performances, there were a video recording and a photoshoot, and the appearing items were examined with the material evaluation and the teacher evaluation forms. After the performances, the PSSS was performed as the final test, and its efficiency was examined. In the process, the children's focus of the process and the behaviors – e.g. interrogation – in the process were taken into consideration by the teacher evaluation form, whereas the ideas – that come out after the activities – and the materials were examined with the material evaluation form. In the course of the performance of the STEM activities, an education environment – supported with various materials – was prepared. The performance of the STEM activities is given a place in the solutions of problem-solving cases, in storybooks of preschool education.

Figure 1. *Work Flow of Data Collection Process*

The PSSS was performed as a pre-test for the study group, in the first week of February of education and teaching the academic year 2017-2018, and the STEM activities were started to be performed for the

specified group. After performing the STEM activities, the material evaluation and the teacher evaluation forms were performed by researchers. Selected stories were read to children twice per week for four weeks and they were asked to solve the problem case in stories by the STEM activities. When the STEM activities were finished, the PSSS was performed as the final test to the study group in the first week of May.

Table 2. Study Design

Study Group	Pre-test	Process	Final Test
Experiment	PSSS	STEM Activities	PSSS

Having a single experimental design, the study design – depicted as one of the semi-experimental research for participants cannot be specified as neutral – is a research in which the effect of the performance is evaluated within each test subject by receiving renewed measurements under standard conditions (Gast, 2010).

Data Analysis

The Statistical Program for Social Sciences (SPSS) version 24 was used for the evaluation of the data received through the study. Whether the scores of the pre-test and final test of the children in the study depicted a normal distribution was determined by the Shapiro Wilk test. As a result of the Shapiro-Wilk test, it was seen that the scores depicted a normal distribution ($p>0.05$). According to the obtained data, the dependent t-test was performed to test the meaningfulness between the two average differences of the relationship between the groups.

3 | Findings

In this section, the findings obtained as a result of the research are presented.

Table 3. Obtained Scores of Pre-Test and Final Test of Children From Problem-Solving Skill Scale

Order no	Pre-test	Final test
1	17	31
2	13	18
3	12	21
4	13	27
5	15	20
6	11	18
7	17	18
8	8	12
9	12	17
	$\bar{x}$ = 13.11	$\bar{x}$ =20.22

When the scores of the children in the study group were examined, their average score of the pre-test was 13.11, and their average score of the final test was 20.22.

Table 4. Performed Paired T-Test Results Between Pre-Test and Final Test

		N	Average	SS	St. Error	t	df	Sig.
Problem-Solving Skill Test Scores	Pre-test	9	13.11	4,45658	1,485	-4,787	8	,001
	Final test	9	20.22					

When the pre-test and the final test scores were examined in reference to the analysis of the problem cases in the preschool stories by the STEM activities, it was found out that there was a meaningful increase in the scores of the children ($t=-4,787$, $p<0.01$). The average pre-test scores of the children before the STEM activities was $\bar{x} = 13.11$, whereas the average final test scores after the performance of the STEM activities rose up to $\bar{x} = 20.22$. This finding indicates that the analysis of the problem cases in the preschool stories by the STEM activities affects the increase of the problem-solving skill of children.

Table 5. Material Evaluation Form

Criteria	Good (3)	Average (2)	Bad (1)
Target Suitability	4	26	2
Accuracy of Information	5	7	20
Drawing Attention	15	7	10
Robustness/Endurance	3	15	14
Level of Comprehension	6	19	7
Technical quality	6	6	20
Degree of efficiency	2	24	6
Ease of use/applicability	2	18	12
Total	43	122	91

According to the material evaluation form, the obtained results were 43 times good, 122 times average, and 91 times bad, depending on the conclusion of the evaluation of the total score of the criteria, i.e., target suitability accuracy of the information, drawing attention, robustness/endurance, level of comprehension, technical quality, degree of efficiency, ease of use/applicability. Considering the evaluation of the materials produced, it is seen that the criteria of compliance with target suitability, drawing attention, robustness/endurance, level of comprehension, degree of efficiency, ease of use/applicability are relatively better than the accuracy of the information and technical quality criteria.

Table 6. Teacher Evaluation Form

Criteria	Good (3)	Average (2)	Bad (1)
Asking questions about the subject and resolution of curiosity	30	2	-
Development of hypotheses for finding answers to problems	32	-	-
Seeking extensive acknowledgment by contribution to present information	20	12	-
Revision of problems	2	25	2
Sharing and discussing thoughts, listening to thoughts of other points of views, and inquiry of new information	20	12	-
Total	104	51	2

According to the teacher evaluation form, the obtained results were 104 times good, 51 times average, and 2 times bad, depending on the conclusion of the evaluation of the total score of the criteria, i.e., asking questions about the subject and resolution of curiosity, development of hypotheses for finding answers to problems, seeking extensive acknowledgment by contribution to present information, revision of problems, sharing and discussing thoughts, listening to thoughts of other point of views and inquiry of new information. When considering the teacher evaluation form, it is seen that asking questions about the

subject and resolution of curiosity, development of hypotheses for finding answers to problems are relatively better than seeking extensive acknowledgment by contribution to present information, revision of problems, and sharing and discussing thoughts, listening to thoughts of other points of views and inquiry of new information criteria.

4 | Discussion & Conclusion

Having a deep curiosity, a desire for investigation, and exploration in preschool education, children could be helped as well in developing their problem-solving skills, by combining those interests with the activities of science and nature (Akaya, 2006). In the study, in which the nursery school infants of 6 years of age were examined based on the problem-solving skills, it was specified that all the students were eager to solve problems (Tavlı, 2007). The explanation of the problem-solving skills by way of living in the first years of education, i.e., the preschool period, will help children pave the way for long-lasting learning with other skills, for what they have learned through experience by associating and making connections (Aydoğan, 2004). Situated in STEM education, the information – based on science, mathematics, and engineering – should be presented by integrating it with education psychology; otherwise, we cannot imagine children becoming scientists right away without developing thinking processes. For this reason, the content, the cognitive and sensual results of STEM education should be examined by integrating them into the education curriculum (Lamb et al., 2015). Chesloff (2013) states that the frequently used high-level thinking skills in STEM education are required to be present in the educational system, beginning from the preschool period – the first stage of education –. It was concluded that meaningful differences were obtained between the pre-test and the final test scores of the children in the solutions of the STEM activities of the problem cases in storybooks ($p<.001$). In the study, in which the effect of structured and unstructured education programs was examined in the course of helping children gain problem-solving skills, it was seen that both structured and unstructured education programs had a dramatic effect on the problem-solving skills of children (Aydoğan, 2004). Since STEM education is involved in the advanced level of thinking skills, it enables students to have advanced levels of learning opportunities (Lubinski, 2010). In preschool education, problem-solving skills may be promoted with various activities in the program. Activities such as mathematics, music, games, and science support the problem-solving skills of children in the preschool period. Mathematics education is very important in preschool education. Problem-solving is the key to comprehending all the fields of mathematics. Children learn how to solve problems by using a good number of different ways. Through mathematics education, their problem-solving abilities develop (Akman, 2002). According to the results of the study, in which the opinions of the preschool teachers about the STEM education performances have been taken into account, it has been specified that they want to receive a STEM-themed training and perform it with lessons (Uğraş, 2017).

In Özdil's research (2008), he examined the effect of the interpersonal problem-solving education program on the children continuing the preschool institutions. In conclusion, it came into view that there was a meaningful difference in the interpersonal problem-solving skills of the children attending the interpersonal problem-solving education, compared to those not attending the education. When the early period of the preschool education program in Turkey was examined according to STEM education, it was revealed that it involved most of the qualities of STEM education including the basic concepts and the notions relating to it (Aka Aktürk et al., 2017). Similar studies are specifying the requirement of the performance of the STEM education beginning from the preschool period – the first stage of education – for it is one of the educational reforms used in the development of problem-solving skills, i.e., a thinking skill (Katz, 2010; Soylu, 2016). In the solutions of the problem cases in the preschool storybooks, it is suggested that people get support from the teachers of different departments to meet the probable needs for help and answer questions during the group studies of the STEM activities. As Baran et al., (2015)

states that it was concluded that the students who received a similar suggestion, benefited from the official instructors' and advisers' help in the project, in the development processes of the STEM spot.

When children are included in the solutions of the problems they encounter in the preschool classes of teachers, they are required to encourage children to attend the solution process and to produce different solutions. For that, the STEM performances could be given a place in the present science activities in preschool education. In that respect, teachers could be helped in benefiting from the necessary in-service training on STEM education.

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Statements of publication ethics

Science and publication ethics were taken into consideration in the research. Written consent was obtained from the families who were planned to be included in the study. Research and publication ethics were followed in the research. There are no unethical problems.

Researchers' contribution rate

The first author contributed to finding the problem statement and data collection. The third author contributed to data analysis and interpretation of the results, reporting, All authors checking the final form of the manuscript. All the authors contributed to the literature review.

Conflict of interest

No potential conflict of interest was reported by the authors.

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Pictorial and Narrative Representations of Children's Peace Perceptions

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Abstract

The aim of this study is to reveal children's perceptions of peace through drawings and semi-structured interviews. The second aim of the research is to make inferences about peace education based on the results. Participants consist of 22 students aged 11-12 studying at a public school in Karlsruhe / Pforzheim. The study was designed with phenomenological research method. The data were analyzed by semiotic analysis of the drawings and content analysis of semi-structured interviews. As a result of drawings and interview analysis in the study, the meaning of peace was revealed to be at most "positive peace." Although students mostly used peace icons, indexes and symbols in their peace drawings, they also used about half of the icons, indexes and symbols of war. In the interviews, the meaning of peace was most defined as "interpersonal peace", which is the most common theme related to positive peace in the literature, secondly "general social peace" and least "peace in nature." About half of the children defined peace as "the absence of war" both in drawings and negotiations. In the discussions on the meaning of peace, negative peace was defined mostly as "negative interpersonal peace", secondly, similar to the common perception in the literature, "absence of the war", and least "negative individual peace."

Keywords: Concept of peace, children's drawings, peace education

Çocukların Barış Algılarının Resimli ve Anlatısal Temsilleri

Öz

Bu çalışmanın amacı, çocukların barış algılarını çizimler ve yarı yapılandırılmış görüşmeler yoluyla ortaya çıkarmaktır. Araştırmanın alt amacı sonuçlardan yola çıkarak barış eğitimi konusunda çıkarımlar yapmaktır. Katılımcılar, Karlsruhe / Pforzheim'da bir devlet okulunda okuyan 11-12 yaş arası 22 öğrenciden oluşmaktadır. Çalışma fenomenolojik araştırma yöntemi ile tasarlanmıştır. Veriler, çizimlerin göstergebilimsel analizi ve yarı yapılandırılmış görüşmelerin tümevarımsal içerik analizi ile analiz edilmiştir. Çalışmada yapılan çizimler ve röportaj analizi sonucunda barışın anlamı en fazla "pozitif barış" olarak ortaya çıktı. Öğrenciler barış çizimlerinde çoğunlukla barış ikonları, indeksler ve semboller kullansalar da, savaş ikonlarının, indekslerinin ve sembollerinin yaklaşık yarısını da kullandılar. Görüşmelerde barışın anlamı en çok literatürdeki pozitif barışla ilgili en yaygın tema olan "kişilerarası barış", ikincisi "genel sosyal barış" ve en az "doğada barış" olarak tanımlandı. Çocukların yaklaşık yarısı barışı hem çizimlerde hem de müzakerelerde "savaşın olmaması" olarak tanımladı. Barışın anlamı üzerine yapılan görüşmelerde olumsuz barış, çoğunlukla "olumsuz kişiler arası barış", ikinci olarak literatürdeki ortak algıya benzer şekilde "savaşın yokluğu" ve en azından "olumsuz bireysel barış" olarak tanımlandı.

Anahtar kelimeler: Barış kavramı, çocuk resimleri, barış eğitimi

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1 | Introduction

In the literature, the essential features of peace are mentioned its social dimension and its universal dimension in terms of its acceptance in all cultures (Fogarty, 1992). Although there are still debates in the definitions of peace, peace is generally perceived in two dimensions as positive peace and negative peace. In the literature, negative peace relates to the denial of adverse conditions, "the absence of war, the absence of the war activities, or a decline in conflict" (Galtung, 1969). It means the elimination of all forms of direct violence (harassment, armed violence, fighting, etc.). Positive peace goes beyond "the end of war and physical violence, addressing the need for justice, equity, democracy and an end to structural violence (oppression, exploitation, racism, poverty, etc…)" (Ardizzone, 2002).

According to the literature, peace education could be defined as "teaching individuals the knowledge, attitudes, values and behavioral competencies required to resolve conflicts and establish and maintain mutually beneficial and harmonious relationships" (Johnson & Johnson, 2005). The positive and negative understanding of peace used by educators reveals the goals of peace education. The primary purpose of education for negative peace is to develop an informed citizen to achieve peace and disarmament. Education for positive peace focuses on removing all structural and cultural barriers to peace and creating real peace (Ardizzone, 2002). The ultimate goal of peace education, which is a multi-disciplinary and international field, is to create fair and sustainable futures "between individuals (personal peace), individuals (peace between individuals), groups (peace between groups), countries, societies, and cultures (international peace)" (Hicks, 1988; Johnson & Johnson, 2005). Achieving peace is a universal aspiration. The most crucial point in peace education is that education programs are prepared regarding the contextual environment in which children live (Harris, 2009) because children tend to use and store the information close to their experiences (Frias, 2008).

Over the past 30 years, many studies have explored how children understand war and peace. Children's perceptions of peace are mostly found in studies investigating their perceptions of war and peace together. The literature has shown that children of different ages, genders, and socio-cultural and contextual settings could highlight different aspects of peace (Frias, 2008; Oppenheimer & Kuipers, 2003). However, the literature shows more existence of some common themes in children's understanding of peace, regardless of these differences, in studies conducted both by written and verbal methods and through drawings. Negative peace, as a common theme in children's perceptions of peace, is largely perceived as the absence of war, conflict, and quarrels (Covell, Rose-Krasnor, & Fletcher, 1994; Hakvoort, 1996; Hakvoort & Oppenheimer, 1998; Oppenheimer & Kuipers, 2003; Hakvoort & Oppenheimer, 1993; de Souza, Sperb, McCarthy, & Biaggio, 2006; Jabbar & Betawi, 2019; Baring, 2013; Walker, Myers-Bowman, & Myers-Walls, 2003). It has been observed that the most common theme of positive peace in children's perceptions of peace is related to "interpersonal interactions such as treating people well, sharing and being friends" (Covell et al., 1994; de Souza et al., 2006; Frias, 2008; Hakvoort, 1996; Hakvoort & Oppenheimer, 1998; Oppenheimer & Kuipers, 2003; Walker et al., 2003). Oppenheimer and Kuipers (2003) conducted a study with 10-year-old Filipino children using the methodology developed by Hakvoort (1996) and used in different socio-cultural and contextual settings (Hakvoort & Oppenheimer, 1998). These Filipino children, who do not face any environment of war and conflict, in line with the findings of 10-year-olds elsewhere, understood primarily negative peace as "the absence of war, conflict, and violence". In a study by Walker and his colleagues with children aged 3-12 in the United States shortly after the Yugoslavia-NATO conflict, two main themes related to peace emerged from the war and peace drawings: peace as interpersonal interaction and peace as negative peace/absence of war. Walker and colleagues found that the findings in the drawings were similar to verbal responses of Australian children (Hall, 1993), Canadian children (Covell et al., 1994), Swedish and Dutch children (Hakvoort & Hägglund, 2001), and drawings of Northern Irish and English children (McLernon & Cairns, 2001).

As stated above, besides the similarities in the main themes in children's perception of peace, some studies have seen differences in sub-themes because of socio-cultural and contextual differences (Baring,

2013; Frias, 2008; Jabbar & Betawi, 2019; McLernon & Cairns, 2001). Frias (2008) analyzed war and peace drawings of children aged 8-13 from South Korean, US, and Filipino cultural backgrounds. The results showed that the children's drawings of peace supported the literature on the main themes. However, Frias identified some intercultural differences in micro-level sub-themes under general themes. Although there is the theme of "positive actions and interactions"; interpersonal level activities such as "helping others, playing together and making friends" in children from Flipino and the USA, it did not exist in South Korean children's drawings of peace. South Korean children associated peace with positive social action, using images of groups "holding hands and shaking hands" to reach agreements. Frias says that this cultural difference at the micro-level in peace themes could result from due to the tension with North Korea, and therefore children could perceive peace at the international level. Similarly, unlike the South Korean and Filipino-American peers' drawings, the pictures of US children did not contain images of leaders and presidents who came together to end the war. Frias says this difference could attribute to the absence of a real war around the USA. The peace pictures of Filipino-American children had Christmas celebrations not found in the drawings of their South Korean and US peers. Frias states that this difference could be attributed to that the Filipinos are predominantly Catholic, and religious holidays are often celebrated with fun and friendship in the Filipino culture. In the study conducted by McLernon and Cairns (2001), primary school children aged 6-7 in Northern Ireland with high and low political and sectarian violence were compared with primary school children in a region non-violent in England. Northern Irish children emphasized the concept of negative peace as the "absence of war" more than British children. Many images indicated that the war was over. There were images of armies laying down their weapons or soldiers getting on board to go home. On the other hand, it is seen that English children draw pictures of nature and religion. Mclernon and Cairns found that drawings generally support the findings in studies using children's verbal explanations (Covell et al., 1994; Hakvoort & Oppenheimer, 1993; Hall, 1993).

This research aims to understand children's perceptions of peace through drawings and semi-structured interviews. As mentioned above, war and peace drawings of children from different cultural backgrounds were mostly analyzed by quantitative methods or content analysis. (Baring, 2013; Bedir & Demir, 2012; Cengelci Kose & Gurdogan Bayir, 2016; Frias, 2008; Jabbar & Betawi, 2019; McLernon & Cairns, 2001; Walker et al., 2003). None of these studies did analyze the pictures according to Pierce's semiotics scheme. In this sense, it is thought that this study will contribute to the literature on children's perceptions of peace in terms of semiotics. Moreover, previous research did not compare qualitative categories of children's perceptions of peace to each other so widely as far as we know. Another aim of this study is to try to make inferences about the qualities of peace education given to children based on children's perceptions of peace.

2 | Method

Research Design

A phenomenological design was used in the research. “Phenomenological design aims to reveal and interpret individual perceptions related to a specific phenomenon” (Creswell, 2012). In this qualitative study, semi-structured interviews with children about peace, children's narratives about pictures, and pictures of peace were used to understand children's perceptions of peace. Interviews are one of the most important data collection techniques in qualitative research. In semi-structured interviews, interview questions are prepared in advance by the researcher. However, in some cases, it may be necessary to ask new questions depending on the interview course (Karasar, 2009). Pictorial representations have recently played a central role in postmodernist research (Finley, 2011). It was found that “information presented to children is represented mentally, and reproduced from memory in images and modes of representation that suit themselves” (Eng, 1973). One of the main reasons visual research methods are seen as more suitable for working with children is commonly seen as "child-centered"(Mitchell, 2006). As drawings quickly reveal cognitive and communicative skills related to being a child, particularly suitable for pre-

adolescence. Drawings could compensate for the deficiencies in children's verbal abilities, facilitate expressions, and reveal the details verbally conveyed by children (Gross & Hayne, 1998). In this sense, children can reflect their personal, social, and cultural experiences on their peace representations by expressing images about peace graphically (Emmison & Smith, 2000). According to the semiotic approach, the indicator consisting of the signifier and the signified is a substitute for anything for a person in any capacity or any way (Saussure, 2011). Pierre Guiraud, in general terms, defines semiotics as "the science of non-linguistic communication sciences." In this definition, semiotics constitutes the methodological basis of semiotics that examine non-linguistic objects (Guiraud, 1975). Semiotically, symbols take the form of words, sounds, gestures, and objects (Chandler, 2007). Thus, drawing an object allows us to understand how the drawing person perceives that object. Semiotics is an important resource for understanding the pictures that enable children to express themselves and perform a communication function (Bayav, 2006).

Participants

Participants of this study consist of 22 volunteer students from among those who participated in the "Friedensplackat" peace drawings contest organized by Lions Club Pforzheim in Schlössle-Galerie in Pforzheim/ Karlsruhe region of Baden-Würtenberg state of Germany. There were over 100 drawings in the exhibition. After these pictures were recorded, letters about the research were written to the art teachers of the three schools in order to connect with students and their families. Feedback came only from the Kepler Gymnasium art teacher. Aiming that the study reflects the diversity of children living in Germany, a total of 31 research permission letters were sent to the families of children from different races and ethnic backgrounds through Kepler Gymnasium art teacher. 22 families made positive feedback. However, most of the participants were families of native German children. Although some students and families were tried to be contacted again to increase the diversity of participation, no positive feedback was received. In this sense, since the conditions for maximum variation sample did not occur, 22 volunteering students could be included in the study through convenience sampling. Of the 22 students aged 11-12, 18 were girls and 4 were boys. 20 of the participants were German, 1 Turkish and 1 Hungarian. 8 of the students were Evangelical, 6 were Religious, 4 were Muslim and 4 were Catholic.

Data Collection

The research was conducted in April of the 2017-2018 academic year at the Kepler Gymnasium in Pforzheim. Two Turkish translators who can translate from German to Turkish participated with me in the research. The translators were prospective teachers with pedagogical formation. First, the researcher and translators came together and shared information about the investigation. With the art teacher Frau Jost's permission, a separate part of the art class was allocated for research. Two translators and researchers were present together in all interviews. Individual interviews were face-to-face to feel comfortable with students. It was explained to the children that they could finish the interview whenever they want, ask for time for rest. Also, it was announced that they could say that they did not want to answer any question. Besides, it was noted that the correct and incorrect answers would not be questioned, and their identity information will not be used in the research. Firstly, to understand the proper way and what the students expressed in their paintings, 22 students were interviewed about their drawings one by one. Then, three open-ended questions about peace were asked to get their opinions about peace based on their verbal statements: i. What is peace? ii. What could be the barriers to peace? iii. What would you do to spread peace in the world? Because participants do not want to have audio recordings, the interviews about the drawings and the answers to the open-ended questions were written down by the translators at that moment. There was no time limit for students to freely freely express their ideas, and the research was carried out in a very comfortable environment. The interviews about the drawings for each participant lasted between 7-10 minutes. Responses to open-ended questions took between 10-12 minutes. Considering the average 30-35 minutes that children drew peace drawings before, in this study, at least 45-50 minutes are allocated to each student.

Data Analysis

Peace drawings were analyzed according to Pierce's semiotic scheme (Hoopes, 1991). If the elements included in the drawings are expressed with their literal and real meaning, they were classified as "icon." If they had a cause-effect relationship, the drawings were classified as "index." When were expressed in a symbolic sense; they were classified as "symbol." An important classification created by Pierce is the "icon, index ve symbol" trio. The icon is an indicator that directly portrays what it indicates. The icons are in direct relation with the object it evokes, though not exactly. It is similar to its item. If the elements we see in a child's picture remind us more or less what he wants to show, it means that the drawings have the icon's feature. The index is an indicator determined by that object because of the actual relationship it establishes with the symptom object. For example, whether smoke is a symptom of fire depends on the cause-effect relationship between two things. Symbols do not have to resemble the one shown (Guiraud, 1975). It is a symbolic indicator based on consensus. The child's drawing of a dove in a picture about peace shows his/her ability to use meaningful symbolic functions. The symbolic expression is not just with forms. A person who is aware of the symbolic values of colors, for example, can use black in themes such as despair and disappearance (Bayav, 2006; Guiraud, 1975). Semi-structured interviews about peace were analyzed with content analysis. The purpose of the content analysis is to obtain concepts and relationships that can explain the collected data. Content analysis steps are to encode data, define themes, organize and define themes according to codes, and interpret findings (Yıldırım & Şimşek, 2016). The analysis in this study is not based on a previous theory. The study is a descriptive and exploratory qualitative study based on the information obtained from this sample. In this study, it was aimed to reveal children's perceptions of peace by seeking answers to the following questions through interviews: i. What are the indicators used by students in the drawings? ii. What are the visual icons, indexes, and symbols in the drawings? iii. What qualitative themes emerge from children's responses to open-ended questions about the meaning of peace, the spread, and obstacles to peace? iv. What are the similarities and differences between the themes that emerged from this study and those from previous studies? MAXQDA software (2018.2.4 version) was used for data analysis. After the researcher coded the interviews, meticulously created a chart from the codes, this chart was prepared according to the table suggested by Guest, Bunce, and Johnson (Guest, Bunce, & Johnson, 2006).

TRUSTWORTHINESS OF RESEARCH

In this study, data were collected and analyzed using two different methods. In phenomenological research design, participants are chosen for their experience being researched (Baker, Wuest, & Stern, 1992). In this study, 22 students who drew pictures about peace were interviewed about peace. The analysis of the interviews was deepened and reinforced by the semiotic analysis of children's peace drawings. A male and female interpreter joined at each interview. Children from German and other racial and ethnic backgrounds participated in the study. After the researcher meticulously coded the interviews, created a chart from the codes, this chart was prepared according to the table suggested by guests and colleagues (Guest et al., 2006). With the code chart prepared, the data was sent to a peer who had experience in qualitative analysis. The codings made by the researchers were compared in the "intercoder agreement/min. code intersection rate of X% at the segment level [%]" section in the maxqda (MAXQDA, 2018, version 2.4). The result of the 'Kappa test' was 96. 4%. According to the "symbol, index, and symbol" scheme, the art-based analysis was first coded by the researcher. Then drawings were sent to a lecturer in the art teaching department, and some codes were checked mutually, and the final form of coding was given.

Research Ethics

Before collecting the data of this study conducted in Germany, necessary permissions were obtained from the school where the research was conducted, the art teacher and the parents of the children

participating in the study. All participants in this research participated voluntarily. Participants' identities were preserved in the study. This research titled " Perception of Peace in Children's Drawings and Interviews" was approved by Hacı Bektaş Veli University Ethics Committee with the number 17 meeting dated 22.09.2020.

3 | Findings

The findings are presented under two main headings as "findings on the semiotic analysis of peace pictures" and "findings of interviews on the concept of peace." Semiotic analyzes of peace drawings are given as icon, index and symbol according to Pierce's semiotic scheme. The distribution of the intensity of the interviews on peace is given in tables. Since very large tables were needed to give the density table according to individual documents, the tables were given according to religious groups. The aim was to see the general distribution rather than a comparison by religious groups.

Findings Regarding The Semiotic Analysis Of Peace Drawings

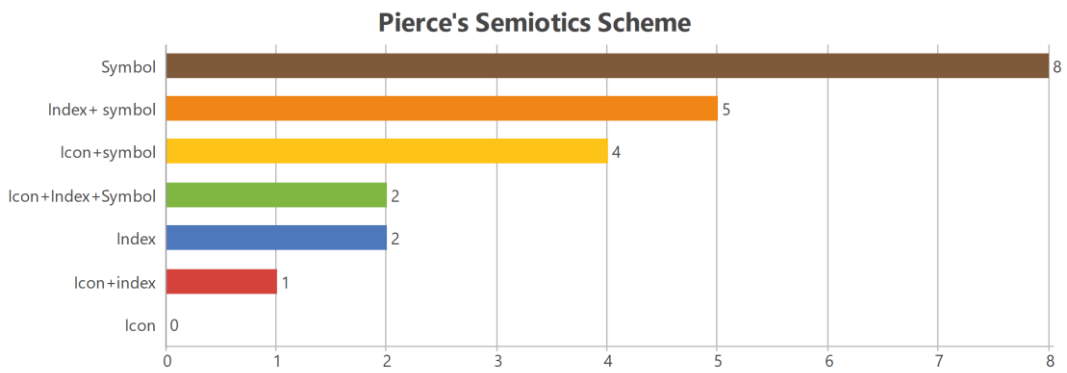

Figure 1. The Indicators Used by The Participants in Their Drawings According to Pierce's Semiotic Scheme

As seen in Figure 1, 8 out of 22 students participating in the study used the symbol sign alone in their peace paintings. Five participants used the index and symbol indicators together. Four participants used the icon and symbol indicator together. Two participants used three types of indicators together. Two participants used index indicators, and one participant icon and index indicator together. No student used the icon indicator alone.

Table 1. The Density Distribution Table of the indicators Used by The Participants in Their Pictures (Cod Matrix Browser)

Code System	Non-religious	Muslims	Evangelist	Catholics	SUM
Symbols used by students					0
Symbols regarding peace					44
Symbols regarding war					15
Indexes used by students					0
Indexes regarding peace					9
Indexes regarding war					4
Icons used by students					0
Icons regarding peace					3
Icons regarding war					8
SUM	20	10	36	17	83

As seen in Table 1, students mostly used peace icons, indexes, and symbols (56 times). On the other hand, they also used war icons, indexes, and symbols (27 times) to describe peace. Children mostly used the symbols (44 times), second indexes (9 times), and least icons (3 times) regarding peace. Children mostly used the symbols (15 times), secondly icons (8 times), and least indexes (4 times) regarding war.

Table 2. Density Distribution Table of the Symbols Related to War And Peace Used by The Participants in Their Peace Drawings

Code System	Non-religious	Muslims	Evangelist	Catholics	SUM
Symbols used by students					0
Symbols regarding peace					0
Cloverleaf	■				1
Spaceship (animals and human beings live in it peacefully)	■				1
Colorful bird feathers		■			1
Red			■		1
Green trees			■		1
The harmony of colors			■		1
Infinity symbol (eternity of peace)			■		1
Heart	■				1
White Flag	■				2
Alive flowers	■	■	■		4
Animals			■		1
Green	■		■		4
Light colors	■		■		5
Branch of olive			■		1
Smiling face				■	1
Gerald Haltom Peace Symbol	■	■	■	■	5
White piegon	■		■	■	5
Rainbow		■	■	■	4
Sun	■		■	■	4
Symbols regarding war					0
Blue			■		1
Brown			■		1
Dried trees			■		1
Strikethrough heart	■				1
Red	■				1
Black			■		1
Dark colors	■		■		2
Withered flowers	■		■		2
Black piegon			■		1
Nimbus			■	■	3
Lightning				■	1
SUM	18	5	29	7	59

As seen in Table 2, students used many symbols related to peace. They at most used "light colors, Gerald Haltom Peace Symbol, and white Piegon" symbols. Secondly, they drew the symbols of "alive flowers, green, rainbow, and sun." They at most used the symbols "nimbus, dark colors, withered flowers" related to war.

In below, the drawings and the narrations of the two students who used the symbol indicator are.

Drawings 1. *Student 9/12-year-old girl*

Student's narrative about her drawing:

"I painted feathers. I made the background in rainbow colors. This tells me about peace. I adapted the colors to the colors of the rainbow. These colors in the sky tell me about peace. A group of birds' flies near the rainbow, and each of them leaves its feathers as it passes by. In this way, such a picture is formed. My picture is not realistic at all. Because there are no such colorful birds and we cannot see the sky as closely as the picture shows. There were beautiful pictures in the classroom. However, among them, my picture tells about peace the most

Drawings 2. *Student 5/12 year-old girl*

Student's narrative about her drawing:

"I drew two locks in my picture. The bad side represents the war. The lock is closed here. The good side represents peace. I drew the good and bad sides face to face. The middle key can open both locks. So peace can be achieved through the key. On the good side, the arm of the lock is like a rainbow. The rainbow is a beautiful and positive thing. On the bad side, I painted the arm of the lock brown. Brown shows evil and sadness. I painted the inside of the good lock with light colors. There is a beautiful view of it with the sun, trees, and flowers. I painted the inside of the bad lock with dark colors. It contains rain, lightning, withered flowers, and dried tree."

According to student 9, it is understood that the various birds in the picture lay down their feathers and use the rainbow colors as symbols that express peace. Student 5 expressed his thoughts on peace by using war and peace symbols together.

Table 3. Density Distribution Table of The Indexes Related to War And Peace Used by the Participants in Their Peace Drawings.

Code System	Non-religious	Muslims	Evangelist	Catholics	SUM
Indexes used by students					0
Indexes regarding peace					0
Shake hands			■		1
Flower on spaceship (for preventing emission)			■		1
Destruction of all weapons				■	1
Coexistence of various flags			■	■	2
Different skin-colored people together			■	■	2
Smiling face		■		■	2
Indexes regarding war					0
Torn Geralt Haltom peace symbol (absence of peace)		■			1
Get injured				■	1
Weeping face				■	2
SUM	0	2	4	7	13

As seen in Table 3, peace symbols based on the cause-effect relationship that is most commonly used in pictures are "coexistence of various flags, different skin-colored people together, smiling face." Some children stated that it is possible to live together with differences as a result of peace, and they explained this by drawing various flags side by side and drawing people of different skin colors together. Some children stated that as a result of people's love and communication with each other, their faces would smile, and that meant peace. One student drew that peace would occur as a result of the destruction of weapons. Another participant drew a flower on the back of the spaceship he drew. He explained that this flower prevents gas emission. As a result, less carbon dioxide will go to the universe, and peace with nature will be achieved. Another student drew "shake hands" in the middle of the drawings, where he drew the symbols of peace and war side by side and explained that this handshake was the result of peace.

In below, the drawings and the narrations of 2 students using the index indicator are given.

Student's narrative about her drawing:

"The right side in the picture wishes for the world to be what it wants. Everyone here is peaceful, everyone is happy. The left side in the picture describes the current situation; wars and sadness.

Drawings 3. *Student 20/12-year-old girl*

Student's narrative about her drawing:

"I painted a world and it is a rocket that moves away from the world. That rocket symbolizes all weapons so that all weapons and rockets are gone from this world and the war is over. The yellow round thing above is the moon."

Drawings 4. *Student 21/12-year-old boy*

By dividing the Student 20 picture pages into two, he drew to one side of it a peaceful landscape and a smiling person, burning houses and a crying person to another side. It is understood that the student uses the index indicator by establishing a cause-effect relationship between happiness as a result of peace and unhappiness as a result of the war. The student 21 represents all the weapons in his drawing with a rocket. It means that when all weapons are gone from the world, wars will end, and peace will come. From here, it is understood that the student uses the index indicator by establishing a cause-effect relationship between the disappearance of weapons and the arrival of peace.

Table 4. Density Distribution Table of icons Regarding War and Peace Used by the Participants in Their Peace Drawings

Code System	Non-religious	Muslims	Evangelist	Catholics	SUM
Icons used by students					0
Icons regarding peace					0
Side by side and hand in hand		■	■		2
Icons regarding war					0
Fire		■			1
Soldiers				■	1
Weapons					0
Guns			■		1
Bombs	■				1
Rocket	■				1
Tank		■	■	■	3
SUM	2	3	3	2	10

As is seen in Table 4, children used the least the icons that express the real meaning of the object compared to other indicator types. The children drew more war-related icons in the drawings than did the peace-related ones. They drew the most tank icons about war and drew people holding hand in hand concerning peace.

In below, there are examples of drawings which icon + index + symbol indicators are used together.

Drawings 5. *Student 10/12-year-old girl*

Student's narrative about her drawing:

"In my picture, I wanted to show that the world is interconnected and showed that there can be peace on the earth. I drew a peace sign. Drawing several flags (Germany, France, Spain, Turkey, Italy, Argentina, Finland, Czech Republic) I wanted to show the diversity in the world. The rainbow symbolizes the colorful world. Pigeon is also a symbol of peace. People around the World have different skin colors."

Drawings 6. *Student 13/11-year-old girl*

Student's narrative about her drawing:

"One half of the human face in the middle symbolizes war, and the other half symbolizes peace. In the half symbolizing the war, tears flow from the eye and there is a wound on his cheek. This shows the severity of the war. Sun is on the top right corner. The sun symbolizes peace. I painted a rain cloud and lightning on the left, which symbolizes the war. I painted a house on the right side of the picture below. I painted a tank and soldiers shooting on the left."

Student 10 used all three types of indicators in his picture. The fact that people are hand in hand and side by side evokes the theme of peace as a literal indicator, which is an icon when looking at the picture.

The student thinks the various flags and people of different skin colors together as a result of peace and uses the index indicator. Besides, the student used the Gerald Haltom Peace Symbol, the white dove, and the rainbow symbols as symbols of peace in his painting. Student 13 also used three types of indicators together. Half of the picture depicts war and the other half peace. The presence of a tank and soldiers firing on one side of the drawing evokes the war as a literal visual indicator, which is an icon. At the same time, the student uses the index indicator by establishing a cause-effect relationship between the presence of wounds and tears on the face and the violence of war. Also, the rain cloud and lightning are depicted as the symbol of war and the sun as the symbol of peace in the drawing.

Findings Regarding The Interviews On The Concept Of Peace

Findings On The Meaning Of Peace

Table 5. Density Distribution Table of the Participants' Views on the Meaning of the Concept of Peace

Code System	Non-religious	Muslims	Evangelists	Catholics	SUM
The meaning of the peace					0
Pozitive Peace					0
Individual peace					0
Improving yourself			■		1
Feeling of happiness			■		1
Feeling of serenity			■		1
Fighting evil			■		1
Interpersonel peace					0
Understanding each other	■■		■■		6
Getting along well with each other	■	■	■	■	7
Being respectful to each other	■			■	3
Mutual helping	■	■	■		3
Loving each other of everyone			■		2
General social peace					0
Unity between people (commitment,contact, togetherness)	■	■	■	■	6
Happiness of everyone		■	■		3
Respect for differences (race, religion, language)	■		■		2
Existence of justice			■		1
Equality between people	■				1
Peace in nature					0
Don't hurt the trees		■			1
Not to damage playgrounds		■			1
Negative Peace					0
Individual negative peace					0
Absence of stress		■			1
Interpersonal negative peace					0
Non-separation of couples		■			1
Not to hurt people's hearts			■		1
Not being angry with each other	■				1
Absence of debate	■	■	■	■	6
The absence of conflict	■				1
Absence of fighting			■	■	2
The absence of hate and rage	■				2
Not killing each other			■	■	2
Absence of war	■■	■■	■■	■■	14
Absence of violence			■		1
Not to harm anything			■		1
One religion does not fight other religions			■		1
Not mobbing at school		■			1
SUM	21	16	27	11	75

As seen in Table 5, the meaning of peace emerged under two main themes as positive (40 times) and negative peace (35 times). Positive peace consists of 4 sub-categories in order of frequency, "interpersonal peace, general social peace, individual peace and peace in nature." As seen in the table, positive peace concentrates mostly on "interpersonal peace" that emerges through relationships such as "understanding each other, getting along well with each other, being respectful to each other, mutual helping, loving each other of everyone." Secondly, "general social peace" has been expressed the most. Negative peace consists of four sub-categories, in order of frequency, "negative interpersonal peace, absence of war, absence of violence, and individual negative peace." The negative meaning of peace was mostly expressed in "interpersonal relations."

Some direct quotations from the interviews in the sub-theme "interpersonal peace", which is the most expressed theme in the main theme of positive peace, are as follows: Student 21: *"Although there are different opinions among people, we need to respect each other."* Student 1: *"For me, peace is that everybody getting along well with each other."* Student 6: *"For me, peace is that everyone is thoughtful and attentive to each other."* Negative quotations: Student 14: *"Absence of war between the countries."* Student 20: *"For all families to be happy, there will be no wars and destruction will end, and then there will be peace everywhere."*

Findings On Barriers To Peace

Table 6. Density Distribution Table of the Opinions of the Participants on the Barriers of Peace

Code System	Non-religious	Muslims	Evangelists	Catholics	SUM
Barriers to peace					0
Individual barriers					0
Envy	■		■		2
Hate	■				1
Ignore the peace		■	■		2
Selfishness of people	■	■	■		3
Interpersonal barriers					0
Fights			■		1
Interpersonal controversy	■		■	■	4
Not getting along with each other of people			■	■	2
The differences in ideas	■			■	2
Not to accept the differences (racial, ethnic and religious)	■		■	■	6
Interstate barriers					0
Production of weapons		■			1
The desire to have power by seizing more land		■	■		4
Interstate controversy	■	■	■		4
Administrative barriers					0
Injustice	■				1
Poverty				■	1
The conflict of interest in politics		■	■		2
Money, power and coercion over the country	■				1
SUM	11	8	12	6	37

As seen in Table 6, children's views on situations that prevent peace have emerged in 4 themes, in order of frequency, "interpersonal, intergovernmental, individual and administrative barriers." Children expressed that the biggest obstacle to peace is interpersonal barriers such as "fights, controversy, not getting along with people, the difference in ideas, not to accept the differences (racial, ethnic and religion)." Secondly, they said that the inter-state barriers could prevent peace.

Some direct quotations from the interviews in the theme "individual barriers," which is one of the sub-themes in the theme of barriers to peace, are as follows: Student 6: *"People's selfishness."* Student 4: *"Not*

wanting to share." Student 2: *"People always want to be the best, and nobody wants others to be better than him."* Student 9: *"Some people don't care about peace. They only want to win the war."*

Findings On Spreading Peace

Table 7. Density Distribution Table of the Participants' Views on Spreading Peace

Code System	Non-religious	Muslims	Evangelists	Catholics	SUM
Spreading peace					0
Through positive peace					0
Spreading general social peace					0
Spreading good news			■		1
Telling about the importance of peace	■■		■		3
Telling the importance of equality in differences			■		1
Telling the evil of racism			■		1
Bringing democracy management	■				1
Complimenting foreign people		■			1
Helping the poor and volunteer aid agencies	■			■	2
Spreading individual peace					0
Saying own opinion	■				1
Spreading interpersonal peace					0
Complimenting everyone			■		1
Comforting people			■		1
Making friends with people			■		1
Calming aggressive people			■		1
Making others happy			■■		2
Solving people's problems			■		1
To want everyone's happiness			■		1
Giving a gift the children		■			1
Sharing of everyone's own belongings with others		■■			2
Ignoring mistakes		■			1
Fulfilling others' wishes	■				1
Respecting everyone	■		■		2
Getting along well with everyone				■	1
Getting along well with her/his family		■		■	2
Talking instead debate	■				1
Protecting nature					0
Collecting garbage in the forest	■				1
Protecting animals			■		1
Through negative peace					0
Not to start the war				■	1
Lifting weapons				■	1
Telling about the absurdity of war	■			■	2
Putting bad people in jail			■		1
Helping victims of war			■		1
Not arguing with people	■				1
Not fighting		■■			2
Not insulting people		■			1
SUM	11	9	16	6	42

As seen in Table 7, the views of the participants on what could do spread peace, similar to the main themes in the meaning of peace, appeared in two main themes, respectively, in order of frequency, as "through positive peace (32 times) and through negative peace (10 times)." The main theme of positive

peace has emerged in 4 sub-categories as "spreading interpersonal peace, spreading general social peace, protecting nature, spreading individual peace times" in order of frequency. The children said that peace at most could be spread by "spreading interpersonal peace." Besides, the participants also think that peace could spread through negative peace such as "not to start the war, lifting weapons, telling about the absurdity of war, putting bad people in jail, helping victims of war, not arguing with people, not fighting, not insulting people."

In the sub-theme of "protecting nature" under the main theme "through positive peace," some direct quotations from the interviews are as follows: Student 7: "There is a lot of garbage in the forest." Student 3: "I take care of the animal world and look after them." Some direct quotations from the interviews on the theme of the "through negative peace" are as follows: Student 21: "Eliminating weapons is just like I paint them in my picture." Student 22: "When there are bad people, it is necessary to immediately put them in jail, not to allow them to do bad things. We cannot change those people. They willingly *do bad things."*

4 | Discussion & Conclusion

Drawings of Peace

Naturally, peace symbols and indexes were more than war symbols and indexes in peace-themed drawings. But there were more icons about war than the ones about peace. That may be because children are more likely to encounter icon indicators of war through means such as the social environment and the media. No student has used the icon indicator alone. They used the icons with index or symbols together. While ten students used one indicator alone in their paintings, 12 students used at least two indicators together. Participants used the indicator symbol most often (see Figure 1). Similar to these results, in a study we conducted with Grunschule, Realschule, and Gymnasium students aged 9-12, it was seen that Gymnasium students with the highest academic level used the icon indicator least, only these students used the symbol indicator, and in the same way, these students used more than one indicator together (Güleç, 2019). In the study of Türkcan (2013), in which third-grade students draw the "key" concept, it was observed that children in upper socioeconomic status use symbol indicators more than students in the lower socioeconomic group (Türkcan, 2013).

Only 8 of the 22 students (student 1,4,9,2,11,12,16,10) drew the theme of peace alone. Fourteen students explained the peace using the theme of war and peace together (see the appendix I / Figure 2). Although the students mostly used peace icons, indexes, and symbols in their drawings, they also used war icons, indexes, and symbols about half (see Table 1). In this sense, the positive perception of peace is more common in the drawings in parallel with the studies made by drawings (Baring, 2013; Frias, 2008; Jabbar & Betawi, 2019; Walker et al., 2003). Children drew elements of nature as symbols of peace, using animals, plants, natural phenomena, and light colors to express positive peace. They also used the well-known pigeon and Gerald Haltom Peace Symbol. Similarly, in Baring's (2013) research, most of the drawings contain "house, farm, tree, shining sun, and clouds." Birds and doves, two well-known symbols of peace, were also in the pictures. In the research of Cengelci Köse and Gürdogan Bayır (2016), pigeon, olive branch, kite, and letter symbols were used as symbols of peace. Similar to the colors used in our study, it was seen that light colors were used in the peace paintings in the work of Bedir and Demir (2012). Secondly, positive peace was expressed mostly in indexes such as "people with different skin colors being side by side and hand in hand, hands shaking hands, the coexistence of various flags" that mostly express interpersonal relations. Similarly, Baring (2013) had the theme of "holding, shaking, or raising hands" in the drawings. In parallel, under the theme of "positive actions and interactions," South Korean children described peace with group images, "holding hands and shaking hands" (Frias, 2008). It was seen that the most common theme defined in the peace drawings of US children was peace as "interpersonal interactions." In this theme, there were positive peace relationships, such as "being friends, shaking hands, holding hands, and helping someone else or playing together" (Walker et al., 2003). In the present study, negative peace is most often depicted with the colors and symbols of nature. Secondly, negative peace was mostly described

with icons representing war environments consisting of soldiers, fire, and various weapons. Similarly, the second theme identified in the study of Walker et al. (2003) was peace as negative peace.

As stated above, in the literature on children's drawings of peace, it was seen that their perception of peace was generally similar in main themes. But there were cultural and contextual differences in some sub-themes. Similar to the results in the literature, in this study, it was seen that some themes that were not included in the indicators used in the drawings were found in some other studies done with drawings. There are no icons, indexes, and symbols related to religion and beliefs in the drawings in our study. However, in Baring's (2013) study, there were symbols of "church and cross, bible" evaluated under the theme of "faith." Similarly, although there are Christmas celebrations in the drawings of Filipino-American children, these celebrations were absent in the drawings of their South Korean and US peers (Frias, 2008). Likewise, in the study of Jabbar and Betavi (2019), there were sub-themes related to religious activities and religious symbols in the theme of "religion" regarding positive peace. For example, an 11-year-old girl represented her drawings as: "A church with three crosses and a colorful garden showing that peace is security, protection, and spirituality." Regarding negative peace, there was a sub-theme "the end of Isis" quite different from our study and the general literature. For example, an 11-year-old boy depicted his drawing as: "There is a new house in Australia, a beautiful garden and a waterfall surrounding the house, there is no Isis." In our study, there were quite a lot of indicators related to nature. In the study of McLernon and Cairns (2001), English children drew more images of nature and religion associated with positive peace than Northern Irish children. Moreover, in our study, there were no icons, indexes, and symbols that could be related to the "people dealing with peace" theme in the drawings in Frias's (2008) study.

The meaning of peace in the interviews

Children perceived peace at most as positive peace in the interviews. Likewise, Turkish children (Bedir & Demir, 2012; Cengelci Kose & Gurdogan Bayir, 2016) perceived peace at most as positive peace in their written opinion. However, in the study of Oppenheimer & Kuipers (2003) and Souza and colleagues (2006), the perception of peace in the verbal opinions of children was mostly negative. In the study, positive peace was mostly seen in "positive interpersonal relationships" such as sub-codes; "understanding each other, getting along well with each other, being respectful to each other, mutual helping, loving each other of everyone." In this sense, it is compatible with the theme of "interpersonal interactions," one of the most common themes related to positive peace in the literature (Covell et al., 1994; de Souza et al., 2006; Hakvoort, 1996; Hakvoort & Oppenheimer, 1998; Oppenheimer & Kuipers, 2003). Similarly, in the study of Bedir and Demir (2012), when children were asked to write the first three things that the word peace brings to mind, the first three things were, respectively, "love" (love/joy), "respect for others' opinions," and "reconcilement." Negative peace was most commonly expressed in the interviews with the theme of "negative interpersonal relationships." Secondly, negative peace has been described as the "absence of war," in line with the common perception in the literature (Covell et al., 1994; Hakvoort, 1996; Hakvoort & Oppenheimer, 1993, 1998; Oppenheimer & Kuipers, 2003).

The sub-themes in the context of positive peace and negative peace in our study (see Table 5) are quite similar to the study of Cengelci Kose & Gurdogan Bayir (2016). However, the "individual peace" theme found in our study was absent in this study. There were also similarities in many themes in Baring's (2013) 's work with our work. However, the "individual peace" theme found in our study was not found in Baring (2013), and the themes of "satisfaction of needs, religious proposition, national concern" found in Baring (2013) were absent in our study.

5 | Conclusion and Educational Imlications

In this study, the perception of peace of 22 children between the ages of 11-12 who live in Pforzheim/ Karlsruhe region of Baden-Würtenberg state of Germany and continue their education in a Gymnasium-

level high school was examined through their drawings and verbal expressions. Children should describe their drawings to be understood the meaning of the signs and the sources of the drawings.

In the study, the meaning of peace was mostly perceived as positive peace, both in pictures and interviews. Although the students mostly used peace icons, indexes, and symbols in their peace drawings, they also used almost half of the icons, indexes, and war symbols. In this sense, although the positive perception of peace is more in the drawings, children also reflected the drawings' negative peace perception.

In the drawings, positive peace was most often represented by the colors and symbols of nature. The second most positive peace was shown by indexes describing interpersonal relationships. In this study, similar to the literature on peace drawings, besides the similarities in the main themes in children's perception of peace, differences were observed in sub-themes due to different contexts. The meaning of peace in the interviews was mostly defined by the theme of "interpersonal interactions," which is the most common theme related to positive peace in the literature. Besides, children emphasized the importance of interpersonal relationships in situations that prevent peace and in spreading peace.

The children almost half described peace as the absence of war in both drawings and interviews. Negative peace was most often depicted in the drawings by colors and symbols of nature. Secondly, negative peace was mostly indicated by icons showing war environments consisting of soldiers, fire, and various weapons. Negative peace was mostly defined with the theme of interpersonal negative peace in the negotiations on the meaning of peace. Secondly, negative peace was expressed as the absence of war, similar to the common perception in the literature. Furthermore, they also stated that the situations that led to war would create an obstacle to peace. Moreover, they also noted that peace could also be spread through negative peace.

If the results obtained from this sample are evaluated in terms of guiding peace education, some results may arise:

i.In this study, the participants defined peace in their verbal expressions, both positively and negatively, by interpersonal relationships. Likewise, they stated that situations that hinder peace stem from mostly interpersonal relationships. They also said that peace might be spread mainly through spreading peace between people. In summary, children emphasized the most importance of interpersonal relationships. Again, they talked about the protection of nature concerning the definition of peace and the spreading of peace.

In peace education through positive peace, the "virtue-based peace education approach" can be applied to improve the individual's responsibilities towards himself, other people, and nature. The person who is at peace with himself and with other people, instead of trying to have nature and the beings in nature, to use them consciously will realize. Thus, communities at peace with themselves, other people, and nature will create an ecosystem where peace prevails. In our opinion, approaching peace education with a virtue-based approach is one of the most important ways social peace culture continues permanently. This approach requires applying methods and means of gaining universal human values (Rajshree, 2012) according to people's capacities and needs.

The children emphasized that the most significant obstacle to peace stems from some non-virtuous behavior in interpersonal relationships. They stated that thoughts and behaviors in interpersonal relations such as "fights, controversy, not getting along with people, the difference in ideas, not to accept the differences (racial, ethnic and religion)" could be an obstacle to peace. Similarly, they expressed some individual non-virtuous such as "envy, hate, selfishness." It may be beneficial for children to gain the virtues of "respect, tolerance, and empathy" to minimize these thoughts and behaviors. Remarkably, participants recommended more ethical behavior to spread peace than they said in the definition of peace. Starting from respecting everyone in interpersonal relationships for the spreading of peace, they recommended more ethical behaviors such as "getting along well, sharing things, giving gifts, ignoring mistakes, solving

other people's problems, relieving angry people, and even complimenting people." Children are not satisfied with respect alone, which is perhaps the minimum virtue for spreading peace among individuals. But they talk about the virtues that could be included in "altruism and compassion" (McClain, Ylimaki, & Ford, 2010). To gain such virtues and turn them into behavior, the family still maintains its feature of being the "seedbed of peacemaking"" (Baring, 2013). The school continues to be the essential auxiliary institution next to the family.

According to some studies, if the meanings given to peace are based on thoughts, attitudes, and behaviors coming from parents (Frias, 2008) and the immediate environment (Walker et al., 2003), it may be easier for children to acquire peace-making skills and make it permanent. Children are more open to learning new information and developing various skills during their school years. Schools are the most relevant institutions to provide the necessary conditions for peace education (Harris, 2009).Peace education programs in schools should include textbooks, various learning materials, and extracurricular activities (Bar-Tal & Rosen, 2017). In the virtue-based approach to peace education, starting peace education in pre-school education could be more effective. Depending on their age capacities, starting with four-year-old children, values such as "friendship, cooperation, gentleness, concern for others, love, respect, responsibility, honesty, helpfulness, and courtesy" should be taught with fun and active participation of the student. Starting education at an early age could have a lifelong effect (Rajshree, 2012) by ensuring that such values are internalized. Peace education should continue during the primary school period. The teacher who will teach peace education must be a positive model. The teacher should strive for the classroom environment to be a peaceful democratic environment, and encourage the students to "kindness, critical thinking and cooperation" (Harris & Morrison, 2012). It seems to be one of the important preconditions for peace that both teachers and students comply with concepts such as "transparency and accountability" (Baring, 2013). A value education program that focuses on the virtues of "respect, tolerance and empathy" should continue in primary and secondary school years. Children should be taught strategies for dealing with conflicts that arise when living with people of different ethnicity, gender, national origin, or other distinctive differences (Harris, 2009; Schwebel, 2001). In his high school years, with an approach focused on "altruism and compassion," permanence of peaceful behavior could be achieved through the maturation and internalization of previously learned virtues. In fact, with the effect of the "sense of justice" that is intense among young people in this period, many students could develop the will and courage to spread peaceful behaviors. When peace-making efforts fail, students should be taught what they can do to avoid harm to themselves and other people. Alternative behaviors that can be done when faced with physical harm should be shown. The teacher's example of mediation, which is a key principle in peace education (Rajshree, 2012) could be influential in shaping students' attitudes and behaviors in resolving conflicts between individuals. Besides, family and the school have an important place in developing an awareness of responsibility towards nature. Today, the consequences of the destruction of the natural environment cause great disasters and are at an unprecedented level. "Pedagogy of ecological responsibility" should be in line with today's needs. It requires developing a deepened consciousness by controlling our choices and behaviors that are harmful to living in peace with nature (Mische, 1999).

ii. In this study, the children did not only mention individual, interpersonal, and protection of nature themes regarding peace. Children also define peace as providing general social peace, which they express with concepts such as "unity between people, the existence of justice, equality between people, respect for differences (race, religion, language)". Moreover, children believe that general social peace could be achieved with a fair and democratic government by explaining the importance of peace to the society, spreading the good news, helping aid organizations, and creating a culture of living together with differences. In addition, children emphasized that inter-state barriers (interstate controversy, the desire to have power by seizing more land and production of weapons) and administrative (injustice, poverty, the conflict of interest in politics, money, power, and coercion over the country) barriers could also prevent peace. Developing individual virtues in peace education is part of peace education. However, it is not all (Harris & Morrison, 2012). Peace could be provided with a global understanding that includes the

education of children and society, as well as relations between states, religions, races, and ethnic structures (UNESCO, 1995). This study says much more than research (Nasser & Abu-Nimer, 2012), recommending that peace may be provided through urgent reconciliation and considering peace as the opposite of war and violence. Children here think of peace as an active, dynamic, and mutual process (Johnson & Johnson, 2005), contrary to what children often think of peace as "weak, passive and boring" (Matthews, 2002). Children advocate the relational aspects of peace (Baring, 2013; McClain et al., 2010; Rajshree, 2012), penetrating many areas related to peace, including individual, interpersonal, natural, social, administrative, interstate, and global, both in drawings and interviews.

iii. Peace was defined as "the absence of war" on the proportion of almost half in both the drawings and peace's definition. Likewise, children stated that situations that could lead to war, such as "the production of weapons, conflicts, the desire of states to have more land to have more power," could prevent peace. In this sense, peace education must also include in the concept of the "absence of war" regarding this research. Even though the root words of peace clearly show that peace is more than the absence of war, the studies on peace education in the literature are mostly about active war and countries in conflict (Johnson & Johnson, 2005). That may be due to the perception of peace as the absence of war and non-violence in previous studies. The children participating in this study conducted in Germany were not in active war and conflict environments. Similarly, in some previous studies, it was observed that children who do not directly face to a war and conflict environment use the expression "the absence of war and violence" when defining peace because they encounter war and various types of violence through media and other environmental sources (Walker et al., 2003). Children should know that even if there is no war in their own country, there are places in the world where there is active war. However, wars should be discussed with children, not from the preconceived viewpoint that is widely available from the media, but with truthful data presented (de Souza et al., 2006). Speaking and awareness of wars could be useful in understanding the true meaning of peace and the importance of human cooperation in achieving peace.

Limitations and future research directions

Conducting the study with a qualitative methodological procedure does not allow the findings to be generalized. The research was originally intended to variation sampling diversity. However, since the conditions did not exist, volunteers could be included in the study with convenience sample. In this sense, the research does not represent the diversity of children living in Germany. Future research could include more representative examples. The cross-sectional of the study limits our understanding of how children's understanding of peace changes with age. Longitudinal studies should be conducted in the future to understand the developmental changes that may occur over time. Peace drawings in this study can not be culturally compared with those in other studies. Intercultural studies could be conducted in cooperation with researchers who are closely acquainted with the cultures to compare the cultural peace images used in the drawings.

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Statement of Publication Ethics

I declare that the research has no unethical problems and I observe research and publication ethics.

Conflict of Interest

The author proclaimed that there was no conflict interest in the publication and authorship of the article.

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APPENDIX I

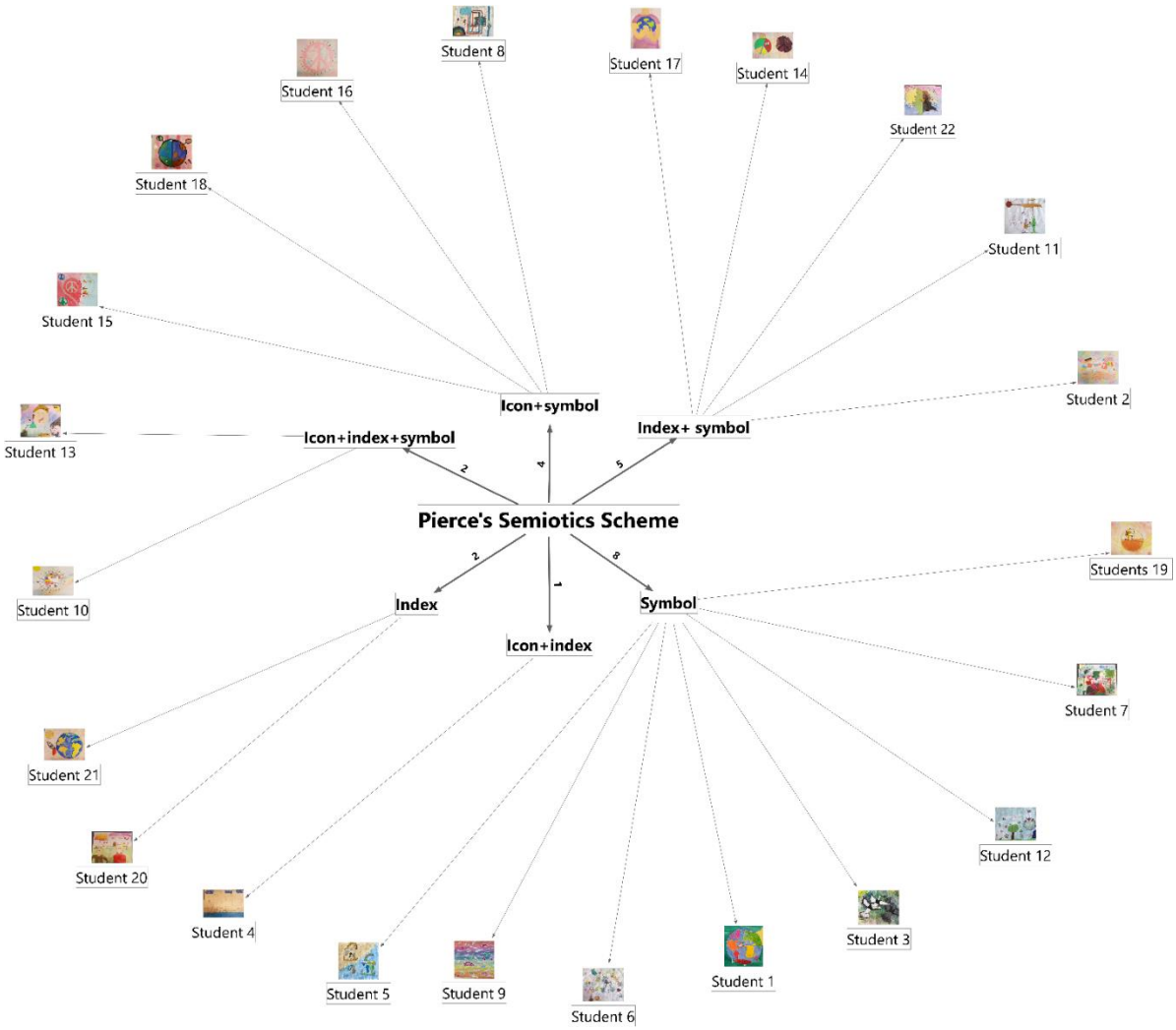

Figure 2. Pierce's Semiotics Scheme/Code-Subcodes-Segments Model

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The Study of Primary School Visual Arts and Science Curricula in Turkey in the Context of Interdisciplinary Approaches: 1923-2020

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Abstract

This study aims to identify any associated subjects in the primary school Visual Arts and Science courses in Turkey from 1923 when the Republic was declared till 2020, and reveal the historical dimension of such associations between the two courses. In this context, primary school curricula of 1924, 1926, 1936, 1948, 1968, and 1992 implemented in primary schools of our country; 2005 Science and Technology and 2006 Visual Arts course curricula; 2013 and 2018 primary school curricula have been reviewed. Since the scope of this research covers the primary school level, Grades 4-5 until 2012 when the Law No. 6287 was adopted and Grades 3-4 after the adoption of this law are discussed. The data were evaluated by content analysis in the research which was carried out by the document review method. As a result of the analyses, it is recognized that the association between the two courses has been made since the 1924 Curriculum, the first program of the Republic although it was disrupted in certain periods. In addition, it has been found that in the interdisciplinary approach adopted between 1926 and 1992, the Art-Craft course was primarily seen as the field of application of the Science courses and assumed a role of an auxiliary course in teaching the Science courses. Thus, despite the increase in the number of learning outcomes in the current programs, the learning outcomes to be associated with the two courses are still quite limited.

Keywords: Visual arts course, science course, interdisciplinary approach, interdisciplinary relations.

Türkiye'de İlkokul Görsel Sanatlar ve Fen Bilimleri Programlarının Disiplinler Arası Yaklaşımlar Bağlamında İncelenmesi: 1923-2020

Öz

Bu araştırmada, Türkiye'de Cumhuriyet'in ilanı olan 1923'ten 2020'ye kadar uygulanan ilkokul Görsel Sanatlar ve Fen Bilimleri derslerinde birbiriyle ilişkili konuların olup olmadığının tespit edilmesi ve iki ders arasındaki ilişkilendirmelerin tarihsel boyutunun ortaya çıkarılması amaçlanmıştır. Bu kapsamda ülkemiz ilkokullarında uygulanan 1924, 1926, 1936, 1948, 1968, 1992 tarihli ilkokul programları; 2005 Fen ve Teknoloji ve 2006 Görsel Sanatlar dersi öğretim programları; 2013 ve 2018 ilkokul programları incelenmiştir. Araştırmada 6287 Sayılı Kanun'un kabulü olan 2012'ye kadar 4 ve 5; bundan sonra ise 3 ve 4. sınıflardaki çalışmalar ele alınmıştır. Doküman incelemesi yöntemiyle yürütülen araştırmada veriler, içerik analiziyle değerlendirilmiştir. Araştırma sonunda -belli dönemlerde sekteye uğrasa da- Cumhuriyet'in ilk programı olan 1924 Programı'ndan beri iki ders arasında ilişkilendirme yapıldığı anlaşılmıştır. Ayrıca 1926-1992 arasında benimsenen disiplinler arası yaklaşımda Resim-İş dersinin, Fen derslerinin uygulama sahası olarak görüldüğü ve bu dersin öğretiminde yardımcı ders rolü üstlendiği; güncel programlarda ise kazanım sayılarındaki artışa karşın iki dersin ilişkilendirileceği kazanımların oldukça sınırlı olduğu tespit edilmiştir.

Anahtar kelimeler: Görsel sanatlar dersi, fen bilimleri dersi, disiplinler arası yaklaşım, disiplinler arası ilişkiler.

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1 | Introduction

Educational and instructional programs are a form of targeted changes to be realized in individuals expressed as the whole of pre-designed activities within a plan. Although educational programs are more comprehensive compared to instructional programs, instructional programs refer to a narrower framework. Because, instructional programs can be considered as type of programs that can vary across specific subject contents, courses, levels of education, educational institutions and structures of schools and include all the processes that are required for the accomplishment of the objectives determined in line with needs.

In the first periods of the Republic, the instructional programs which consisted of target and content dimensions are now prepared with a more comprehensive understanding compared to the past by brining different components of the program together. These programs which contain information and instructions on the objectives and content of the courses, learning and teaching process and evaluation dimensions are designed separately for each course. The concept of course can sometimes be defined as "discipline" in the educational literature. The term “discipline” refers to a strict understanding of order according to the Turkish Language Institution and to “the whole of the information that is or may be the subject of instruction and a field or a scientific branch of specialization” in the field of education (Turkish Language Institution, 2000, p.286). In the current study, what is meant by the interdisciplinary associations is the links established between courses and the relevant points shared between courses.

Interdisciplinary teaching can be seen as one of the instructional approaches used in the field of education and instruction. Klein and Newell (1997) define the interdisciplinary teaching approach, which has been interpreted differently by many researchers, as the process of answering a question, solving a problem, or dealing with a subject that is too broad and complex to be adequately addressed by a single discipline or area of expertise (Klein & Newell, 1997, p.396). According to Jacobs, it is the use of methods and knowledge of multiple disciplines to teach an issue while Erickson describes it as the conceptual integration of a concept in different disciplines (Erickson, 1995, p.96). According to Yarımca (2010), it is “an education process that is integrated to improve the objectives of two or more fields being taught in a school’s program” (Yarımca, 2010, p.1). However, Yıldırım suggests a different and elaborative definition of the interdisciplinary approach. For him, the interdisciplinary approach is the ability of the student to produce solutions to the problem he encounters after learning in different courses, to create his own inference with the knowledge he has gained from different disciplines and to comment on the problem from different angles (Yıldırım, 1996). In this approach, which involves the interaction of two or more disciplines, this interaction may have a very wide scope. In fact, the interaction between disciplines can range from the simple connection of ideas to the mutual integration of organizational concepts, methodology, data and research and educational organization in a very large area (Berger, 1972, p.24-25). Furthermore, in our country, making reference to learning outcomes of other/relevant disciplines in places where the different disciplines are related to the same subject being taught in a curriculum can be considered within the scope of interdisciplinary teaching. Regardless of which definition is accepted, the interdisciplinary teaching can be considered as an approach where a subject, theme or problem situation is analyzed from different perspectives; students establish connections between concepts with the ideas they have acquired from knowledge of different disciplines, and can adapt and apply the knowledge gained in one discipline to another discipline by deepening their learning experiences.

Even though a lot of information that students may use in everyday life is taught in schools, students cannot easily explain the reasons of many events they encounter in daily life using the information they learned at school. Similarly, students have difficulties in switching between subjects of different courses and science disciplines. This view is also supported by Berryman. Berryman (1991) states that individuals cannot only use the information they learn in school effectively in everyday life but also they are unable

to use the information they acquire in daily life in school environment and that context-based education is critical for understanding and therefore learning (qtd in Wicklein & Schell, 1995, p.61). Educators express that teaching without making any connection to the real life is not met with interest by students and that concepts are easily forgotten (Ciesla, 2009). For Yıldırım (1996), if the information learned at school cannot be transferred to daily life, it means that the time spent by students at school is wasted.

Ziya Selçuk, the Minister of National Education, points out similar issues in the Turkish education system too. Selçuk explains the project he wants to realize in education as follows: "The student has also difficulties in applying the theoretical knowledge in their minds when they begin to work.... Instead of making them [students] memorize knowledge, we aim to make them internalize and use such knowledge in life by developing the links between knowledge and life." Stating that the most successful countries in education are Australia, Far East countries and Finland, Selçuk highlights that the number of courses is low in all of these countries and that teaching is carried out in an interdisciplinary manner (Akyol, 2019).

Since the history of interdisciplinary education is linked to the history of disciplines, it is also possible to trace back the history of this approach to the years before Common Era. For instance, Pythagoras, who associated the subjects of mathematics, music and astronomy, being inspired by the sound of objects in 586 BC, also established a number-harmony relation and revealed the relation of musical series (Yıldırım & Koç, 2003). The most obvious example of this approach in Turkey was the 1926 Program. It is possible to evaluate the system called "Collective Education" adopted in this program as a derivative of interdisciplinary association.

In a study examining the theses on interdisciplinary approach, it was found that this concept entered the field of education in the 1990s and reached its highest number in the 2000s (Turna & Bolat, 2015). Indeed, it can be said that the importance of this approach has started to be mentioned frequently in our country especially after the 2000s. When the related literature is reviewed, it is observed that experimental studies are conducted in which Visual Arts and Science courses are examined in various aspects in terms of interdisciplinary approaches. If expressed in chronological order, in the study by Güven and Hamalosmanoğlu (2012), the activities with environmental content in the Grade 4 Science and Technology textbook were dealt with in terms of interdisciplinary approach and the relationship of this course with the Visual Arts course was revealed in virtue of the activities with environmental content. Aslantaş's study (2013) examines the attitudes of students towards the lesson designed and implemented according to the interdisciplinary approach in the Grade 4 Visual Arts course. In the study conducted by Korkmaz and Konukaldı (2015), the effects of the interdisciplinary thematic teaching approach in primary school Science and Technology education on students' learning products are examined; the academic achievements and attitudes of students are measured. In the research conducted by Karakuş, Turhan Türkkan and Karakuş (2017), the opinions of Science teachers on interdisciplinary associations are identified; the Science teachers' frequency of making associations with the Visual Arts course in their lessons is determined. In the studies of Uğraş, Güneş and Asiltürk (2018), the opinions of the Science course teachers on the relationships of the activities in the textbooks with the branches of arts are collected. Cura and Yalman (2019) investigate the levels of utilizing the interdisciplinary approach by pre-service science course teachers. However, there has been no research specifically examining the historical changes and developments of the associations between these two courses in teaching programs.

Art and science are two fields that complement each other and benefit from each other's mindset. Especially in recent years, in the field of science, it is essential that students learn knowledge and skills in a multidimensional way from the perspectives of different disciplines, and STEM (Science, Technology, Engineering, Maths) education, where the holistic examination of science, technology, engineering and mathematics fields is prioritized, has come to the fore. This education, which has an interdisciplinary approach in itself, has moved to a different level with the addition of the field of art. This new approach combining science fields with art is called STEM+A or STEAM. In other words, the unique knowledge and skills of art have been combined with technology, science and engineering in this education.

If these two seemingly distinct fields are addressed in an integrated manner, it will be possible for students who are inclined to the field of science, whose logical-mathematical intelligence are dominant or who have a developed visual-spatial intelligence to comprehend the relationship between these two fields, make sense of the information, recall it, transform it into a form that can be used in daily life, and create awareness and sensitivity to search for art in science and science in art because the examinations and observations made with a scientific perspective towards nature in the field of science gain an artistic character in the field of visual arts; thus, scientific knowledge is enriched with aesthetic sensitivity and artistic perspective. Similarly, the aesthetic sensitivity and observation power gained towards the environment add a different dimension to nature studies in the field of science. The starting point of the research about the connections between art and science is the idea that visual art studies will be effective in the teaching of science subjects, and science applications will be effective in the teaching of visual art studies. However, the predominant tendency is to facilitate and make learning permanent by supporting science subjects with art studies. Art and science, which are constantly evolving according to the demands and needs of society, are complementary to each other and like branches fed from the roots of a single tree. The more frequent use of the association between these two disciplines in education, whether be it science-based or art-based, is very important for raising and training individuals who have developed the ability to design, think more freely, are academically successful, can transfer the knowledge they learned at school to daily life, can express themselves by transforming what they learned into an aesthetic and usable scientific form and have both artistic and scientific perspectives.

The past should be depicted exactly and the present should be interpreted correctly so that the quality of future practices may be improved and the future may be directed. From this point of view, revealing the past and current practices between the two courses, showing the changes, identifying the similarities and differences of the past and present practices are deemed to be important in the research as it may manifest a situation and shed light on future curricula.

PURPOSES OF THE PRESENT STUDY

The purpose of this research is to examine comparatively if the association between Visual Arts and Science courses was established in primary school curricula implemented in Turkey between 1923 and 2020. The general research question may be expressed as “Which topics are associated with each other in the primary school Visual Arts and Science courses curricula implemented between 1923 and 2020?” The answers to the following questions were sought in order to investigate the general purpose:

1) How is the association between the Painting and Nature Study (Resim ve Tabiat Tetkiki), Agriculture and Health (Ziraat ve Hıfzısıhha) courses in the 1924 Curriculum?

2) How is the association between the Painting-Handicraft (Resim-Elişi), Nature and Material (Tabiat ve Eşya) courses in the 1926 Curriculum?

3) How is the association between the Art-Craft (Resim-İş) and Nature Studies (Tabiat Bilgisi) courses in the 1936 Curriculum?

4) How is the association between the Art-Craft (Resim-İş) and Nature Studies (Tabiat Bilgisi) courses in the 1948 Curriculum?

5) How is the association between the Art-Craft (Resim-İş) and Science and Nature Studies (Fen ve Tabiat Bilgileri) courses in the 1968 Curriculum?

6) How is the association between the Art-Craft (Resim-İş) and Science (Fen Bilgisi) courses in the 1992 Curriculum?

7) How is the association between the courses in the Science Curriculum of 2000 and the Art-Craft Curriculum of 1992?

8) How is the association between the courses in the Visual Arts Curriculum of 2006 and the Science and Technology Curriculum of 2005?

9) How is the association between the Visual Arts and Science courses in the 2013 Curriculum?

10) How is the association between the Visual Arts and Science courses in the 2018 Curriculum?

2 | Method

Research model

This research was carried out on the basis of the document analysis method which is one of the qualitative research methods. Since qualitative research is one of the important sources of information, it is necessary to actively use the documents in the document analysis, which includes information about the facts and events aimed to be examined, and the analysis of written items (Yıldırım & Şimşek, 2008, p.187). The main reason for selecting the document analysis method in this research is that the relevant content information regarding the education and teaching curricula implemented in Turkey within 97 years is included in written forms, namely documents.

Population and sample

The population of the research consists of the teaching curricula that have been implemented from 1923, when the Republic was proclaimed, to the present day (2020). The unit to be included in the sampling based on the population was determined by the "criteria sampling" method. In this sampling method, situations that are predetermined by the researcher or prepared on the basis of any list of criteria are studied (Yıldırım & Şimşek, 2008). In the event that the units to be examined consist of people, situations, objects or events with certain characteristics, the units that meet the predetermined are taken as a basis in the selection of the sample (Büyüköztürk et al., 2010). Moreover, the teaching curricula of Visual Arts and Science courses approved by the Ministry of National Education (MoNE) and implemented only in primary schools located in urban areas were accepted as criteria in determining the sample of this research. Accordingly, the curricula and draft curricula implemented in primary schools located in rural areas between 1926 and 1948 were not included in the research.

Science courses were taught in all grades from 1923 to 1926, in Grades 4 and 5 from 1926 to 2013, and in Grades 3, 4 and 5 since 2013. Since primary schools which were consisted of Grades 1-5 for many years started to cover Grades 1-4 with the Law No. 6287 enacted in 2012, the comparisons were made for Grades 3 and 4 after this date. Therefore, the curricula of the two courses were examined only for these grades and in terms of the content of such curricula.

Data collection

Some limitations may be encountered in the collection of documents subject to the document review method. One of them is that the documents may not reflect the truth and do not contain accurate information (Creswell, 2017). However, it is possible to say that this situation is more likely valid for the sources that are not directly related to the events being examined, but where the events and situations are conveyed in a third person's narration. For instance, according to Cohen, Manion and Morrison (2005), the sources, textbooks, encyclopedias and reproductions cited by the researchers are considered among the secondary data sources. The secondary resources are not defined as original ones and are used in cases where the primary resources are not available. Some of the primary sources are laws, regulations, official reports and all kinds of official publications.

The documents used in this research are the teaching curricula prepared by the Board of Education which is the official unit of the state, and approved by the Ministry of Education. These documents in written form are genuine and primary data sources that have not been modified. The institutions and persons that prepared the documents and the time and place that the documents were prepared are

obvious. All of these factors may give an idea of the reliability of the documents used in the research (Yıldırım & Şimşek, 2008). While some of the curricula were accessed from the Ferit Ragıp Tuncor Archive and Documentation Library affiliated to the Ministry of National Education, the others were accessed from online media.

DATA ANALYSIS

The teaching curricula, which constitute the only data set of this research, were examined by the "content analysis". The main purpose of the content analysis is to explain the data at hand and to reveal the relationship between them (Yıldırım & Şimşek, 2008). A number of stages were followed while analyzing the data in the research. The first stage is to choose a sample from the data set. In this sense, the curricula belonging to Visual Arts and Science courses were chosen among other curricula as samples. Only the "content" aspect of such courses was taken into consideration. However, as general education and teaching practices adopted in the curricula are included in the introduction section of such curricula, those explanations in the introduction of the curricula are also included in the research. Subsequently, analysis units were identified for each curriculum in line with the sub-purposes of the research.

Analysis units vary depending on the purpose of the research and words, themes, characters, sentences, paragraphs, items, and contents are used as an analysis unit (Yıldırım & Şimşek, 2008, p.199). In this sense, words, sentences, paragraphs and explanations given in the content constitute the analysis unit of this research. Accordingly, the words "association between courses/interdisciplinary association/ relationship/ link/ connection/ reference" were firstly scanned in the introduction section of the curricula. Then, the following keywords were scanned for the two courses respectively: (a) "Painting/ Painting-Handicraft/ Art-Craft/ Visual Arts/ association between courses/interdisciplinary association/ relationship/ link/ connection/reference" in the Science curriculum; (b) "Nature Study/ Nature and Material/ Nature Studies/ Science and Nature Studies/ Science/ Science and Technology/ Sciences/ association between courses/ interdisciplinary association/ relationship/ link/ connection/ reference" in the Visual Arts curriculum. Next, the sentences and paragraphs in which these words were included were examined semantically in terms of content with a holistic approach by means of context reading. Finally, the connections were determined in the curricula where the relationship between Science and Visual Arts courses was anticipated and comparisons were made and a relationship was established between the related subjects.

While the teaching curricula of all courses were simultaneously issued on the same date until 1968, issue dates varied after this date. For example, Visual Arts curricula were issued in 1992, 2006, 2013 and 2018 while Science curricula were issued in 1992, 2000, 2005, 2013 and 2018. Comparisons were made chronologically, regarding the order of the years in which the curricula were issued and reported in prose. In addition, direct citations from original sources were made for the purpose of increasing the reliability of the research.

3 | Findings

The principal research question is "Which topics are associated with each other in Visual Arts and Science courses teaching curricula implemented between 1923 and 2020?" In this section, results regarding the sub-purposes identified for the overall research purpose are given. In each sub-purpose, the denomination of Science and Visual Arts courses belonging to the relevant period is also included.

Findings Regarding the First Sub-Purpose: How is the association between the Painting and Nature Study, Agriculture and Public Health courses in the 1924 Curriculum?

In this curriculum, the subjects of the paintings that students are required to do within the framework of the "Painting Education (Tedrisi Resim)" taught in all grades in the Painting course are taken from the

themes in other courses. In this regard, the following exact statement is included in the curriculum: "Painting education: Drawing paintings and portraiture works belonging to the Accounting, Geometry, Language, History, Geography, Nature Study and Homeland Study courses" (MoNE, 1340, pp.45-47). As it can be understood from this statement, associations were made between the "Nature Study (Tabiat Tetkiki), Agriculture (Ziraat ve Hıfzıssıha)" course, taught in all grades and can be counted as Science course today, and the Painting course in the 1924 Curriculum which was the first curriculum of the Republic. To put it more clearly, the subjects covered in the Nature Study course constitute the subject of the works to be done in the Painting course in all grades in primary school. The subjects covered in the Nature Study courses are as follows in general according to the grade levels:

Grades 1 and 2: Examining the seasonal variation of seasonal flowers, fruit and non-fruit trees, and various vegetables in the immediate vicinity of the student; handling of domestic and non-domestic animals, insects, birds, aquatic animals and plants from various aspects; explaining the ways of sowing, mowing and grinding grains; inquiring natural phenomena such as day and night, seasons, stars and rain and snow.

Grade 3: Continuing previous studies; inquiring local arts such as coppersmith, sericulture, carpetmaking, schools and household items and house construction.

Grade 4: Continuing studies on animals, plants and natural phenomena; examining the human body from all angles; health information.

Grade 5: Continuing studies on animals, plants and natural phenomena; teaching some physics-related subjects such as floating ferries and explaining steam power through machines; examining visible physical phenomena such as lightning bolt and lightning (MoNE, 1340).

Although there is no explanation in the curriculum that there is an obligation to establish a relationship between the courses, and such approach is not adopted as a general practice, it is understood that an interdisciplinary approach is applied in the Painting course.

Findings Regarding the Second Sub-Purpose: How is the association between the Painting-Handicraft, Nature and Material courses in the 1926 Curriculum?

In the program in which the principle of collective teaching was embraced in the Grades 1, 2 and 3, which is called the first period, the associations between the courses of Grades 4 and 5, which are the second period classes, were considered important and this issue was explained as follows in the "Introduction" section of the curriculum: "In the second period, the teaching of the courses in a way that will more or less regularly present the principles of various sciences was found useful. However, the need for these lessons to go parallel and reinforce each other has not been overlooked" (MoNE, 1930, p.4). The Science course is included in this curriculum as two separate courses, "Nature" and "Material". In the curriculum, Nature courses are taught in Grades 4 and 5; Material courses are taught only in Grade 5. For this reason, the subjects related to the Painting course are involved in those classes only.

In the Painting-Handicraft course curriculum, the framework of the associations with the Nature and Material courses is explained as follows: "[The student] sketches the materials he observed and the subjects discussed in the Nature and Material courses" (MoNE, 1930, p.114). The concept of "materials" here refers to the tools and machines that are included in physics and chemistry subjects and that the student sees and uses every day. For example, mirrors and lenses (magnifying glass) used in the teaching of the subject of light, the barometer used in the teaching of air pressure, the thermometer used in the teaching of the subject of temperature, the pulleys and levers used in teaching of the working mechanisms of simple machines, and the batteries and dynamos used in the teaching of electricity are some of these materials (MoNE, 1930, pp.98-100). The associations between Painting-Handicraft and Nature and Material courses in the curriculum were established with the following four works in the Painting course: "Paintings from Nature", "Sketches", "Decorative paintings" and "Industrial paintings".

The works of painting from nature, as the name suggests, includes the drawing of objects in nature. In paintings from nature, it can be said that the works that students will draw are directly selected from the subjects of the Nature course. In the scope of paintings from nature in the Grades 4 and 5, students are required to make drawings of leaves and plants, branches and fruits, branches with flowers, flowers in glasses, spring plants, birds, flowers, butterflies, insects, simple landscapes, animal pictures, second-hand beautiful items. In the Nature course, the growth, reproduction and development conditions of fruit and non-fruit trees growing in the environment where the school is located; insects such as locusts, ants and bees that appear in various seasons and birds such as storks, swallows and sparrows; aquatic animal species such as fish, frogs and crabs are studied in various aspects (MoNE, 1930). In other words, the starting point of both paintings from nature and the Nature course is nature, and the subjects studied in the Nature course constitute references to the works of paintings from nature.

Sketches cover simple depiction of the shapes examined in the Nature and Material courses in a simple form of schematics and plans. In the decorative paintings, old items are decorated with shapes inspired by animal and plant pictures made from nature and geometric shapes (MoNE, 1930, p.113). In this case, it can be said that the subjects of the Nature and Material course are significant in determining the works of the Painting-Handicraft course. At this point, it is necessary to remind the following statement in the "Introduction" section of the 1926 Curriculum: "A special value has been attributed to the Painting-Handicraft courses .... especially as an important educational element that will revive other courses" (MoNE, 1930, p.4). In other words, Painting-Handicraft is a course that reinforces the Nature and Material courses and reinforces them by the implementation of what is learned in those courses.

Within the scope of industrial painting works, a machine part or tools and equipment used in the visited factories, shops like joineries and blacksmiths are drawn in the form of simple sketches. Similarly, after examining plants and animals in the Nature course, they are depicted in the notebook as simple pictures and sketches. Educational trips to factories around schools, agricultural and industrial schools, repair shops and garages are organized in the Material course, the subjects of which are related to the fields of physics and chemistry. Furthermore, the working mechanisms of leverages and simple machines are examined; Students draw their experiences with sketches and pictures in their notebooks after their visits related to the teaching of vehicles such as automobiles, tractors, cameras and telephones which operate with forces such as wind, water, electricity and light (MoNE, 1930). Besides the Nature course, all of these activities, especially in the Material course, are almost identical to the industry paintings which are among the topics of the Painting course in the Painting-Handicraft curriculum in terms of content.

In addition to the Painting discipline, the Handicraft discipline is also associated with the Nature and Material courses. In the Handicraft course, students are required to make materials such as leverages, handbarrows, pulleys, tumblers used in education with matters such as mud, clay, plaster, wax, paper, cardboard, timber and wood. The main objective here is to teach the working mechanisms of the tools and equipment used in school (MoNE, 1930, pp.120-127). Given the areas of use of these materials and the main reason for the performance of these works, it can be said that the teaching materials in the Nature and Material courses create sources for the handicraft works and that a better understanding and comprehension of the subjects of the Nature and Material course is, in turn, enabled by the handicraft works.

Findings Regarding the Third Sub-Purpose: How is the association between the Art-Craft and Nature Studies courses in the 1936 Curriculum?

Just as in the 1926 Curriculum, the relations between the second period courses are emphasized in this curriculum. In this respect, the expressions of "the Art-Craft course will take its subjects .... from all courses in the second period" and "the Art-Craft course is an assistant to other courses in the widest meaning" are included in the curriculum of the Art-Craft course (Ministry of Culture [MoC], 1936, p.187).

Based on the explanations, it is understood that there is a compulsory association between the Art-Craft and the Nature Studies courses. Accordingly, it can be said that the "Paintings from Nature", "Industrial Painting" and "Decorative Paintings" works in the Painting course are associated with the Nature Studies course.

Paintings from Nature works start from the second period with the Nature Studies course in the curriculum. Within the scope of paintings from Nature works, creatures such as branches, flowers, butterflies, insects and leaves, which are part of nature, are drawn individually or as a whole in landscapes such as country, street, and forest (MoC, 1936, pp.194-195). Animals such as sheep and goats, hunting animals and fish studied in the "Food we receive from animals" unit and vegetables and fruits studied in the "Vegetable foods" unit included in the Nature Studies course can also be the subjects of painting works from nature.

In the industrial painting works in the second period, the sketches of the tools and machines examined in the other courses are performed. Machines such as mills, meat grinders, carpenter workshops, pulleys and spinning wheels are also studied in the Nature Studies course. In decorative paintings, some objects are decorated based on natural motifs such as flowers and leaves in nature (MoC, 1936, pp.194-195). In addition, trips are made for educational purposes to personally observe nature or events in the Nature Studies course. The things observed during these trips are drawn in the form of drafts and sketches (MoC, 1936, p.114). This reveals the intrinsic association of the Nature Studies course with the Painting course by taking visual notes.

The "Craft" part of the Art-Craft course can also be associated with the Nature Studies course through "gardening" because vegetables and flowers are planted in pots prepared in advance within the scope of gardening; trees are planted in the garden; poultry, bees, birds and other animals in school are cared (MoC, 1936, pp.197-198). In parallel with this, school practice gardens, school poultry houses, aquariums, terrariums and insectariums are prepared in the Nature Studies course (MoC, 1936, pp.116-117). In other words, the work done in the garden in the Craft course creates a source for the teaching materials of the Nature Studies course; therefore, students learn about animals and plants while gaining value about the contribution of these products to the national and local economy.

Findings Regarding the Forth Sub-Purpose: How is the association between the Art-Craft and Nature Studies courses in the 1948 Curriculum?

In the introduction section of the curriculum– as in the previous two programs– it is stated that the subjects taught in separate disciplines in the second period should be studied by associating with each other (MoNE, 1948, p.21). In this respect, it is expressed in the Art-Craft curriculum that "the Art-Craft course will take its subjects .... from all courses in the second period" and "the Art-Craft course is an assistant to other courses in the widest meaning" (MoNE, 1948, p.219). Although the subjects through which this practice as the general teaching approach of the curriculum is to be performed for these two courses are not specified, the associated subjects of the two courses have been tried to be identified depending on this approach. Painting works identified to be associated with the Nature Studies course are "Paintings from Nature" and "Craft paintings".

While the "Living and Non-Living Beings Around Us" unit at the Grade 4 of the Nature Studies course focuses on plants and animals, in the Painting course works, branches, flowers, butterflies, insects and leaves that are part of nature are depicted separately or in their natural environment. Again, tools such as leverage and wheel are emphasized in the "Tools That Make Our Work Easier" unit at the Grade 4 of the Nature Studies course, the tools and items examined in other courses are drawn in the form of sketches in craft paintings of the Painting course works (MoNE, 1948). In addition to these, the following expressions, which clarify the way in which the feedback and corrections are made regarding Art-Craft works, are also significant in revealing the association between the two lessons:

The teacher will reinforce the child's knowledge and opinion on the subject, and explain the role of the subject and the laws of nature affecting the subject. In a sense, the task of the teacher in the Art-Craft course is to teach nature. For example, "The leg of table is short; if we lean on this table, it will bend over one side", "The stem of the flower doesn't stand straight like that. It will obviously bend due to the weight of the flower" (MoNE, 1948, pp.223-224).

The aforementioned examples are directly related to the topics of weight and balance studied within the subject of "Gravity and its effects" in the Grade 5 "Nature Force and Us" unit of the Nature Studies course.

Apart from the Painting course, when the content prepared within the scope of "Craft" works is examined, it is understood that some of the craft works are directly or indirectly associated with the subjects studied in the Nature Studies course. Tools and equipment to be used in other courses are prepared in some craft works. For example, students prepare collections from objects such as stones, flowers, insects, trees and leather and etc. found in their immediate surroundings. Tools and equipment used to catch living things in the collections are made in metalworking; materials such as partitioned stone collection boxes, standard boxes, frames and butterfly drying boards required for the preservation and display of the products in the collection are also made in woodworking. Moreover, sundials and the color circle also called Newton's wheel, pulleys and spinning wheels are also made within the framework of craft works (MoNE, 1948, pp.232-234). Especially these materials are used in the teaching of Physics subjects covered in the Nature Studies course.

In the Nature Studies course, students express the subjects studied both in writing and in drawing; after students summarize the subjects studied in the course, they support and enrich these summaries by drawing drafts, sketches and graphics. In addition, during the trips and observations organized within the course, drawings in the draft and sketch styles are made (MoNE, 1948, pp.160-161). In sum, students acquire the habit of taking visual notes by means of painting in order to make their learning more permanent in the Nature Studies course.

Findings Regarding the Fifth Sub-Purpose: How is the association between the Art-Craft and Science and Nature Studies courses in the 1968 Curriculum?

In this curriculum, the collective teaching practice adopted in the first period since 1926 was also embraced in the second period. In this framework, all courses are gathered around the axis of the two courses determined as pivots. One of the pivot courses is Social Studies (Sosyal Bilgiler) and the other is Science and Nature Studies (Fen ve Tabiat Bilgileri). According to the collective teaching practice, expression and skill lessons, including the Art-Craft course, are taught in association with the pivot courses (MoNE, 1968, p.18). In the Art-Craft course curriculum, it is stated that "Provided that the main objective of the Art-Craft course which is the teaching of Art and craft is not forgotten, ... some subjects will be taken from other courses, daily events, and students' own lives in the second period" (MoNE, 1968, p.217). Although there is no explanation for the links to be established with the Art-Craft course in the Science and Nature Studies course curriculum, how the two courses are to be associated with each other within the framework of the subjects of Kemalism introduced to the curriculum in 1986 is described. In contrast, since any subject studied in the Science and Nature Studies courses constitutes one of the subjects of the Painting course due to the nature of the curriculum, it is possible to establish association between the two courses through "Painting from Nature" and "Craft paintings".

The Grade 4 units of "Let's Investigate the World of Living Beings", "Animals in the World of Creatures" and the Grade 5 unit of "Our Sources of Richness" in the Science and Nature Studies course focus on plants and animals in various aspects (MoNE, 1968). They can be associated with paintings from nature studies in which plants such as leaves, branches, flowers and animals such as insects are drawn. The "Matter and Energy" unit of the Science and Nature Studies course examines pulleys, wheels, levers and

gear wheels that make up machines. Craft paintings also cover simple sketch-style drawings of tools and items examined in other courses (MONE, 1968). Therefore, these items examined in the Science and Nature Studies course can also be a source for craft paintings.

Students draw their observations in the form of drafts and sketches during the field of educational trips in the science course (MoNE, 1968, p.85). In addition, regarding the learning and teaching process in the Art-Craft course curriculum, it is stated that "… the teacher will reinforce the child's knowledge and opinion on the subject; the teacher will explain the role of the subject and the laws of nature affecting the subject" (MoNE, 1968, p.219). In short, when drawing pictures on natural sciences, it is necessary to benefit from science at the points that form the essence and theoretical dimension of the subject.

In the craft course, collections of stones, insects, flowers, trees, leather and other products available in the neighborhood where the school is located are prepared in the subject of "course craft tools and equipment" studied in the second period classes; sundial and color circles are made. In order to preserve the objects in the collection, items such as boxes and frames are made in woodworking (ağaç işleri); the tools and equipment necessary for catching insects and butterflies to be included in the collection are also made in metalworking (maden işleri) (MoNE, 1968, pp.227-229). So, at this point, the 1948 and 1968 curriculums appear to be the same.

While this curriculum was in effect, with the decision of the Board of Education dated on April 24, 1986, a clear association was made between the two courses due to the subjects of "Kemalism". Accordingly, in the Grade 4 within the scope of "Atatürk's Life" and "Atatürk's Personal Characteristics and Various Aspects", students are required to draw pictures based on memory and imagination in the Art-Craft course about the subjects studied in the "Our World and the Sky" unit of the Science course. In the Grade 5, students are required to draw pictures based on memory and imagination about the subjects in the "Our Wealth Resources" unit of the Science course for teaching the subject of "National Power Elements in Kemalist Thought" (Ministry of National Education, Youth and Sports, 1988, pp.653-654).

Findings Regarding the Sixth Sub-Purpose: How is the association between the Art-Craft and Science courses in the 1992 Curriculum?

The deep-rooted understanding since almost 1926 that the Art-Craft course had been seen as an auxiliary and complementary in the teaching of other courses was abandoned with the acceptance of the 1992 Curriculum. Regarding this issue, it is stated in the curriculum that "…The painting course should not be considered as the time reserved for activities such as making and repairing tools and equipment related to other courses" (MoNE, 1992, p.8). In other words, the signals of a change regarding the status of the Art-Craft course in the program have been given. There is no statement that the implementation of an interdisciplinary approach is implemented in any section of the current curricula of the Art-Craft and Science courses issued in 1992.

Findings Regarding the Seventh Sub-Purpose: How is the association between the courses in the Science Curriculum of 2000 and the Art-Craft Curriculum of 1992?

While the curriculum of the Art-Craft course, which was accepted in 1992, was in effect, the new curriculum of the Science course was in effect in 2000. It was not mentioned that an interdisciplinary approach should be implemented in the curriculums of both courses in general or that association should be made between the two courses in particular.

Findings Regarding the Eighth Sub-Purpose: How is the association between the courses in the Visual Arts Curriculum of 2006 and the Science and Technology Curriculum of 2005?

Studies, subjects and activities required to be performed by students in many of the curricula prepared after the 2000s have been determined in accordance with the learning outcomes. Yet, curricula of some

courses include pre-framed units and subjects. The Science and Technology course is among such courses. However, the order of content in the Visual Arts course has been made in such a way that it may be structured by teachers together with the student in line with the learning outcomes.

Although there is no reference to the Visual Arts course in the Science and Technology course curriculum accepted in 2005, the association between the two courses is mentioned in the sample activities of the Visual Arts course curriculum. For instance, the learning outcomes of "Distinguishes natural and artificial (produced) objects" and "Recognizes that s/he can benefit from natural and artificial objects in his/her visual studies" within the learning domain of "Figuring in Visual Arts" at the Grade 4 Visual Arts course are suggested to be associated with the learning outcome of "Distinguishes natural, processed and artificial matter" within the learning domain of "Matter and Change" in the "Getting to Know the Matter" unit of the Science and Technology course (Commission, 2006, pp.47-49). Within the framework of this learning outcome of the Science and Technology course, it is mentioned that natural materials such as stone, soil, rock, wood, copper, silver, cotton, leather and clay are processed and transformed into artificial substances; natural substances are used in the production of many materials such as magazines, books, fabrics, sweaters, vases, pots, plates today (Commission, 2008, pp.100-101). In addition, although not specified in the curriculum, it is possible to associate the learning outcome of "Realizes that colors vary according to light" of the learning domain in the Grade 4 Visual Arts course Figuring in Visual Arts with the subjects in the "Light and Sound" unit of the Science and Technology course. However, it cannot be said that directly associated subjects are encountered at the level of Grade 5.

Findings Regarding the Ninth Sub-Purpose: How is the association between the Visual Arts and Science courses in the 2013 Curriculum?

With this curriculum, the Science course started to be taught from the 3rd grade of primary school and the curriculums of both courses were accepted in 2013. In the curriculum, it is reported that the activities prepared for the learning outcomes of the Visual Arts course should be linked to other courses, and for this purpose it is stated that "Cooperation with other fields should be made for students to achieve the learning outcomes in the curriculum. In this sense, activities can be carried out in cooperation with many fields such as Turkish, Social Studies, Science, Mathematics, Music, Physical Education and Sports" (MoNE, 2013a, p.6). However, the activities and the ways to create such associations were not been officially announced; this task was left to the responsibility of the teacher. At this point, the interrelated learning outcomes of each course were analyzed comparatively.

Accordingly, within the context of one of the objectives of the Visual Arts 3rd grade curriculum "Uses geometric and organic forms in his/her observation-based drawings" and one of the objectives of the Science curriculum in the unit "The Shape of the World" "Expresses that the shape of the World is like a sphere", students are expected to express that the shape of the world is like a sphere (MoNE, 2013a, p.13; 2013b, p.6). In other words, with this objective, awareness is raised about the sphere as a three-dimensional form. While the three-dimensional form of the Earth is a sphere, its image on a two-dimensional plane is a circle. In the stated objective of the Visual Arts course, students are expected to use geometric forms in their drawings. Thus, it is possible to make connections between these two courses by associating geometric shapes with each other.

In the fourth grade, the links between these two courses can be established through the theme of "environment". Correspondingly, connections can be created between the two objectives "Understands the importance of mutual interaction between human and environment" and "Discusses how to prevent environmental pollution" within the unit "Human and Environment Relationship" in the Science course curriculum (MoNE, 2013b, p.13) and the objective "Uses the steps of shaping while constructing the work of visual arts" in the Visual Arts course curriculum (MoNE, 2013a, p.15). Students who gain awareness of

environmental pollution in the Science course can be engaged in performing visual arrangements about the environment within the Visual Arts course.

Findings Regarding the Tenth Sub-Purpose: How is the association between the Visual Arts and Science courses in the 2018 Curriculum?

As in the 2013 curriculum, it is also reported here with the same statement that there should be association between the Visual Arts course and other courses including the Science course. In the curriculum, the units, subjects or learning domains that will be associated with the Visual Arts course are included separately for each grade. In addition, within the framework of interdisciplinary relations, it is stated that the Visual Arts course in all grades can be associated with the appropriate learning outcomes of other courses (MoNE, 2018a, p.18). In this direction, the two learning outcomes of the Grade 3 in the curriculum are associated by means of the "Shape of the World" subject of the Science course. Within the subject, it is taught that the earth has the form of a sphere and consists of layers (MoNE, 2018b, p.15). The associated learning outcomes of the Visual Arts course with this subject are as follows:

a) G.3.1.4. Uses geometric and organic forms in his/her drawings based on observation.

b) G.3.1.6. Performs three-dimensional work using different materials by adding, removing, applying internal and external force (MoNE, 2018a, pp.18-19).

In the first of these learning outcomes (the Article a), geometric and organic forms of objects such as flowers, leaves and seashells in the surrounding area are emphasized in drawings based on observations; in the second one (the Article b), three-dimensional works are performed with waste materials such as wood, metal, fabric, and balloons (MoNE, 2018a, pp.18-19). As it is known, the sphere which is a three-dimensional form is a circle in its geometric shape when considered in two dimensions. Therefore, in order to achieve the learning outcome specified in the Article a, it is possible for students to examine objects in the sphere form such as oranges, balls, watermelons and marbles, which are likened to the world in terms of shape in both curriculums and textbooks. In line with the other learning objective (the Article b), similar to inflating a balloon or a ball by applying internal force, it can be stated that materials such as clay, mud, play dough or dough will be transformed into spheres by applying external force in the palm and that they can be used as artistic units in visual art works. Thus, the association between the shape of the world and the learning outcomes of the course can be established.

In the 4th grade, connections can be established between the two courses through the theme of "extravagancy" or "saving" because two objectives are addressed within the context of the topic "Conscious Consumer" in the unit "Human and Environment" in the Science course. These are "Becomes careful about saving in the use of resources" and "Recognizes the importance of the resources necessary for life and recycling". Within the context of these objectives, the concepts of "resource use, saving, thriftiness and recycling" are explored (MoNE, 2018b, p.24). Correspondingly, in line with the objective "Uses the steps of shaping while constructing the work of visual arts" in the Visual Arts course, the issue of "extravagancy" is addressed (MoNE, 2018a, p.21). Therefore, after making students more conscious of the issue of saving in the Science course, awareness can be increased by getting students engaged in visual art activities on the issue of extravagancy.

4 | Discussion & Conclusion

In this article, the interaction of the Visual Arts and Science courses was examined in terms of interdisciplinary associations in primary school curriculums implemented from 1923 to 2020. In light of the data obtained in the study, the following results have been reached:

1) Interdisciplinary associations are clearly stated in some of the past primary school curriculums, whereas they are not specified others. While this approach was envisaged in the primary school

curriculums of 1926, 1936, 1948, 1968 and the Visual Arts course curriculums of 2006, 2013 and 2018, such implementation was not mentioned in the curriculums issued in between 1992 and 2006.

2) No reference has been made to the manner in making connections with the Art-Craft/Visual Arts course in any Science curriculum implemented since the Republic. However, the associations to be made with the Science course are mentioned in the Painting/Painting-Handicraft/Art-Craft/Visual Arts course curriculums dated in 1924, 1926, 2006, 2013 and 2018 and in the teaching of the subjects of Kemalism in 1986.

3) The main point of the associations between the two courses consists of paintings from nature, craft drawings and craft studies at technical level from 1926 to 1992. To put it more clearly, the paintings made in this period are based on the nature and natural sciences such as flowers, trees, animals that the student sees in his immediate surroundings and related to the working principles of vehicles such as automobiles, tractors, cameras, telephones and the subjects of the physics and chemistry relevant to them. The subjects studied in the Science course become the subjects of the Art-Craft course; they are sometimes well-known landscape paintings, sometimes in the forms of schemes, plans and sketches by reducing things into simple drawings or in other times in the forms of decorations by transforming them into decorative painting. In addition, the educational and teaching materials such as handbarrows, leverages, pulleys, wheels, gear wheels, tumblers, collection boxes, sundial and color wheel used in the teaching of Science courses are also used in the "Handicraft or Craft" discipline of the course and are shaped by craft techniques and materials such as mud, clay, paper, cardboard, wood and metal.

4) Between 1926 and 1992, the Art-Craft course was largely a course that served the purposes of better grasping the subjects in the Science course or preparing the course materials in this course. Therefore, it can be said that the association between the two courses was established in a one-way direction only from the Science course to the Art-Craft course in these years. However, in a true interdisciplinary association, it can be said that the interaction is expected to be two-way, that is, mutual and multi-dimensional. Basically, it is possible to attribute this situation to the purposes of raising individuals "who can use knowledge and skills in daily life" and "who can provide benefits to their school, family, environment and ultimately society" which were dominant objectives in the curriculums of that period.

5) When the course contents are examined, it is understood that the associated and complementary learning outcomes that will enable the two courses to be conducted interactively in the curriculums after 2006 are limited. For example, when the learning outcomes in the Visual Arts course curriculum of 2006 are compared with those of the Science course, it is seen that while a limited number of connections can be made at the level of the Grade 4, it is unlikely to encounter associated subjects in the Grade 5. As a matter of fact, the result of the research carried out by Güven and Hamalosmanoğlu (2012) also supports this finding. In the research, it was understood that the environmental activities taught in the Grade 4 of the Science and Technology curriculum of 2005 were associated with the same learning outcome in the 2006 Visual Arts course curriculum. This learning outcome is similar to those stated in the curriculum of the Visual Arts course: "Distinguishes natural and artificial objects" and "Enjoys exhibiting their work and watching the work of their friends", which can be adapted to each class.

6) It was understood that the Science course and Visual Arts course are associated with each other through geometric shapes in the third grade and through the environmental issues in the fourth grade in the 2013 and 2018 curriculums. In these curriculums, these two courses were found to be associated with each other through one or two objectives in the 3rd and 4th grades. While the connections between the two courses were stronger in older curriculums, they were weakened after the 2000s. In the study conducted by Karakuş et al. (2017), it was found that the Visual Arts course ranked fourth among the courses that Science teachers made connections; that is, it was not even among the top three courses.

The limited number of topics or objectives found to be related to each other in these two courses may be one of causes of this result. Moreover, in the study of Karakuş and Aslan (2016), it is determined that in interdisciplinary practices, teachers face problems such as insufficient course time, excessive number of learning outcomes and lack of sufficient activities that can be associated with other courses (Karakuş & Aslan, 2016). One of the reasons why teachers experience difficulties in creating connections between the courses can be said to be the limited number of the points of connection between these courses or the limited number of the shared themes. At the same time, it is understood that the levels of pre-service science teachers' ability to apply this approach in accordance with the activities given to them in the new curriculum is at the moderate level (Cura & Yalman, 2019). This result makes us think of two possibilities. One of them is that the level of the topic or objective is over the level of the student and the other one is that during the undergraduate education of pre-service teachers, they are largely educated in a discipline-centered manner and as a result their awareness of interdisciplinary approaches cannot be raised enough.

In the studies conducted, it is identified that with the help of the interdisciplinary approach, transfer of knowledge is maintained by combining knowledge and skills belonging to different disciplines, knowledge is made to be applied in daily life, meaningful and permanent learning is achieved, and students become more willing to learn (Yarımca, 2011; Karakuş et al., 2017; Cura & Yalman, 2019, Kaçar, 2012). It is concluded that the science teaching integrated with the visual art activities carried out by Türkoğuz (2008) and the interdisciplinary teaching approach implemented in science education by Korkmaz and Konukaldı (2015) positively affected the academic achievements and attitudes of the students. Similarly, in the study of Kaçar (2012), it is proved that the science academic achievements, scientific creativity and science learning attitudes of the students have increased in the courses implemented through the problem-based teaching method integrated with the visual arts in the Science and Technology course. In addition, it is understood in the aforementioned study that students learn the concepts of science better, are able to embody abstract concepts of science, to establish cause and effect relationship between events, learn the types of visual art, begin to seek art in science and science in art, realize that science and art benefit from each other, and have increased interest in science. In contrast, the study conducted by Alkış Küçükaydın (2019) highlights that the primary school students of the Grade 4 have difficulty in associating what they have learned in science class with daily life.

All these results indicate that as the relevant points between the courses increase, the attitudes towards and interests in the courses can change in a positive direction. Without doubt, as people cannot internalize the concepts they cannot understand or make sense of, they may have difficulty in incorporating those concepts or experiences into their lives. In particular, it is thought that the concretization of science subjects, which are thought to contain socially more complex or abstract concepts, and reduce them to daily life and address them from the perspective of other disciplines will break down some prejudices developed against this field and remove the obstacles to learning. It can also be said that visual arts course should be used more frequently in teaching science lessons, especially in this interaction. Similarly, in visual arts education, it is important to realize the scientific, social and historical structure behind a so-called very ordinary event in daily life for the art to occupy more space in the lives of individuals. In this way, it is thought that individuals who receive aesthetic pleasure from the works and who can make arrangements to combine aesthetics and science by blending art and science will be educated.

However, while in the 2018 Curriculum, which is currently in practice, the Visual Arts course have 17 learning outcomes at the Grade 3 and 16 learning outcomes at the Grade 4 and the Science course have 36 learning outcomes in the Grade 3 and 46 learning outcomes in the Grade 4, establishing association(s) between one or a few of them is a serious issue that needs to be focused because many subjects in Science courses can be a material for the Visual Arts course. For this reason, it is recommended that the teaching curriculums be reviewed in terms of interdisciplinary relations between the Visual Arts and Science courses. Furthermore, it can be said that examining the associations of these courses with other courses is also important for demonstrating the level of implementation of the interdisciplinary approach in the curriculum.

Finally, in the study of Karakuş and Aslan (2016), it is stated that classroom teachers believe that the activities related to the interdisciplinary teaching approach in their curriculum are limited and they have difficulty in establishing relationships between courses (Karakuş & Aslan, 2016, p.1335). Based on both this reality and the result of the weak association between the Visual Arts and Sciences course in the present study, it is recommended to prepare theme, topic or problem-centered activity guidebooks combined with other disciplines essentially for primary schools. Since Science and Visual Arts courses are given by classroom teachers in primary schools, it is believed that it will be much easier for the courses to be studied around a single theme by integrating courses at this level compared to the secondary school level.

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RESEARCHERS' CONTRIBUTION RATE

The contribution rate of the to this article first author is 75%, and the contribution rate of the second author is 25%.

CONFLICT OF INTEREST

The authors declare that the study has not any conflicts of interest with respect to the research and/or authorship.

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Adaptation of the Coronavirus Anxiety Scale in Turkish for the Higher Education Context: A Validity and Reliability Study

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Abstract

Since the onset of the coronavirus pandemic, several studies in medical fields have been conducted; however, the impact of the disease on individuals' psychology has not been covered enough. The measures taken to prevent the spread of COVID-19 have brought various restrictions both in social life and in areas such as education, economy and health. Due to the pandemic and subsequent restrictions, students continuing to higher education are likely to experience some psychological problems such as anxiety and depression. Therefore, studies regarding the anxiety levels of students should be carried out. In line with this need, the aim of the study is to adapt the Coronavirus Anxiety Scale (CAS) into Turkish in the context of higher education. The sample consisted of 513 undergraduate and graduate students. The data collection tools were the CAS and the State-Trait Anxiety Inventory (STAI). The results of the confirmatory factor analysis (CFA) supported the factor structure of the original scale and yielded an excellent fit for all the indices. The original factor structure of the CAS was also confirmed, and the scores significantly correlated with gender, state-anxiety and health status of the participants. The scores obtained from the adapted scale were found highly reliable and valid. The increase in the spread of COVID-19, especially after the mutations of the virus have emerged, indicates that its psychological and behavioral consequences and effects might last longer. To this end, the study has valuable implications for higher education policy makers, university administrators and teaching staff.

Keywords: coronavirus anxiety, higher education, scale adaptation, the CAS, the STAI

Koronavirüs Kaygı Ölçeği'nin Yükseköğretim Bağlamında Türkçe'ye Uyarlanması: Geçerlik ve Güvenirlik Çalışması

Öz

Koronavirüs salgınının başlangıcından bu yana, tıp alanında çeşitli çalışmalar yapılmış; ancak, salgının insan psikolojisi üzerindeki etkilerine ilişkin yapılan çalışmaların sayısı nispeten sınırlı kalmıştır. COVID-19'un yayılmasını engellemeye yönelik alınan önlemler hem sosyal hayatta hem de eğitim, ekonomi ve sağlık gibi alanlarda çeşitli kısıtlamaları beraberinde getirmiştir. Salgın ve devamında getirilen kısıtlamalar nedeniyle, yükseköğretime devam eden öğrencilerin de diğer bireyler gibi kaygı ve depresyon gibi bazı psikolojik problemler yaşama olasılığı yüksektir. Dolayısıyla öğrencilerin kaygı düzeylerine ilişkin çalışmalar yapılmalı ve mevcut durumları belirlenmelidir. Bu ihtiyaca paralel olarak, çalışmanın amacı, Koronavirüs Kaygı Ölçeği'nin (KKÖ) yükseköğretim bağlamında Türkçeye uyarlanmasıdır. Araştırmanın örneklemi 513 lisans ve lisansüstü öğrenciden oluşmaktadır. Araştırmada, veriler KKÖ ve Durumluk-Sürekli Kaygı Ölçeği (DSKÖ) kullanılarak toplanmıştır. Doğrulayıcı faktör analizi sonuçları, orijinal ölçeğin faktör yapısını desteklemiş ve uyarlanan ölçekten elde edilen puanları geçerlik ve güvenirlik düzeylerinin yüksek olduğu bulunmuştur. Ayrıca, analiz sonuçları KKÖ'nün orijinal faktör yapısını doğrulamış ve puanların, katılımcıların cinsiyet, durumsal kaygı ve sağlık durumları ile anlamlı bir ilişkiye sahip olduğunu göstermiştir. Özellikle virüsün mutasyonları ortaya çıktıktan sonra COVID-19'un yayılmasındaki artış, psikolojik ve davranışsal sonuçlarının ve etkilerinin daha uzun sürebileceğini işaret etmektedir. Bu doğrultuda, uyarlanan ölçeğin yükseköğretim politika yapıcıları, üniversite yöneticileri ve öğretim personeli için faydalı olacağı vurgulanmaktadır.

Anahtar kelimeler: Koronavirüs kaygısı, yükseköğretim, ölçek uyarlama, KKÖ, DSKÖ

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1 | Introduction

The coronavirus disease 2019, or widely known as COVID-19, is an infectious disease that appeared first in Wuhan, China, in late December 2019 and rapidly spread across the world. Due to the serious increase in the number of cases and causalities observed throughout the world, the World Health Organization (WHO) declared COVID-19 as a pandemic on 11 March 2020. WHO has stated that there are no preventive or curative medicines for COVID-19, but "ongoing clinical trials of both western and traditional medicines" (World Health Organization, 2020, May 4). According to the Strategic Preparedness and Response Plan published by WHO in April 2020, clinical case fatality is roughly "over 3%, increasing with age and rising to approximately 15% or higher in patients over 80 years of age" and "underlying health conditions that affect the cardiovascular, respiratory and immune systems confer an increased risk of severe illness and death" (World Health Organization, 2020, p. 3). To this end, most governments have taken precautionary measures against COVID-19 in order to minimize the social and economic damages of this pandemic.

Measures to prevent the spread of COVID-19 have resulted in drastic changes in educational, social, economic and sanitary practices. The initial stage started with uncertainties, during which the governments could not take drastic measures about their education systems. After the initial shock wave, decisions about the courses, exams, school days, curricula started to be taken, each time with a clearer understanding of the situation. Governments around the world ordered institutions at all levels to cease face-to-face educational activities and to use online methods for teaching (Daniel, 2020). Most of the institutions had little or no time to get prepared for such a system.

Apart from the serious threats the COVID-19 pandemic posed to individuals' physical health, it has provoked a range of psychological issues such as fear, anxiety and depression (Huang & Zhao, 2020; Qiu et al., 2020). Individuals have often been exposed to information surge regarding the pandemic about the dramatic increase in the number of cases and death rates, as well as ways to protect themselves and prevent the spread of disease (Šrol et al., 2020). Indeed, the studies conducted so far reported that people at all levels (individual, social and international) have been subject to a wide range of psychological impacts (Wang et al., 2020). Previous studies on endemics such as SARS and MERS also revealed that people were prone to psychological problems during emergency states (Chang et al., 2004; Lee et al., 2018; Lu et al., 2006; McAlonan et al., 2007). To this end, we argue that the COVID-19 pandemic, affecting nearly all the countries around the world, has had psychological consequences, one of which is the increase in the level of anxiety.

During the pandemic, it is of vital importance to take precautions regarding the individuals' mental state. Anxiety, one of the most basic and universal emotions, is "an emotion characterized by feelings of tension, worried thoughts and physical changes like increased blood pressure" (American Psychological Association, n.d.). The concept is also described as a state of arousal against a non-objective danger, manifested by bodily, emotional and mental changes, and is also summarized as anxiety or anxious expectations about the future (Lewis & Aiken, 1976). Spielberger (1996) suggested that anxiety is a multidimensional construct and can be explained in two dimensions: state and trait anxiety. State anxiety occurs when a person makes a mental assessment of some types of threats in line with their own perceptions (Spielberger, 1983). State anxiety increases when stressful life events are intense, and it decreases when stressors disappear (Endler & Kocovski, 2001). Trait anxiety, on the other hand, is a relatively permanent individual difference and a permanent personality trait in anxiety tendency and the possibility of future anxiety (Spielberger, 1972). COVID-19 anxiety can be also regarded as a state anxiety, since it is based on a specific stressful event.

The relationship between COVID-19 and some other psychological constructs have been studied in several countries since the start of the pandemic (Duan & Zhu, 2020; Greenberg et al., 2020; Holmes et al., 2020; Tan et al., 2020; Zandifar & Badrfam, 2020). Since the first case due to COVID-19 occurred on 11 March 2020 in Turkey, several studies have been conducted (Aktoz et al., 2020; Erdeve et al., 2020;

Günertem et al., 2020; Yavuz & Ünal, 2020). For instance, fear of COVID-19 was examined by a seven-item scale which was also adapted into Turkish by Haktanir et al. (2020) and Satici et al. (2020). There are still few studies investigating COVID-19 in terms of its psychological effects (e.g., Akdeniz et al., 2020; Bostan et al., 2020; Çetin et al., 2020; Özdin & Bayrak Özdin, 2020; Tutku et al., 2020). In order to offer a reliable and valid scale to measure the psychological effects of COVID-19 on the public in the Turkish context, we aimed at adapting the Coronavirus Anxiety Scale (CAS) developed by Lee (2020).

At parallel time frames, the CAS was adapted into Turkish through two other studies which focused on the general Turkish population (Biçer et al., 2020; Evren et al., 2020). Moreover, the tools used for convergent validity and the expressions used in the translated scales vary among these studies. These differences might add further evidence regarding the proof to the scale scores' validity and contribute to the explanation of the psychological construct that is assessed.

Present Study

In the process of the pandemic, the dramatic changes occurred in the lives of both teachers and students, and psychological effects took a back seat. Thus, people have been likely to avoid recognizing the psychological effects of the pandemic. The teachers have been struggling to adapt to a new way of teaching with technologies, while students, along with getting used to online learning, have been trying to understand and decide "what will happen next?". All students have been dragged away from their social lives overnight and some other students have been on the verge of starting a career or making career choices. Most of them, including the ones at higher education institutions, worry about the long-term disadvantages of COVID-19 and feel confused about their future. Previous research revealed that health-related emergencies could have many psychological effects that can be expressed as anxiety and fear on university students (Mei et al., 2011). To this end, we can assert that the concerns and fears about the negative effects of the illness on academic deeds might influence the mental health of students (Immediate Psychological Responses.), and the search for a "normal" could be a cause of such psychological problems as depression and anxiety. The present study aims to adapt the CAS into Turkish to be used in higher education settings. Therefore, the scale can be used for the assessment of dysfunctional anxiety of the university students caused by the COVID-19 pandemic.

2 | Method

Participants

In this study, online survey data from 513 undergraduate and graduate students were collected in the Fall semester of the 2020-2021 academic year. The undergraduate participants were enrolled at a faculty of education, and the graduate participants were studying at the department of educational sciences at a state university in Turkey. In order to obtain similar participants with the original scale development group, the participants were selected from the group of people who had spent at least one hour during the past three weeks thinking about or watching media about COVID-19. The ones who had not spent enough time thinking or getting information about the coronavirus excluded from the data set (n=11). Convenient sampling was utilized, and the study group was composed of 70.3% women and 29.7% men aged between 18 and 54 ($\underline{x}$=23.82).

The sample was randomly divided into two groups as Sample 1 and Sample 2 for the analysis. The data of Sample 1 (n= 249) was used to perform the confirmatory factor analysis (CFA). The data obtained from the Sample 2 (n=253) was used for correlational analysis providing evidence for validity and variance analyses.

The participants from different cities were included in the study group to gain maximum possible representation. Most of the participants live in big cities where the population is more than 750.000 (n= 199, 39.6 %), followed by cities (n= 141, 28.1%), provinces (n= 95, 18.9%), villages (n= 58, 11.6%) and towns (n=9, 1.8%). The majority of the participants stated that their health conditions were 'good' (n=292,

58.2%) and very good' (n=184, 36.7%), while 4.6 % (n= 23) of the participants reported that their health was at a moderate level, 0.6% (n=3) reported health problems.

Instruments and Adaptation Procedure

An adapted Turkish version of the Coronavirus Anxiety Scale (CAS) and the State-Trait Anxiety Inventory (STAI) were used for data collection. The data were gathered online via Google forms. In order to collect data, a few measures were conducted. The first measure was background information form. In this form, participants were asked to report their gender, age, current residency, health status and whether they spent at least one hour during the past three weeks thinking about or watching media about the coronavirus.

State-Trait Anxiety Inventory: Spielberger (1983) developed the STAI in order to further investigate state and trait anxiety. It is a self-report scale and consists of two scales, and each scale includes 20 items. In this study, the Turkish version of the STAI adapted by Öner and LeCompte (1983) was used to get evidence for validity proof for the adapted anxiety scale. In many studies, the psychometric qualities of the STAI have been investigated and the studies have shown that the scale has excellent internal consistency and average Cronbach alpha value as 0.89. Also, STAI-Trait has evidenced perfect test-retest reliability with average Cronbach alpha value estimated as 0.88 (Barnes, Harp and Jung, 2002). Despite the general consistency of the STAI, the STAI-State version has been reported as having lower temporal stability due to the nature of the measured construct. Furthermore, there is much evidence that shows the STAI has convergent and discriminant validity (Spielberger, 1983). In this study, the STAI was used to get a validity proof for the adapted anxiety scale. In other words, the STAI and the CAS were developed to measure anxiety and the STAI was preferred here in order to investigate the validity of the adaptive scale due to its high psychometric qualities.

Coronavirus Anxiety Scale: The original scale was developed by Lee (2020). The scale included 20 items, and the researcher composed an item pool by considering the psychology of fear and anxiety literature. All of the items were written as manifestations of this type of anxiety. The dimensions of coronavirus anxiety were determined as follows; cognitive, behavioral, emotional and psychological. The final form of the CAS included five items that were written in a 5-point Likert format reflecting the frequencies of symptoms, ranging from 0 (*not at all*) to 4 (*nearly every day*) over the preceding two weeks. The scaling type was developed in line with the American Psychiatric Association's system of measuring psychiatric symptoms over time and response treatment. In the development study, it was found that the CAS discriminates well between persons with and without dysfunctional anxiety using an optimized cut score of 9 (90% sensitivity and 85% specificity). These results support the CAS as an efficient and valid tool for clinical research and practice (Lee, 2020).

The adaptation process was designed in accordance with the related literature (Hambleton & Patsula, 1999). First, the existing scales about COVID-19 were investigated with regard to their psychometric qualities and convenience for the context of the current study before starting the adaptation process. The CAS was chosen for the present study as it was an easily applicable, time-efficient and effective tool with its high psychometric qualities. In addition, the CAS has been adapted into different languages such as Bangla and Polish, which proved that the scale could be used in different cultures as well (Ahmed et al., 2020; Skalski et al., 2021). In the second step of the adaptation process, official permission from the scale developer was obtained through an email. After this, to ensure language validity, the translation and back-translation method was utilized with well-qualified academics who had a high level of proficiency in English language. The initial translated version was asked to be reviewed by two experts in Turkish language and psychology. After the revisions were completed upon expert views, the Turkish form of the scale was sent for back-translation. The original scale and the translated one were compared, and the final version for the pilot study was developed. In the third step, content and face validity of the scale was investigated by calculating Lawshe's Content Validity Index (Lawshe, 1975) and statements in the scale were analyzed

whether they could actually measure the proposed latent structure. Also, for face validity, expert views were taken into account, and expert judgment was analyzed based on Miles and Huberman inter-coder reliability. The inter-coder reliability of the two experts was calculated as 0.86, and it was concluded that the experts were consistent with the translation of the statements into Turkish (Miles & Huberman, 1994).

In the fourth step, a pilot study was conducted with a small group consisting of 72 adults to perform some basic statistics. In the light of the feedback and analysis, the final form of the scale for the study (Appendix I) was produced and administered to the target group. Then, the CFA was utilized in order to get evidence proof for the construct validity of the scale scores. In the sixth step of the adaptation process, psychometric qualities, item characteristics and reliability of the scale scores were calculated for data accuracy.

Data Analysis

Descriptive statistics were calculated at the scale and item level. In addition, the CFA was conducted to investigate the factorial structure of the scale. In the CFA, the Maximum Likelihood Estimation (MLE) was used since the normality assumption of the total score was met. We also reported several goodness of fit statistics. The Relative Chi-Square Test, Root Mean Square Error of Approximation (RMSEA), Root Mean Square Residual (RMR), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Relative Fit Index (CFI), Relative Fit Index (RFI), Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) were used. For the relative chi-square test, X2/df ratio, several lower bound values were proposed in the literature, and the values below 3 indicate the perfect fit; the ones between 3 and 5 indicate the moderate fit (Kline, 2015). According to Brown (2015)'s suggestions, the values ≤ 0.08 are considered good for RMSEA, RMR and SRMR (Standardized Root Mean Square Residual). For the fit indices such as NFI, NNFI, CFI, IFI (Incremental Fit Index), RFI, GFI, AGFI, the recommended thresholds for acceptable values are above 0.90 (Brown, 2015).

The dimensionality of the CAS was investigated in terms of Mokken Scale Analysis (MSA) included in Nonparametric Item Response Theory (Mokken, 2011). In particular, the dimensionality of the scale is analyzed with the Automated Item Selection Procedure (AISP) in MSA. The AISP uses the coefficient of homogeneities (H_{ij} index) to assess the dimensionality of the data. In this study, for H_i and H values, the lower bound was accepted as .3, and for H_{ij} indexes, non-negativity was taken as a criterion (Sijtsma & Molenaar, 2002). The MSA analyses were performed on the R 4.0 program with the "*mokken*" package.

In order to get evidence regarding the criterion validity of the scores obtained from the adapted scale, the total scores of the CAS and the STAI were compared through Pearson Correlation Coefficients. Finally, in order to investigate the reliability of the measures, several statistics were performed. In social sciences, Cronbach's alpha coefficient is generally preferred to investigate the reliability of the scales, but in the current research, McDonald's omega coefficient, which is a more robust index, was also estimated due to the theory-based scale (Dunn et al., 2014; McDonald, 2013; Peters, 2014). Hence, Cronbach's alpha, McDonald's Omega and Grate Lower Bound (GLB) coefficients were estimated. Item analyses, correlations and reliability investigations were carried out by SPSS 22.0 and JASP, while the CFA was performed via Lisrel 8.1.

Research ethics

The present study received ethical approval from the research ethics board of a public university in Turkey (2020-3/18). Before starting the survey, the participants were informed through a consent form which involved the confidentiality of given responses, the objectives and aim of the study, risks and so on. The participants included in the study signed informed consent statements by choosing "I agree to participate". Anonymity and data confidentiality was guaranteed by the researchers.

3 | Findings

Preliminary analysis

Before conducting the CFA, the data were reviewed regarding the assumptions of the analyses. Extreme values, normality of the variables, multicollinearity and singularity were investigated, and it was found that the data did not have issues pertaining to these assumptions. For missing values, the Missing Completely at Random (MCAR) test was performed, and the results yielded a non-significant chi-square value which suggested that missing values occurred randomly. Only three answer patterns were detected as having missing values; hence these patterns were excluded from the data set.

Confirmatory Factor Analysis

The CFA was carried out on Sample 1 (n= 249) to test whether or not the original unidimensional structure of the scale was confirmed in the adapted scale. The results supported the one-dimensional factor structure of the original scale. It was found that the one-dimensional structure of the original CAS was preserved in the Turkish form. The single factor model yielded an excellent fit for all indices. The following results were obtained for the Turkish version of CAS; [$X^2(5)=5.64$, p=.34; X^2/df= 1.128; RMSEA=.026 (.00, .045; 90% CI); CFI=1.00; RFI=.98; NFI=.99; NNFI=1.00; GFI=.99; AGFI=.97; SRMR=.021].

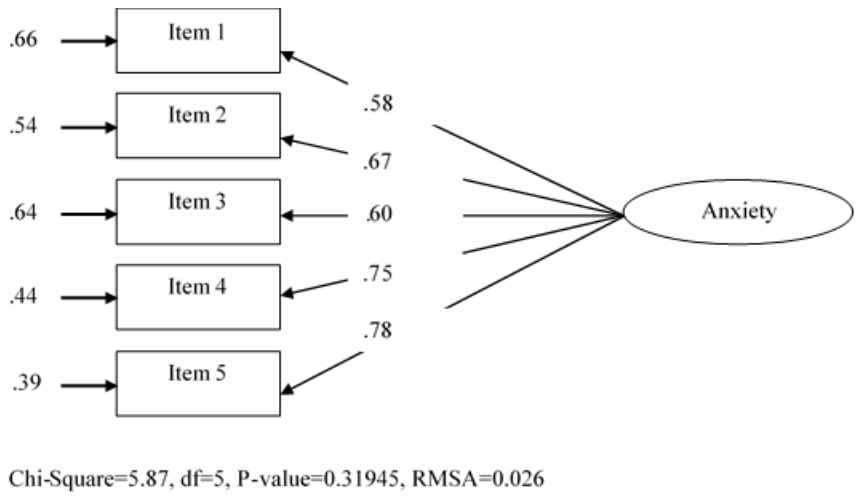

Figure 1. *Single Factor CFA Model*

The factorial structure proposed by the CFA and the standardized coefficients are presented in Figure 1. The standardized coefficients were estimated as ranging from .58 to .78, higher than the critical value .40, and all of these coefficients were found significant at the .01 level. Hence it can be concluded that these items were significant indicators of the latent variable, anxiety. In addition to standardized coefficients, the whole model was found significant in the assessment of Coronavirus anxiety (p<.05).

The CFA was repeated for different gender groups in order to examine if the Turkish version of the CAS measured the same way across the gender. The results demonstrated that in the assessment of the coronavirus anxiety construct, there was no significant difference across gender. Excellent model-data fit indices were estimated for both genders [$X^2(10)=13.55$, p=.52; X^2/df= 1.135; RMSEA=.031 (.00, .038; 90% CI); CFI=.99; RFI=.96; NFI=.98; NNFI=.99; GFI=.97; AGFI=.95; SRMR=.025]. In addition, the X^2 differences were not found significant, and this indicated that there was not any significant model change between the genders. These findings demonstrated that the Turkish version of the CAS was valid for adults and both genders

The Results of the AISP

The AISP was performed in order to investigate the factor structure of the CAS. The first finding of the analysis was that all of the *Hij* indexes were estimated positive; hence the estimation of item and scale level coefficients were conducted, and the results of the analyses are given in Table 1.

Table 1. The Scalability Coefficients and AISP Results

	Hi	Se	AISP
Item 1	0.47	0.05	1
Item 2	0.55	0.05	1
Item 3	0.53	0.06	1
Item 4	0.57	0.05	1
Item 5	0.63	0.04	1
H value	0.55	0.04	

The H_i values were found higher than the lower bound value c=.3. The values between 0.3 and 0.4 indicate weak scaling, .4< H_i <.5 indicate moderate scaling, and the ones higher than 0.5 indicate the high power of scaling (Mokken, 2011). When the H_i *and H* values were examined, according to these boundaries, it can be concluded that three items had a high level of scalability, one item had a moderate level of scalability and item 5 had perfect scalability. Also, the standard errors of the coefficients were low which indicates high reliability. Based on the high H_i values, the H value was found as 0.55, which shows the high power of scaling and unidimensionality. In the third column of Table 1, the results obtained from the AISP are presented, and the value 1 one indicates that these items were grouped in the same dimension. When the results were analyzed, it can be seen that all items were clustered under one dimension, which revealed that scale items compose a unidimensional scale. In summary, considering the results provided by the AISP, the adapted version of the CAS had a strong unidimensional feature, which had also been confirmed by the CFA. The results of the AISP provided another evidence proof for the construct validity of the CAS scores.

Analysis of variance and correlation analyses

The descriptive statistics regarding the total scores of the CAS and the STAI were calculated and these statistics are presented in Table 2

Table 2. Descriptive Statistics of the CAS and the STAI

	N	Min.	Max.	Mean	Mode	Median	Sd	Skewness	(se)	Kurtosis	(se)
CAS	253	.00	13.00	2.16	.00	1.00	2.46	1.592	.153	3.238	.305
STAI-State	253	20	76.00	41.04	38	40	8.93	.825	.153	1.458	.305
STAI-Trait	253	24	67.00	44.96	45	44	7.01	.610	.153	.612	.305

The results showed that the participants' coronavirus anxiety level was at a very low level. The distributions of the CAS and the STAI-State total scores did not fit the normal distribution. In order to decide the distribution features of the total scores accurately, normality tests (Kolmogorov-Smirnov) were performed, and the results confirmed that none of the total scores were normally distributed.

After the estimation of the descriptive statistics, the differences in the CAS scores of the participants according to the health status, gender, age and place of residence were analyzed. Due to the non-normal distribution of the total scores, Mann-Whitney U test was performed. The results indicated that the CAS scores of the female participants were significantly higher than the males' scores. The mean rank was estimated as 272.62 for the women and 201.46 for the men (p=.00).

As for the investigations of age groups about the CAS scores, the participants were grouped into three categories (18-25, 26-40 and above 40). The results revealed that there were no significant differences in

the CAS scores based on age and among the age groups. Hence it can be concluded that the age variable did not make any difference in the level of coronavirus-related anxiety.

In order to find out the influence of the participants' health status on the CAS scores, the independent samples of Kruskal Wallis test were used. When the findings were analyzed, it was found that there were significant differences between the group that stated their health status as very good and the ones whose health status was good or moderate. The results of this analysis were given in Table 3.

Table 3. The Results of Kruskal-Wallis Test

Health Status Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test. Statistic	Adj. Sig.
Very good - Bad	38.69	82.51	.47	1.00
Very good - Good	51.75	13.34	3.87	.001**
Very good - Moderate	95.13	31.35	3.03	.014**
Bad - Good	-13.06	82.27	-.16	1.00
Bad - Moderate	-52.46	87.02	-.65	1.00
Good -Moderate	43.37	30.70	1.41	.95

In Table 3, it can be seen that the CAS scores of the participants varied among the groups, but these differences were found significant in the two groups only. The participants reporting that their health status was very good had lower levels of Coronavirus anxiety than the ones who stated that their health status was good or moderate. These findings were also confirmed with the mean scores of the groups. The means of the health group status groups are given in Table 4.

Table 4. The Mean Scores of Health Status Groups

Groups	N	Mean
Bad	1	2.00
Moderate	13	4.08
Good	147	2.66
Very good	88	1.70
Total	249	2.38

The results in Table 5 show the differences in the CAS scores among the groups. The ones who stated that their health status was very good had lower levels of Coronavirus anxiety than other groups. However, the number of the participants within the groups was not equal; hence interpretation of the total scores may be misleading. Based on the significant differences, it can be claimed that the participants with very good health had lower levels of Coronavirus anxiety than the other groups.

Another demographic variable was the place of residence, which was investigated through the Independent Samples Kruskal-Wallis Test. The results showed that the anxiety levels did not differ significantly with regard to the place of residence.

Correlation analyses were conducted in order to get the validity evidence for proof for the CAS scores and to examine the relationship between CAS scores and the anxiety levels of the participants and its relationship with people's anxiety. The results yielded that the total scores of the Turkish version of CAS were correlated with the total scores of the STAI. In addition to the STAI, the CAS and age, place of residence and health status differences were investigated in Sample 2 (n=253). The results were given in Table 5.

Table 5. Correlations between the STAI scores and the CAS

		CAS	STAI-State	STAI-Trait
Spearman's rho	CAS	1.000		
	STAI-State	.411**	1.000	
	STAI-Trait	.292**	.408**	1.000

In Table 5, the estimated Spearman's Rho coefficients are presented, and all of the correlation coefficients were found significant. The correlation coefficient between the CAS and the STAI-State scores indicated a moderate correlation (r=.411, p<.01). On the other hand, the correlation between the STAI-Trait and CAS was calculated as .292 indicating a low correlation.

Reliability

The reliability of the adapted scale was investigated through Cronbach Alpha, McDonald's Omega and GLB coefficients. The estimated coefficients are given in Table 6.

Table 6. Reliability coefficients

Reliability Coefficients	McDonald's ω	Cronbach's α	GLB
Scale	0.82	0.81	0.85

The coefficients given in Table 6 indicate the internal consistency level of the adapted version of CAS. The Cronbach Alpha coefficient of the scale was estimated as 0.81, which is higher than the cut-off value, 0.70 (Crocker and Algina, 1986). The Omega coefficient was found similar to the Cronbach Alpha value, which indicates the more realistic boundary of the Cronbach alpha. The GLB was found higher than the other, and all of the coefficients demonstrated that the scale had a high level of internal consistency.

In order to analyze the relationships among the items, item statistics were also calculated, and the findings are given in Table 7.

Table 7. Item-total statistics

Items	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1	5.29	.506	.802
2	4.62	.623	.769
3	5.18	.601	.775
4	4.62	.650	.759
5	5.18	.633	.767

Item-total statistics and items' contribution levels to the internal consistency of the scale are given in Table 8. When the item-total correlations were analyzed, all of the coefficients were found positive and higher than 0.506. The lower-bound commonly accepted for correlation coefficients is 0.42, and the items having higher correlation with the total score than the lower bound are classified as highly discriminative (Crocker & Algina, 1986). Hence, the results obtained for the CAS items showed that all of the items were very good at measuring the latent trait. Also, it can be concluded from the Cronbach alpha if item deleted values that all of the items contributed to the internal consistency of the scale positively. The findings supported that the scale items measure the same latent trait, Coronavirus anxiety, and all of the items were highly correlated with the total score.

4 | Discussion

The CAS can be used by healthcare professionals and researchers easily to identify possible cases of anxiety associated with coronavirus. In this study, we aimed to adapt and validate this useful scale to be utilized by higher education institutions in order to screen coronavirus-related anxiety among their students.

The CAS uses five items to reveal a unidimensional factor of COVID-19 related anxiety and demonstrates good internal reliability and moderate to high inter-item correlations, which shows that each item measures a meaningfully distinctive aspect of anxiety. In order to examine the convergent validity of the CAS, the STAI was used, and the results indicated low and moderate correlations. This is an expected

finding because the coronavirus is a current phenomenon, and the STAI-State measures the anxiety of the state rather than the general anxiety level of individuals.

The construct validity of the CAS was analyzed through CFA, and a single factor structure of the scale with 5 items was confirmed with perfect model fit indices in the adapted version of the scale. High scores obtained from the scale mean that the individual has high level of anxiety. The proposed model was also confirmed based on gender variable since there was no significant difference across gender. These findings demonstrated that the Turkish version of the CAS was valid for university students and both genders as it is found in the original study.

The analysis regarding the internal consistency supported that the scale items measure the same latent trait, Coronavirus anxiety, and all of the items were highly correlated with the total score. When compared to the original study, the reliability coefficients were found relatively low, which might be related to the homogeneity of the sample in the current study.

The results also showed that the participants' coronavirus anxiety level was at a very low level. This may be because the coronavirus is less fatal to the young population. However, in the studies conducted with a more heterogeneous sample in a variety of countries where the transmission and mortality rates are much higher, including the USA, where the scale was developed (Lee, 2020), the participants were found to have a high level of COVID-19 related anxiety (Huang & Zhao, 2020; Qiu et al., 2020; Roy et al., 2020; Shevlin et al., 2020; Wang et al., 2020). The reason for this might be that in Turkey, when compared to other countries affected by the pandemic, its transmission and death rates have remained lower because of the measures taken since the first case diagnosed on 11 March 2020.

The results indicated that the CAS and the STAI-Trait scores of the women participants were significantly higher than the men's. Other studies investigating general anxiety in the past (Guo et al., 2016; Sareen et al., 2013) or COVID-19 related anxiety also revealed similar findings (Gao et al., 2020; Qiu et al., 2020; Shevlin et al., 2020; Wang et al., 2020). In line with this finding, we can say that anxiety and COVID-19 related anxiety do not differ with regard to gender variables among cultures.

When the CAS and the STAI scores based on the age and among the age groups were analyzed, the results demonstrated that there were no significant differences. Along with Lee (2020) in the development process of the CAS, some other researchers studying anxiety based on STAI results also found that age is not a significant factor in the determination of anxiety level (Ahorsu et al., 2020; Andreoletti et al., 2006; Brenes, 2006; Fuentes & Cox, 2000). Especially in the pandemic process, the fact that young adults have had anxiety as much as the older ones may not have caused a significant difference in terms of anxiety level. Due to being a newly introduced issue, the number of research studies on this subject is very rare; therefore, additional research in this area is required.

Another finding of the study to be discussed was the significant difference among the participants between the CAS scores and health status groups. As confirmed by other studies on anxiety in general and coronavirus related anxiety (Potvin et al., 2011; Wang et al., 2020), the participants reporting that their subjective health status was very good had a lower level of coronavirus related anxiety than the ones who stated that their subjective health status was good or moderate.

Finally, the results showed that the anxiety levels did not differ significantly with regard to the participants' place of residence. These results differ from some published studies which pointed out that the level of anxiety could be associated with place of residence. For example, Cao et al. (2020) found that living in urban areas, in contrast to rural areas, could result in lower levels of anxiety among college students. The authors described this result by highlighting possible differences between urban and rural areas in terms of economic, cultural and educational resources. We believe that further studies focusing on this kind of variable should be carried out to make more conclusive comments.

5 | Conclusion

In conclusion, the Turkish version of the CAS presented in this study has high internal consistency, as well as convergent and construct validity. The results suggest that the CAS is a reliable and valid scale measuring coronavirus-related anxiety. The findings also supported that the level of COVID-19 anxiety measured by the CAS is not affected by language and culture. In order to generalize the findings, further studies with other translations and samples can be carried out.

The study has essential implications for higher education policymakers, university administrators and teaching staff. The increase in the spread of COVID-19, especially after the mutations of the virus have emerged, indicates that its psychological and behavioral consequences and effects might last longer. Both policymakers and university boards should regularly screen students' level of anxiety caused by COVID-19 to minimize the risks related to the psychological results of the pandemic in educational settings. For instance, Columbia University (USA) requires a similar self-check to be completed by all students and staff members before they visit the university facilities. The CAS also offers an invaluable and effective tool for such purposes.

The study has a few limitations with regard to sampling, data collection and data analysis. The first one is the non-normal distribution; despite the large sample size, the participants in this study were mostly female young adults aged between 18-25. The second limitation is the sampling method. We can say that the sampling was not a true probability, which could be normal considering the current situation, and only the individuals with internet access could participate. Further studies with a balanced distribution in terms of gender, education level and age would yield more representative results for the target population. The third one is the data collection method which was limited to self-report tools since qualitative data collection methods such as interviews or observation were prohibited during the pandemic. The last limitation of the study is related to the analyses. All the analyses were based solely on a cross-sectional design which hindered causal inferences.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Conflict of interest

There is no conflict of interest to disclose.

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Appendix I. Turkish Version of the CAS

Son 2 hafta boyunca aşağıdaki durumları ne sıklıkta yaşadınız?		Hiçbir zaman	Nadiren, 1-2 günden az	Birçok gün	7 günden fazla	Neredeyse her gün
1	Koronavirüs ile ilgili haberleri okuduğumda ya da dinlediğimde, başım döndü, kendimi sersemlemiş veya halsiz hissettim.	0	1	2	3	4
2	Koronavirüs hakkında düşündüğüm için uykuya dalmakta veya deliksiz uyumakta sorun yaşadım.	0	1	2	3	4
3	Koronavirüs hakkında düşündüğümde ya da bu virüsle ilgili bir bilgiyle karşılaştığımda donakalmış ya da felç geçirmiş gibi hissettim.	0	1	2	3	4
4	Koronavirüs hakkında düşündüğümde ya da bu virüsle ilgili bir bilgiyle karşılaştığımda iştahım kesildi.	0	1	2	3	4
5	Koronavirüs hakkında düşündüğümde ya da bu virüsle ilgili bir bilgiyle karşılaştığımda midem bulandı veya mide problemleri yaşadım.	0	1	2	3	4
	Sütunların toplamı:					

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Digital Storytelling in Education from Teachers' Perspectives

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Abstract

This study aims to reveal teachers' opinions about the use of digital storytelling in education. The study was carried out with case study from qualitative methods. The study group consists of 38 teachers participating in in-service training at the end of the spring semester of the 2018-2019 academic year and working in public schools. Data collection tools are demographic information form and semi-structured interview form created by the researcher. Firstly, teachers were trained on digital storytelling within the scope of in-service training. Within the scope of this training, the definition, history, components, types, stages of digital storytelling, the importance of its use in educational environments were explained through presentations. Then, the introduction of software that can be used for digital storytelling and demonstration of sample digital stories have been made. Finally, data collection tool was applied. The content analysis method was used in the analysis of the data. At the end of the study, teachers gave opinions such that digital storytelling provides the opportunity to teach the subject more easily, offers students the opportunity to learn by having fun, may be used to raise awareness on social issues, and the lack of technological infrastructure may be a preventive factor.

Keywords: Digital storytelling, in-service training, teacher education.

Öğretmenlerin Bakış Açısıyla Eğitimde Dijital Öyküleme

Öz

Bu çalışma, öğretmenlerin eğitimde dijital öyküleme kullanımına ilişkin görüşlerini ortaya çıkarmayı amaçlamaktadır. Çalışma nitel yöntemlerden durum çalışmasıyla gerçekleştirilmiştir. Çalışma grubu, 2018-2019 eğitim-öğretim yılı bahar dönemi sonunda devlet okullarında görev yapan ve hizmet içi eğitime katılan 38 öğretmenden oluşmaktadır. Veri toplama araçları, demografik bilgi formu ve araştırmacı tarafından oluşturulan görüşme formudur. İlk olarak öğretmenlere hizmet içi eğitim kapsamında dijital öyküleme eğitimi verilmiştir. Bu eğitim kapsamında dijital öykü anlatımının tanımı, tarihçesi, bileşenleri, türleri, aşamaları, eğitim ortamlarında kullanımının önemi sunumlar yoluyla anlatılmıştır. Sonra dijital öykü anlatımı için kullanılabilecek yazılımların tanıtımı yapılmış ve örnek dijital öyküler gösterilmiştir. Son olarak veri toplama aracı uygulanmıştır. Verilerin analizinde içerik analizi yöntemi kullanılmıştır. Araştırmanın sonunda öğretmenler, dijital öykü anlatımının konuyu daha kolay öğretme fırsatı sağladığı, öğrencilere eğlenerek öğrenme fırsatı sunabileceği, sosyal konularda farkındalık yaratmak için kullanılabileceği ve engelleyici faktör olarak ise teknolojik altyapı eksikliği ile karşılaşılabileceği gibi görüşler belirtmişlerdir.

Anahtar kelimeler: Dijital öyküleme, hizmetiçi eğitim, öğretmen eğitimi.

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1 | Introduction

Today, technology is widely used in educational environments as in all areas of life. The correct and effective integration of technology into education increases the quality of education. Technology integration is a multidimensional and dynamic process that includes many variables such as government policies, school management, teacher, student, technical infrastructure, and curriculum (Avci et al., 2019). Teachers, one of these variables, have a great responsibility in the process. In every century, teachers' qualifications are expected to update along with school, classroom design, and education-teaching strategies (Göçen et al., 2020). In today's digital age, one of these expectations is keeping up with current and new technological applications. Because teachers will include the technology in the learning-teaching process and perform the integration process (Avci et al., 2019). Some of the obstacles in integrating technology into classes are specific to teachers and these are teachers' views about technology use in education and training environments, reluctance to change, and established classroom practices (Ertmer, 1999).

Many technologies, such as augmented reality, digital storytelling, and social networks are used in classrooms. Each new digital technology is a new channel for students to acquire, search, and create information (Lion, 2017). As a result of their interviews with teachers in their study, Avci et al. (2019) concluded that one of the technologies used by teachers in the process of technology integration is digital storytelling. Digital storytelling supports technology integration in learning and teaching environments (Kocaman-Karoğlu, 2016b). It is a combination of narration art with various multimedia tools such as video, image, music, graphic (Stenhouse & Schaver, 2019). There are different classifications of digital stories in the literature. Robin (2006) divided digital storytelling into three groups; (a) Informative and instructive stories on technology, mathematics, etc. (b) personal stories that provide information about important issues in a person's life (c) historical stories that provide information about past.

Digital storytelling is a technology-based and innovative method that allows individuals to create meaningful narratives with the help of technological tools (Karabatak & Şengür, 2019). Digital storytelling, which strives to integrate the experiences of individuals with technology and transfer them to the future, can be expressed as supporting verbal expression with auditory and visual elements (Baki & Feyzioğlu, 2017). As it contains both audiovisual elements, it has positive effects on learning. Digital storytelling is an educational tool that combines digital media with innovative learning and teaching practices, which facilitates the implementation of the constructivist approach (Smeda et al., 2014).

Digital storytelling, which has an understanding of the constructivist approach by living and learning, is a dynamic and powerful tool with various advantages (Baki & Feyzioğlu, 2017). The use of digital storytelling in an educational environment allows students and educators to improve their ability to collect information, solve problems and work with the team (Yuksel Arslan et al., 2016). It provides students with a suitable learning environment in terms of motivation, collaboration, reflective thinking, communication, and technical skill development (Smeda et al., 2014). It also helps teachers overcome the obstacles to using technology efficiently in their classrooms and allows them to create content with student contributions (Robin, 2008). Smeda et al. (2014) stated that digital narration is a powerful tool to create more attractive and exciting learning environments, in addition to integrating teaching messages with learning activities. The literature reveals that digital storytelling increased students' 21st-century skills, language skills, academic achievements, technological skills, attitudes, motivation, problem-solving skills, and participation in the lesson (Baki & Feyzioğlu, 2017; Del-Moral-Pérez et al., 2019; Gömleksiz & Pullu, 2017; Kocaman-Karoglu, 2016a; Niemi et al., 2014; Özüdoğru & Çakır, 2020; Smeda et al., 2014).

Teacher, student and environment are important for the successful use of digital storytelling in classrooms. Göçen et al. (2020) determined that teachers' expectations from 21st-century classes were technological equipment, access to technology, innovative teachers, and innovative learning approaches. In addition, while teachers expected the students to be more productive, active, and have the 21st-century

skills, teachers stated that they needed to learn technological content and applications, how to integrate technology into classes, and the use of technological tools.

Although teachers are expected to effectively integrate new technologies into classes, there are those who resist innovation. There are also computer teachers who depend on traditional computer learning methods and do not want to change (Lion, 2017). Dursun and Saracaloğlu (2016) concluded that information and communication technologies teachers have some deficiencies in the competence of teaching skills that will require an application, other branch teachers are not willing to use information and communication technology, and teachers express that they mostly used ready-made materials on the Internet. Dağ (2016) stated that the attempts to improve the technological competences of teachers in Turkey do not meet the requirements of the information age, and in-service training for their professional development do not support lifelong learning.

This study aims to reveal the opinions of information and communication technologies teachers regarding the use of digital storytelling for educational purposes by providing in-service training. With the pre-service training of teachers, it is not completely possible for them to provide education that is suitable for the needs of the age and the needs of the learner. For this reason, in-service training is extremely important. It is expected that information and communication technologies teachers will dominate technology-related innovations and guide other teachers. In addition, it is important that students use technology for educational purposes and have experience of creating products with technology starting from primary education. This is closely related to having role model teachers. For these reasons, it is important for such teachers to effectively integrate current and new technologies into classrooms. Based on this reason, in this study, the opinions about the effects of this method in case of applying digital storytelling training to these teachers in the classroom were revealed. Information and communication technologies teachers' views as technologically field experts on the application of digital storytelling are valuable. Based on this purpose, the research problem expressed as follows:

What are the opinions of teachers about the use of digital storytelling in educational environments?

2 | Method

Research Model

Case study was used in this research. Case study is a qualitative approach where it collects in-depth information, describes a situation and reveals the themes of the situation, using multiple sources of information to bring in-depth understanding of the real life, current system, or a situation in a particular time (Creswell, 2013). The case is the use of digital storytelling by information and communication technologies teachers in classrooms in this study.

Participants

The study was carried out at the end of the spring semester of the 2018-2019 academic year with 38 teachers who worked in public schools in a city in the Central Anatolia Region and participated in in-service training. The data regarding the demographic information of the participants are given in Table 1.

Table 1. Distribution of Participants by Demographic Information

Gender	N	%
Female	10	26.3
Male	28	73.6
Total	38	100
Seniority	N	%
3-10 year	11	28.9
11-14 year	17	44.7
15-17 year	10	26.3
Total	38	100
Awareness of the method	N	%
Yes	31	81.6
No	7	18,4
Total	38	100
Using the method	N	%
Yes	16	42.1
No	22	57.9
Total	38	100
Willingness to use the method	N	%
Yes	35	92.1
No	3	7.9
Total	38	100
Level of self-efficacy to use the method	N	%
Very insufficient	0	0
Insufficient	4	10.5
Moderately sufficient	10	26.3
Sufficient	19	50
Very sufficient	5	13.2
Total	38	100

As can be seen in Table 1, the vast majority of the participants were male. The seniority of the participants varies between 3 and 17 years. Seven participants have not heard of the digital storytelling method before. 22 participants stated that they did not use the digital storytelling method before. Only three participants were reluctant to use the digital storytelling method. Most of the teachers feel sufficient about using the digital storytelling method.

Data Collection

Within the scope of in-service training, information and communication technologies teachers were trained on digital storytelling at the end of the 2018-2019 academic year. The definition, history, components, types, stages of digital storytelling, the importance of its use in educational environments were explained through presentations. Then, the introduction of software that can be used for digital storytelling and demonstration of sample digital stories have been made. Finally, a form consisting of demographic information form and open-ended questions were applied on a voluntary basis to information and communication technologies teachers who participated in in-service training. The demographic information form consists of six questions. Additionally, four open-ended questions were asked. While designing the form, the opinions of two experts from the field of computer and instructional technology education and one from the language field taken, and corrections were made. In order to test whether there are any questions that are not clear, the form was applied to an information and communication technologies teachers who uses the method of digital storytelling. After a few changes, the form was finalized. Following the demographic information form, the form includes open-ended questions about the effects of using the digital storytelling method for the teacher, the effects for the student, the factors that will prevent the use of the method, if any, and what the purposes of the method may be. The form was applied voluntarily, and the response time was on average 20 minutes.

Data Analysis

The data were analyzed by the content analysis method. Firstly, the data were transcribed. Teachers' opinions were coded as T1, T2, etc. For the reliability of the analysis, the consensus among the coders was calculated. After coding by two encoders, similarities and differences were compared. Then the coding table was created. The consensus of encoders was calculated by the formula of Miles and Huberman (1994). The value was calculated as 90.6%. Miles and Huberman (1994) stated that 80% similarity is reliable.

3 | Findings

When the data were analyzed, the findings were collected under four themes. These are teachers, students, barrier factors and usage purposes.

The Theme of Teacher

The theme of teacher expresses the effect of the use of digital storytelling in education on teachers according to teachers' views. The effects of using digital storytelling in the educational environment were gathered under two sub-themes and 16 code. Frequency refers to the number of teachers for code.

Table 2. Sub-themes, Codes and Frequencies of the Teacher Theme

Sub-theme	Code	Frequency
Course process	Teaching the subject more easily	11
	Attract attention	8
	Taking time	7
	Attracting interest	6
	Activating the student	6
	Providing permanent learning	5
	Increasing motivation	4
	Appeals to multiple sense organs	3
	Providing fun learning	3
	Explanation by a different method	3
	Providing effective learning	2
	Summarizing the subject	2
	Imagination development	1
	Provide a summary	1
Technical	Infrastructure requirement	2
	Media usage skill	1
	Software finding difficulty	1

As can be seen in Table 2, digital storytelling has sub-themes in terms of lesson process and technical aspects for the teacher. Teaching the subject more easily (11) and attract attention (8) codes were the most stated effects of digital storytelling on the course process. The infrastructural requirement (2) code was the most stated effect by teachers in terms of technic. Sample teacher views on the effects of digital storytelling for teachers are given below.

T1: "It will enable the subject to be taught more easily by attracting the attention of the students in the classroom."

T7: "I think I will be less tired while lecturing. Students will be more motivated to the lesson and they will appeal to more sensory organs and understand the lesson better."

T15: "…Internet connection weakness and poor-quality computers take extra time."

T35: "I think it will be easy for the teacher to attract the student's attention and achieve the targeted subject objectives."

The Theme of STUDENT

The theme of students expresses the effect of the use of digital storytelling in education on students according to teachers' views. The effects of the use of digital storytelling in the educational environment for the student were gathered under three sub-themes and 13 codes.

Table 3. Sub-themes, Codes and Frequencies of the Student Theme

Sub-theme	Code	Frequency
Motivation	Learning with fun	11
	Attracting interest	10
	Ease of learning	8
	Attract attention	3
Course Process	Appeals to multiple sense organs	7
	Permanent learning	6
	Increasing participation	4
	Different method opportunities	2
	Educational use of technology	2
	Embodiment	2
Skill	Developing thinking skills	2
	Developing creativity skills	2
	Developing technological skills	1

As can be seen in Table 3, according to the opinions of the teachers, digital storytelling has the motivation, course process, and skill sub-themes for the student. Learning with fun (11), was the most addressed code in the motivation sub-theme. Appeals to multiple sense organs (6) were the most addressed code in the course process sub-theme. Developing thinking skills (2) was the most addressed code in the skill sub-theme. Sample teacher views on the effects of digital narration for students are given below.

T5: "Improves student's thinking skills. Maybe a good opportunity for creativity ..."

T10: "It will increase the student's interest in the lesson. It will make the lesson fun. Participation in the lesson will increase in proportion to these."

T13: "It will provide learning with fun and permanent learning. It will make learning complex topics simpler."

T37: "...It addresses multiple sensory organs, so learning becomes easier."

The Theme of Barrier Factors

The theme of the barrier factors refers to the factors that may hinder the use of digital storytelling in education according to teachers' views. The factors that will affect the application of digital storytelling in the educational environment are gathered under two sub-themes and 11 codes.

Table 4. Sub-themes, Codes and Frequencies of the Barrier Factors Theme

Sub-theme	Code	Frequency
Technical	Technological infrastructure inadequacy	11
	Classes not equipped	10
	Internet problems	6
	Computer problems	5
	Students' ability to use software	4
	Software paid	3
	Technical problems	2
	Software limitation	2
Curriculum	Lack of time	7
	Not to suit every subject	5
	Not suitable for a crowded class	2

As can be seen in Table 4, according to the teachers' opinions, the factors that may prevent the application of digital storytelling in education were gathered under the technical and curriculum sub-themes. Technological infrastructure inadequacy (11) was the most addressed code in the technical sub-theme. Lack of time (7) was the most addressed code in the curriculum sub-theme. Sample teacher views on the factors that may prevent the application of digital narration are given below.

T7: "There may be technical problems. Old computers or taking time while doing can make the lesson boring."

T19: "Videos may not be understood if there is a problem in the audio system. It may not be suitable in crowded classes. Students sitting in the back rows may not hear or see."

T22: "The inadequacies of the information and communication technologies classes of schools and the lack of infrastructure can negatively affect the use of digital storytelling."

T37: "… It will be time consuming if done with students."

The Theme of Usage Purposes

The theme of usage purposes expresses the opinions of the teachers about the purposes that digital storytelling can be used in education. The purposes of digital storytelling in the educational environment were gathered under three sub-themes and 15 codes.

Table 5. Sub-themes, Codes and Frequencies of the Usage Purposes Theme

Sub-theme	Code	Frequency
Motivation	Attract interest	6
	Making it fun	5
	Attract attention	4
	Imagination development	3
Supporting the course process	Teaching complex topics	5
	Providing permanent learning	5
	Presenting audiovisual material	3
	Giving preliminary information	3
	Activating the student	3
	Giving the main idea	2
	Summarizing the subject	2
	Embodiment	2
Awareness-raising	Social issues	7
	Values education	5
	Behavioral education	3

As can be seen in Table 5, according to the teachers' opinions, the purposes of digital storytelling in the educational environment were gathered under motivation, supporting the course process, and teaching social issues sub-themes. Attract interest (6) was the most addressed code in the motivation sub-theme. Teaching of complex topics (5) and providing permanent learning (5) were the most addressed codes in supporting the course process sub-theme. Social issues (7) were the most addressed code in the awareness-raising sub-theme. Sample teacher views on the use of digital narration in educational environments are given below.

T1: "Can be used to attract the student's interest almost in any subject. It will also be effective as it has visual and audio elements in terms of more permanent learning."

T22: "…It can be used to increase the retention of intangible concepts by concretizing them."

T35: "Digital storytelling can be used in the parts of the information technology subjects in the curriculum that are relevant to social life issues."

T37: "…It addresses multiple sensory organs, so learning becomes easier."

4 | Discussion & Conclusion

This section presents the results relating to the use of digital storytelling in educational environments for teachers and students, the factors that will prevent their use in the classroom, and the purposes of use. The first result of the study is regarding the effects of using digital storytelling in the educational environment for the teacher. The teachers reported that easy teaching and attracting attention as an effect of digital storytelling on the course process. In technical terms, they stated that there is a need for infrastructure. The second result of the study is regarding the effect of digital storytelling on the student. The teachers stated that digital storytelling provides motivation and fun learning for students. In terms of the course process, they stated that digital storytelling appeals to multiple senses organs for students. In terms of skill development, some teachers state that digital storytelling develops students' technological skills in addition to their thinking and creativity skills. The third result of the research is regarding the elements that may prevent the application of digital storytelling in classrooms. The teachers stated that the lack of technological infrastructure and the lack of equipped classes are technical obstacles. Also, there might be time deficiencies in terms of the curriculum. The fourth result of the study is regarding the purposes of using digital storytelling in educational environments. The teachers stated that digital storytelling may be used to attract interest to the lesson in terms of motivation, to teach complex subjects in order to support the course process, and to awareness-raising on social issues.

As digital storytelling becomes one of the major study topics in the education field, there are studies with similar results to this study in the literature. From the studies examining the teachers' views on this method; Supporting 21st-century skills (Yuksel et al., 2011), supporting active participation (Dogan & Robin, 2009; Kocaman-Karoğlu, 2016b; Yuksel et al., 2011), providing motivation (Dogan & Robin, 2009; Yuksel et al., 2011; Yuksel Arslan et al., 2016), ensuring concrete experiences (Kabaran et al., 2019; Kocaman-Karoğlu, 2016b), attracting attention (Kabaran et al., 2019); attracting interest (Niemi et al., 2014), improving thinking skills (Kabaran et al., 2019) and contributing to technological development (Del-Moral-Pérez et al., 2019; Dogan & Robin, 2009; Kocaman-Karoğlu, 2016b; Smeda et al., 2014; Yuksel Arslan et al. 2016) are some of the supportive study results. Also, Yuksel Arslan et al. (2016) stated that digital storytelling is a driving force for change. This result is similar to the view that it provides an opportunity to teach a different method in this research. In addition, Dogan and Robin (2009) stated that teachers also increase their presentation skills, research skills, organizational skills, and writing skills. In their studies, Niemi et al. (2014) and Del-Moral-Pérez et al. (2019) stated that the participant teachers are of the opinion that digital storytelling enhances communication and interaction.

In this study, it is noteworthy that teachers have mostly positive opinions about the use of digital storytelling in educational environments. It is important to give teachers, who have a significant role in technology integration, the opportunity to experience such technologies and to evaluate their views as practitioners in educational environments. But teachers stated the lack of time and equipment as negative views. Ertmer (1999) stated that if the teachers do not have sufficient equipment, time, education, or support, meaningful technology integration will be difficult. Problems arising from the lack of theoretical and technological knowledge (Kocaman-Karoğlu, 2016b; Niemi et al., 2014) and time problems (Dogan & Robin, 2009; Kabaran et al., 2019; Niemi et al., 2014) are similar to the results of this study. Similarly, in their study Kabaran et al. (2019) stated that participant teachers are of the opinion that there might be problems due to the students' lack of technical or software competencies.

Teachers' experiences and opinions regarding the use of technology are important in terms of increasing the quality in educational environments. In order to create constructivist learning environments, it might be beneficial to use methods that will enable teachers and students to create content. Technological behavior and technology use of teachers have a profound effect on students (Lion, 2017). Information and communication technologies teachers will be an example and guide for the use of new digital technologies to their schools and environments. Information and communication technologies teachers play a significant role in starting the use of the new digital education environment in schools.

Recommendations

As information and communication technologies teachers can look at the digital storytelling method both technologically and pedagogically, this study is important because it contains the opinions of information and communication technologies teachers about the use of the digital storytelling method in education. Workshops might be organized by including larger teacher groups, school administrators, different branch teachers, students, and parents.

The results of the study reveal that participant teachers are of the opinion that there are technological infrastructure deficiencies and classes are not technically equipped. Projects might be carried out in cooperation with universities and the Ministry of National Education to improve the infrastructure and technological competences of schools.

Another result of the study is that there might be problems in applying the method due to students' lack of technological or software skills. It was also noted by participants that the curriculum development concerns and methods were time-consuming. The number of technology-related courses may be increased in curriculums to improve students' competencies. In other courses, the content and duration of the course may be arranged considering the technology will be integrated.

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Examination of The Album Books Used in Viola Education in Turkey

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Abstract

Sources used in instrument education are theory books covering the historical and structural features of the instrument, methods that provide progress in instrument education, and albums that can be performed depending on one's competience while the education continues. Theory books and methods, which play an active role in the individual completing their development, are sometimes inadequate in a musical sense and do not satisfy the person affectively. The competencies gained by the person attending instrument education through methods are supported by albums with melodic structures at the forefront. This study examined the albums released in Turkey used in viola education and it is a descriptive study based on content analysis. The study sample is limited to 7 viola albums released in Turkey between 2000-2019. The resources accessed were examined in terms of their copyrights page, publication years, types of pieces, the player level, the tone/tonality/modality, whether they are accompanied or not and their availability for playing the pieces. As a result of the review, it was determined that the number of albums increased after 2010, they mostly consisted of arrangement and adaptations, were written at the beginning level except for two methods, the pieces included in the albums consisting of position I, II, III and IV and it is necessary to know the techniques such as detache, legato, staccato and connected staccato in order to perform the pieces. The results obtained are tabulated under the related titles and compared with the literature.

Keywords: Viola, viola education, viola album books

Türkiye'de Viyola Eğitiminde Kullanılan Viyola Albüm Kitaplarının İncelenmesi

Öz

Çalgı eğitiminde kullanılan kaynaklar çalgının tarihsel ve yapısal özelliklerini kapsayan teori kitapları, çalgı eğitiminde ilerlemeyi sağlayan metotlar, ve eğitim devam ederken kişinin yeterliklerini kullanarak seslendirebileceği eserlerden oluşan albümlerdir. Bireyin gelişimini tamamlamasında etkin rol oynayan teori kitapları ve metotlar zaman zaman müzikal anlamda yetersiz kalmakta, kişiyi duyuşsal açıdan tatmin etmemektedir. Çalgı eğitimi gören kişinin metotlar sayesinde kazandığı yeterlikler melodik yapıların ön planda olduğu albümlerle desteklenmektedir. Bu çalışma viyola eğitiminde kullanılan Türkiye'de yayımlanmış albümleri inceleyen, içerik analizine dayalı betimsel bir çalışmadır. Araştırmanın örneklemi 2000-2019 yılları arasında Türkiye'de yayımlanan 7 viyola albümü ile sınırlıdır. Ulaşılan kaynaklar, künyeleri, basım yılları, içeriğindeki eser türleri, çalıcılık seviyeleri, eserlerin makam/tonalite/modalite durumları, eşlikli/eşliksiz olma durumları ve eserleri çalmak için gereken hazırbulunuşluklar açısından incelenmiştir. İnceleme sonucunda albümlerin 2010 senesinden sonra artış gösterdiği, ağırlıkla düzenleme ve uyarlamalardan oluştuğu, iki metot hariç başlangıç seviyesinde yazıldığı, albümlerde yer alan eserlerin I, II, III ve IV. pozisyonlardan oluştuğu ve eserleri seslendirebilmek için detaşe, legato, staccato ve bağlı staccato gibi teknikleri tanımış olmak gerektiği sonuçlarına ulaşılmıştır. Elde edilen sonuçlar ilgili başlıklar altında tablolaştırılmış ve alanyazınla karşılaştırılmıştır.

Anahtar kelimeler: Viyola, viyola eğitimi, viyola albüm kitapları

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1 | Introduction

Art education helps to increase the sociological quality of the individual along with their expertise and ensures a healthier psychological state. Regardless of the branch of art, an individual's direct or indirect involvement in art, will play an active role in their communication and interaction. Music, a very important and effective branch of art, has the power to express a unique feeling. Just as all human beings will be affected by gravity, react to hot and cold, cannot ignore vital needs such as eating and drinking; they will perceive and need music in the same manner (Onay, 2020, p.19). Since music has a power that deeply affects the human spirit throughout the ages, no matter how perfect the languages used in communication are, it does not compete with music in terms of sharing of emotions (Say, 2013, p. 35; Türkmen, 2019, p. 1). The education of this excellent language of communication has always been a need of humanity. Famous philosopher Kant emphasizes this need of humanity as "The aim of education is to educate every person to the perfection that is appropriate to them" and Hungarian composer and educator Zoltan Kodaly as, "Real art has the power to support the progress and dignity of human beings. Art education must be popularized and each individual should benefit from this greatest invention of humanity." (Say, 2013, p.50: Ali, 2017, p.84). General music education has a place in the lives of every individual in Turkey; whereas voluntary music education has a place in the lives of individuals who want to learn music as a hobby, and professional music education has a place in the lives of art lovers who want to learn this strong communication language as a profession. Everyone received music education and trained their soul at some point in their lives. According to Uçan (2005, p. 61), music education is the process of creating the desired change in the behavior of the individual through their own purpose in life. Professional music education, which is the professional dimension of music education, is aimed at individuals who want to choose music as a profession. Therefore, it aims to provide the musical behaviors required by this profession and this process is carried out by experts (Tarman, 2016, p. 10).

Professional music education provides professions such as performance, education, music criticism and instrument production in Turkey. The institutions providing this professional music education are;

- Conservatories
- Department of Performance Arts
- Music Department
- Department of Instrument-Making
- Department of Musicology
- Fine Arts High Schools Music Departments
- Education Faculties Music Education Departments
- Faculty of Fine Arts Department of Music Sciences (Tarman, 2016, p. 10-13).

The most common education at the institutions providing professional music education is instrument education. Playing an instrument is one of the highest level skills that people can have in the dimension of communication with an object (Ece, 2015, p. 161). Instrument training requires a study process which must be executed in a planned and patient manner. Careful planning and correct source selection by the teacher is important in this process. The highest efficiency in the learning of an individual is achieved by revealing individual differences. Knowledge and learning level of each individual are different from each other and these individual differences directly affect the educational process (Çilden, 2001, p. 5). Instrument education is the basis of professional music education in all of the above-mentioned music institutions. Instrument education requires a planned and patient work process. Having the expertise required by the profession occurs by performing musical and technical studies during the education process (Yinal, 2019, p. 81). Instrument training, which is one of the biggest branches of music education, is a long path in which students and teachers are interactive, but it is also a process that requires careful, patient and planned studying. Ensuring the continuity of instrument training in a qualified process is a source for the students to identify and integrate with themselves through the instrument, plays an active role in expressing and socializing their feelings, develops their talent, enriches their knowledge of music and raises their taste for

music to a high level (Parasız, 2009, p.19: Tanrıverdi) , 1997, p.8). Özen (2004, p. 60) lists the factors affecting the success of instrument training as in the following: to be willing to play the instrument, to know and love the instrument, to manage time well, to complete assignments regularly and properly, to establish a good communication with the teacher.

Resources Used in Viola and Viola Education

Viola, a member of the string instruments family, is larger than violin in size, smaller than cello, and is more bulky and has a deep sound, although has a similar tone color to violin. This instrument, called "viole" or "alto" in French, "viola" in Italian, "viol" in English, and "bratsche" in German, emerged at the same time as violin and cello in Northern Italy in the 1500s. Its dimensions are 1/7 larger than violin (Tahan, 2020, p. 1; Derican & Albuz, 2008, p. 36; Yazıcı, 2014, p. 15).

When the instrument of viola is examined from the 16th century until today; it is observed that it shows a great development and change from a technical point of view, in terms of its role among instruments and the width of its literature. Viola has been a complementary, a companion instrument since the early period, and has remained in the shadow of the violin, yet, has become a characteristic solo instrument especially in the 21st century and its repertoire has expanded. (Bahar, 2012, p. 62; Benian, 2019, p. 1). Viola education performed with violin methods and albums in the past turned into a field of education over the years and the number of viola-specific publications increased rapidly.

Written materials used in viola education are the theoretical books on the historical and structural features of the instrument, the methods that ensure progress in the player, and the albums consisting of melodic pieces that one can practice the musical behaviors learned through studies. Theory books are guiding resources that broaden the horizons of the player and improve their mind, and yet, they do not help with muscular progress. The most important sources that instrument education makes use of playing are the methods. The methods provide the player with technical knowledge and skills such as how to hold the viola, the bow grip, the position of the left hand on the instrument and the positioning of the fingers on the touch, the use of different sections of the bow and various bow techniques. There is no local method specially prepared for viola until 1990s in Turkey. Therefore, viola students studying at institutions providing different professional music education continued their instrument education by transposing (transferring) violin methods until they reached a certain level (Tanrıverdi, 2013, I). The fact that instrument education and thus viola education is a long and disciplined process and the studies used in this process to have a technical structure rather than melodic structure, causes the players to lose motivation and creates a lack of satisfaction in the musical sense. Because it is very natural that beginner viola players tend to want to immediately play musical pieces (Can, 2013, p. 2). The most entertaining and melodic sources of viola education step in at this point. Albums are sources that contain original, arranged or adapted pieces, with musical concerns and are generally composed of pieces accompanied by another instrument. It is only possible to introduce the technical knowledge and skills in the instruments, musical and educational competences, and examples of intercultural music through an instrument repertoire that is selected and created correctly (Kurtaslan, 2014, p. 96). The more motivational the education is, the more albums there are in a musical instrument repertoire containing different levels and variety of pieces. However, there are not so many solo pieces in the literature for the viola, so new pieces are trying to be introduced by adapting from the instruments close to the tone color and tessitura of viola (Albuz, 2005, p. I).

After the 1990s, more performers and educators appeared with the increasing number of music education departments of universities and the viola being place in the relative programs. New approaches, studies and works in the field are gained through graduate education in the field of viola at universities. As the number of performers, academicians and teachers in the field of viola increased, the lack of viola albums in the field started to be eliminated. Viola albums, which were limited to only foreign sources until 2000s

in Turkey, consist only of western music samples and only include the music of other cultures. However, including pieces containing different types of music in the repertoire to be performed at in and out of school activities for viola students, and the concert to include samples from popular and traditional folk music will improve the technical and musical skills of the students (Varış, 2019, p. 14). With the development of the university structure, many composers and music educators benefited from the Turkish Folk Music motifs for different instruments and created universally valuable pieces, but the resources created for viola education among these studies are almost non-existent (Nacakcı, 2007, p. 2).

In light of the information and ideas mentioned above, it was emphasized that the place and role of the albums are important among the sources used in instrument education and it is important to create a repertoire consisting of universal and local sources for instrument students. Based on this information and ideas, scanning and examination of the viola albums released in Turkey, is of utmost importance for viola educators and students to reach these resources and to shed the light on the future studies.

Research questions

In this respect, the problem statement of this study is deemed as "What kind of a look do the albums used in viola education in Turkey present?". Depending on this main problem, answers to the following sub-problems were sought;

1. How are the pieces in the albums used in viola education in Turkey in terms of the kind?
2. How are the albums used in viola education in Turkey in terms of technical level?
3. How are the albums used in viola education in Turkey in terms of mode/tonality/modality?
4. Are the albums used in viola education in Turkey mostly accompanied?
5. What is the availability of albums used in viola education in Turkey?
6. What is the distribution of the albums used in viola education in Turkey in terms of their year of release?

2 | Method

This section of the study includes the model, population and sample of the study, limitations, data collection and analysis, and definitions related to the study.

Data collection

Model of the Study

In this study, which aims to examine the albums used in the viola training, descriptive survey method, which is one of the literature review methods, was employed in the analysis of the data. Survey is one of the most common methods used in descriptive studies (Karakaya, 2012, p. 58). Survey model is a research approach that aims to describe a past or present situation as it is (Karasar, 2005, p. 77). Review studies aim to review and analyze as many studies as possible in the study area.

Population and Sampling

Kaptan (1998, p. 116) defines the population as "the group composed of the objects that have common observable characteristics, comply with certain rules, and formed by the units to be studied". Sample, on the other hand, is the selection of a section from any existing population that can represent it. Viola albums released between the years of 2000 - 2019 in Turkey make up the population of this study. Within the scope of the study, 24 books published in this field were reached after consulting the views of 3 faculty members who have completed their doctorate in the field of viola and 3 viola educators working at the Fine Arts High School. These books were classified as method, album and theory books and 17 books were determined as method and theory books while the remaining 7 viola albums were included in the sample. These 7 albums, which can be used in viola training in terms of being sold physically on the internet and

bookstores, constitute the sample of the research. The whole of the population was examined in the study since all available albums were included. The 7 viola albums included in the study are shown in Table 1.

Table 1. Viola Albums Examined Within The Scope of The Study

Title of the Piece	Author	Publication Year	Publisher	Number of pages
Viyola İçin Dağarcık (Repertoire for Viola)	Aytekin Albuz	2005	Evrensel Müzikevi	81
Halk Ezgilerine Dayalı Viyola Albümü (Viola Album Based on Folk Pieces)	Zeki Nacakcı	2007	Feryal Matbaacılık	104
Viyola İçin Piyano Eşlikli Albüm - I (Piano Accompanied Album For Viola - I)	Meltem Erol Düzbastılar	2010	Müzik Eğitimi Yayınları	60
İki Viyola İçin Ezgiler - I (Pieces for Two Violas - I)	Yakup Alper Varış	2012	Etüt Yayınları	32
İki Viyola İçin Ezgiler - II (Pieces for Two Violas - II)	Yakup Alper Varış	2012	Etüt Yayınları	32
Viyola İçin Piyano Eşlikli Sonatlar ve Konçertolar (Piano Accompanied Sonatas and Concertos for Viola)	Fatih Marufoğlu	2017	Ekspress Dijital Baskı	97
Viyola İçin Gitar Eşlikli Popüler Ezgiler (Popular Pieces for Viola Accompanied by Guitar)	Yakup Alper Varış	2019	Eğitim Yayınevi	42

Limitations

- The viola albums included in the study were limited to the period between the years of 2000-2019.
- Examination of viola albums included in the research was limited to the types, technical levels, theme / tonality / modality of the works, being accompanied / solo, the readiness that they require and the years of publication, and the content analysis of the works in the albums is not included.

Collection and Analysis of Data

Viola parts of the pieces included in the albums determined for the purpose of collecting data within the scope of this study were separated from the accompanying parts. The "piece review form", which was created by researchers in order to determine the kind of pieces, mode/tonality/modality, positions they contain, and the competency required, accompaniment status, and their availability for practicing, was presented to the opinion of three doctorate graduates and theory experts. Only the common fields of the data obtained from the field experts are included in the research results. Obtained data are presented with tables under the related titles.

Definitions

Arrangements: It is the arrangement of a piece for different instruments or sounds by adhering to the musical idea in the composition (Say, 2005, p. 88)

Adaptation: The concept of "adaptation" is the transformation of one or more of the characteristics of a piece into a new state (Erzincan, 2006, p. 3).

Detache: In the string instruments, the characteristic for the notes to be signed separately, and using the bow to produce independent sounds, wide but not connected (Say, 2005, p. 147).

Legato: The state that a number of sounds are interconnected without interruption. When playing in the same tone, the sounds obtained should have the same characteristic and the bow length should be divided according to the note values (Uçan & Günay, 1975, p. 21).

Staccato: The technique of playing musical notes in short and separate mode in string instruments is called staccato in universal music language. The term staccato is derived from the word staccare, which means 'to separate' in Italian. The abbreviated spelling of this term is stacc. (Uçan, 2005, p. 110).

Tied Staccato: Connected staccato, a right-hand technique in stringed instruments, is snapping the bow to each musical note unit and performing it with short cuts. The snapping is accomplished by the pressure of the index finger of the right hand, which is suddenly applied to the fiddlestick. This pressure is repeated for each note unit written in the ligature (Kapcak & Çilden, 2012, p. 274).

Research ethics

Since the study is a descriptive survey method, it is not necessary to obtain the permissions from the ethics committee. Ethical principles and rules were followed during the planning, data collection, analysis, and reporting of the research. Moreover, all sources used in this study were cited in the references section, consistent with APA standards.

3 | Findings

This section of the study contains findings related to the sub-problems.

Findings Regarding the 1st Sub-Problem

Table 2. Kinds of The Pieces in The Albums Used in Viola Education in Turkey

Albums	Original Composition	Arrangement	Adaptation
Viyola İçin Dağarcık (Repertoire for Viola) - Aytekin Albuz	Original Piece	-	-
Halk Ezgilerine Dayalı Viyola Albümü (Viola Album Based on Folk Pieces) - Zeki Nacakcı	Original Exercise	Folk Song	Folk Song
Viyola İçin Piyano Eşlikli Albüm - I (Piano Accompanied Album For Viola - I) - Meltem Erol Düzbastılar	-	Small Formed Pieces	Small Formed Pieces
İki Viyola İçin Ezgiler - I (Pieces for Two Violas - I) - Yakup Alper Varış	-	World Folk Music Pieces	World Folk Music Pieces
İki Viyola İçin Ezgiler - II (Pieces for Two Violas - II) - Yakup Alper Varış	-	World Folk Music Pieces	World Folk Music Pieces
Viyola İçin Piyano Eşlikli Sonatlar ve Konçertolar (Piano Accompanied Sonatas and Concertos for Viola) - Fatih Marufoğlu	-	Sonata and Concertos from Violin and Flute Repertoire	Sonata and Concertos from Violin and Flute Repertoire
Viyola İçin Gitar Eşlikli Popüler Ezgiler (Popular Pieces for Viola Accompanied by Guitar) - Yakup Alper Varış	-	World Folk Music Pieces	World Folk Music Pieces
Total	2	6	6

When Table 2 is examined, it is concluded that two of the albums include original pieces from the authors, one with original pieces and the other with original practice pieces and six have arrangements and adaptations formed of small formed pieces, world folk music Pieces, sonata and concertos from violin and flute repertoire. The contents of the albums consist numerically mostly of arrangements and adaptations.

Findings and Interpretation Regarding the 2nd Sub-Problem

Table 3. Technical Levels of The Album Used in Viola Education in Turkey

Albums	Beginner (1st Position)	Intermediate (I., II., III. Position)	Advanced (IV and Further Position)
Repertoire for Viola - Aytekin Albuz		X	X
Viola Album Based on Folk Pieces - Zeki Nacakcı		X	X
Piano Accompanied Album For Viola - I - Meltem Erol Düzbastılar	X		
Pieces for Two Violas -1 - Yakup Alper Varış	X		
Pieces for Two Violas - II - Yakup Alper Varış	X		
Piano Accompanied Sonatas and Concertos for Viola - Fatih Marufoğlu	X		
Popular Pieces for Viola Accompanied by Guitar - Yakup Alper Varış	X	X	
Total	5	3	2

When Table 3. is examined, it is observed that four of the albums included in the sample are written only for the beginning level and the pieces contain the basic position, accepted as the first position in the viola. Two of the albums contain intermediate and advanced level prices containing positions I, II, III and IV, and one of them includes positions I, II and III and appeals to both beginner and intermediate viola players.

3. Findings and Interpretation Regarding the 3rd Sub-Problem

Table 4. Kinds of The Pieces in The Albums Used in Viola Education in Turkey

Albums	Based on maqam	Based on tone	Based on mode
Repertoire for Viola - Aytekin Albuz	X		
Viola Album Based on Folk Pieces - Zeki Nacakcı	X		
Piano Accompanied Album For Viola - I - Meltem Erol Düzbastılar		X	
Pieces for Two Violas - I - Yakup Alper Varış	X	X	X
Pieces for Two Violas - II - Yakup Alper Varış	X	X	X
Piano Accompanied Sonatas and Concertos for Viola - Fatih Marufoğlu		X	
Popular Pieces for Viola Accompanied by Guitar - Yakup Alper Varış		X	
Total	4	5	2

Table 4 shows the maqams/tonalities/modalities of works in albums. Based on the table, two of the albums consist of maqam based works, three consist of tone based works and the other two consist of both tone and mode based works. Maqams/tonalities/modalities of the works by album are as follows:

- Aytekin Albuz "Repertoire for Viola ": Original compositions in Buselik, Rast, Huseyni, Kurdi, Hicaz and Karcigar maqams.
- Zeki Nacakcı "Viola Album Based on Folk Pieces ": Original sequential exercises and folk song adaptations in Çargah, Rast, Acemaşiran, Segah, Kürdi, Hicaz, Nikriz and Eviç maqams.
- Meltem Erol Düzbastılar "Piano Accompanied Album For Viola - I ": Small-form works in C Major, G Major, E Flat Major and D Major tones.
- Yakup Alper Varış "Pieces for Two Violas - I, II": Arrangements and adaptations from world folk music Pieces in A Major, G Major, E Minor, F Major, C Major, D Minor, D Major and A Minor tones; E Kurdi and A Huseyni maqams; and Frigian and Mixolydian modes.
- Fatih Marufoğlu "Piano Accompanied Sonatas and Concertos for ViolaConcerto and sonata arrangements and adaptations in C Major, E Minor, G Minor, D Minor and A Minor.
- Yakup Alper Varış "Popular Pieces for Viola Accompanied by Guitar": World folk music arrangements and adaptations in G Major, D Minor, D Major, F Major and D Minor tones.

Findings and Interpretation Regarding the 4th Sub-Problem

Table 5. Accompaniment in Albums Used in Viola Education in Turkey

Albums	Piano Accompaniment	Viola Accompaniment	Guitar Accompaniment	No Accompaniment
Repertoire for Viola - Aytekin Albuz	X	X		
Viola Album Based on Folk Pieces - Zeki Nacakcı				X
Piano Accompanied Album For Viola - I Meltem Erol Düzbastılar	X			
Pieces for Two Violas - I - Yakup Alper Varış		X		
Pieces for Two Violas - II - Yakup Alper Varış		X		
Piano Accompanied Sonatas and Concertos for Viola - Fatih Marufoğlu	X			
Popular Pieces for Viola Accompanied by Guitar - Yakup Alper Varış			X	
Total	3	3	1	1

The 4th sub-problem of the study investigates accompaniment in viola albums published in Turkey. Table 5 indicates that most of the albums in the sample are written with piano and viola accompaniments. While piano and viola accompaniments constitute three albums each, one of the albums has guitar accompaniment and one has no accompaniment. Works in Aytekin Albuz's album "Viyola İçin Dağarcık" are published with both viola and piano accompaniments. This album is the only album with an accompaniment option in the sample.

Findings and Interpretation Regarding the 5th Sub-Problem

Table 6. Preparatory Requirements for Albums Used in Viola Education in Turkey

Albums	Preparatory Requirement
Repertoire for Viola Aytekin Albuz	Positions I, II, III, IV, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.
Viola Album Based on Folk Pieces Zeki Nacakcı	Positions I, II, III, IV, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth, thirtysecond and dotted weighing patterns.
Piano Accompanied Album For Viola - I Meltem Erol Düzbastılar	Position I, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.
Pieces for Two Violas - I Yakup Alper Varış	Position I, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.
Pieces for Two Violas - II Yakup Alper Varış	Position I, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.
Piano Accompanied Sonatas and Concertos for Viola Fatih Marufoğlu	Position I, Detache, legato and staccato and connected staccato techniques Half, quarter, eighth, sixteenth, thirtysecond and dotted weighing patterns.
Popular Pieces for Viola Accompanied by Guitar Yakup Alper Varış	Position I, Detache and legato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.

Table 6 lists the preparatory requirements for viola players to be able to play the albums in the sample. Works in two of the albums use positions I, II, III and IV. It is necessary to be comfortable with the first four positions in terms of position transitions, which is a left-hand technique. The other five albums only use the first basic position, and included works are easier to play than others. Players who learned and studied the basic (I) position can play these albums. It is necessary to be comfortable with detache, legato and staccato techniques to play the works in six of the albums, and the connected staccato technique to play the works in one of them. All of these techniques are right-hand string instrument techniques. In weighing preparedness, works in five of the albums require a knowledge of and ability to play half, quarter, eighth, sixteenth and dotted weighings.

Findings and Interpretation Regarding the 6th Sub-Problem

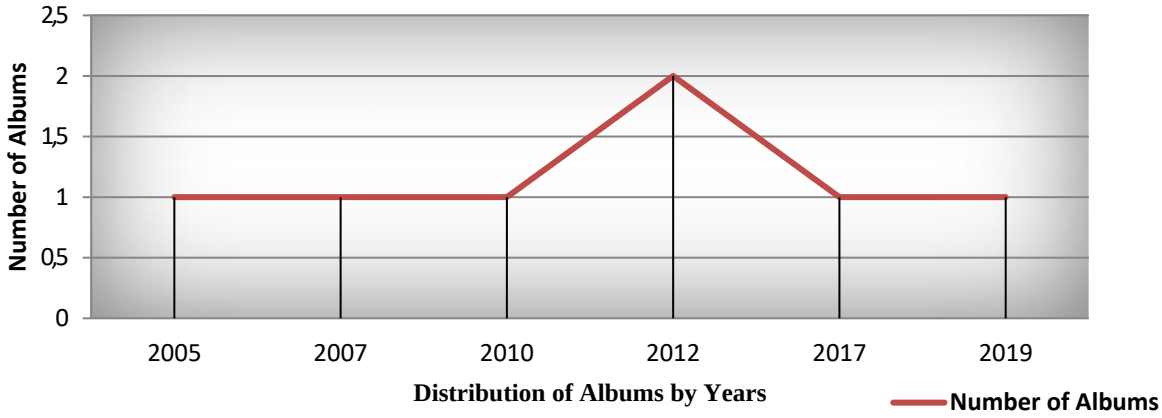

Figure 1. *Distribution of Viola Education Albums By Years.*

6th sub-problem of the study investigates the distribution of published albums by years. The first viola album was published in 2005. One album was published in each of 2007, 2010, 2017 and 2019, and two were published in 2012.

4 | Discussion & Conclusion

The comparative study of seven viola albums included in the study is presented in Table 8.

Table 8. Comparative Study of Viola Albums

	Album Type	Level	Tonality/ Maqam/ Modality	Accompaniment	Preparatory Requirement
Repertoire For Viola - Aytekin Albuz	Original composition	Intermediate - Advanced	Based on maqam	Viola and piano accompaniment	Positions I, II, III, IV, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.
Viola Album Based on Folk Pieces - Zeki Nacakcı	Original composition Folk song adaptations	Intermediate - Advanced	Based on maqam	-	Positions I, II, III, IV, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth, thirtysecond and dotted weighing patterns.
Piano Accompanied Album For Viola - I - Meltem Erol Düzbastılar	Arrangement Adaptation	Beginner	Based on tone	Piano accompaniment	Position I, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.
Pieces for Two Violas - I - Yakup Alper Varış	Arrangement Adaptation	Beginner	Based on maqam, tone and mode	Viola accompaniment	Position I, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.
Pieces for Two Violas - II - Yakup Alper Varış	Arrangement Adaptation	Beginner	Based on maqam, tone and mode	Viola accompaniment	Position I, Detache, legato and staccato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.
Piano Accompanied Sonatas and Concertos for Viola - Fatih Marufoğlu	Arrangement Adaptation	Beginner	Based on tone	Piano accompaniment	Position I, Detache, legato and staccato and connected staccato techniques Half, quarter, eighth, sixteenth, thirtysecond and dotted weighing patterns.

Popular Pieces for Viola Accompanied by Guitar - Yakup Alper Varış	Arrangement Adaptation	Beginner - Intermediate	Based on tone	Guitar accompaniment	Position I, Detache and legato techniques Half, quarter, eighth, sixteenth and dotted weighing patterns.

In conclusion;

Aytekin Albuz's "Repertoire For Viola" fully, and Zeki Nacakcı's "Viola Album Based on Folk Pieces" partly consist of original compositions, while others consist of arrangements and adaptations.

The levels of Aytekin Albuz's "Repertoire For Viola" and Zeki Nacakcı's "Viola Album Based on Folk Pieces" are medium-intermediate, Meltem Erol Düzbastılar's "Piano Accompanied Album For Viola - I", Yakup Alper Varış's "Pieces for Two Violas - I& II" and Fatih Marufoğlu's "Viyola Piano Accompanied Sonatas and Concertos for Viola " are beginner, and Yakup Alper Varış's "Popular Pieces for Viola Accompanied by Guitar " is beginner-intermediate;

Aytekin Albuz's "Repertoire For Viola" and Zeki Nacakcı's "Viola Album Based on Folk Pieces" consist of maqam-based works, Yakup Alper Varış's "Pieces for Two Violas - I& II" consist of tonal, maqam-based and modal works an Meltem Erol Düzbastılar's "Piano Accompanied Album For Viola - I", Fatih Marufoğlu's "Piano Accompanied Sonatas and Concertos for Viola" and Yakup Alper Varış's "Popular Pieces for Viola Accompanied by Guitar " consist of tonal works;

Aytekin Albuz's "Repertoire For Viola" has viola and piano accompaniment, Meltem Erol Düzbastılar's "Piano Accompanied Album For Viola - I" and Fatih Marufoğlu's "Piano Accompanied Sonatas and Concertos for Viola" have piano accompaniment, Yakup Alper Varış's "Pieces for Two Violas - I& II" have viola accompaniment and Yakup Alper Varış's "Popular Pieces for Viola Accompanied by Guitar" has guitar accompaniment;

Aytekin Albuz's "Repertoire For Viola" and Zeki Nacakcı's "Viola Album Based on Folk Pieces" require knowledge of positions I, II, III and IV., while the others only require position I; Fatih Marufoğlu's "Piano Accompanied Sonatas and Concertos for Viola" requires mastery of legato, detache, staccato and connected staccato techniques while others require knowledge of legato, detache and staccato techniques; Zeki Nacakcı's "Viola Album Based on Folk Pieces" and Fatih Marufoğlu's " Piano Accompanied Sonatas and Concertos for Viola" require knowledge of half, quarter, eighth, sixteenth, thirty second and dotted weighing patterns, while the other albums require half, quarter, eighth, sixteenth and dotted weighing patterns.

No viola album publications were found before 2005. The first album for viola was published in 2005, one album was published in each of 2005, 2007, 2010, 2017 and 2019, and two were published in 2012.

Instructors, compositors and interpreters gave us resources to use in the education of various instruments based on our original music. Kurtaslan's study (2009, p.12) of violin education materials in music teacher education institutions, examines the resources published in violin literature. The study concludes that utilization of Turkish musical culture materials in line with instrument education principles included in resources used by instructors for instrument education makes instrument education stronger. While viola is an instrument found in orchestras and music schools for many years, the number of domestic works in this area is very low. Due to the increase in the number of conservatories, fine arts faculties, music education departments and fine arts high schools in the 2000s, more viola interpreters, composers and instructors began to emerge and as these people continued on to graduate programs, academic studies of the instrument increased. Although the number of field-specific studies is still low, the academic development in viola offers hope for the future.

Urhal and Can (2018) examined sheet music books for cello, piano, violin, viola and flute that were published in Turkey. The study analyzed method, album and technical exercise books in terms of identity and content. The study concluded that Aytekin Albuz's "Repertoire For Viola", Meltem Erol Düzbastılar's

"Piano Accompanied Album For Viola - I" and Yakup Alper Varış's "Pieces for Two Violas - I& II" are at beginner and intermediate levels. Study results appear to be consistent.

Tarman (2017) excluded method books from the study of national sheet music publication and music books in Turkey, in which they reviewed qualified publications from Turkish composers. They included Aytekin Albuz's "Repertoire For Viola" in the viola category. Tarman also examined the increase in numbers of published albums and concluded that between 2011 and 2016, sheet music books increased by 30%. Study results are consistent.

Çakıroğlu and Çaydere (2016) also examined viola books in their bibliographic study of music books in the National Library and identified Meltem Erol Düzbastılar's "Piano Accompanied Album For Viola - I" is included in the National Library. Studies appear to support each other in terms of results. The reason for the other albums not being included in the library is thought to be the fact that the first publications were not included in the library, and that there were no subsequent publications.

Based on these results, we make the following suggestions;

Viola instructors and composers creating more works with albums consisting of World Folk Music, Turkish Folk and Art Music and universal classical repertoire examples will be beneficial in terms of the resource problem in viola education.

In music studies, the author shoulder a heavy burden for publication and distribution, and they can only publish in low numbers if they can't find financial support. This causes the publications in our country to be inadequate and fail to reach a wide audience. Publishers who publish in all fields don't provide the necessary support since they cannot make large profits off of albums and methods for music. Publishers established by music instructors offer some solution but sometimes are inadequate. The opportunity to publish without thinking about sales and profits will encourage more instructors and composers to publish their works. An increase in the number of publishers established by musical instructors will provide a great support to the music education world.

It would be beneficial for enriching viola education with nev and diverse resources if viola instructors and composers identify shortcomings and necessities based on the study results and offer works in these areas.

Researchers' contribution rate

First author collected data and contributed to manuscript revisions. Second author contributed with data analysis and reported the results. All authors read and approved the final manuscript.

Conflict of interest

The authors of this article declare that there is not conflict of interest.

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