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Message from the Editor,

I am very pleased to inform you that we have published the second issue in 2020. As an editor of International Online Journal of Primary Education (IOJPE), this issue is the success of our authors, very valuable reviewers who undertook the rigorous peer review of the manuscripts, and those of the editorial board who devoted their valuable time through the review process. In this respect, I would like to thank to all reviewers, researchers and the editorial board members. The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to International Online Journal of Primary Education (IOJPE). For any suggestions and comments on IOJPE, please do not hesitate to send me e-mail.

Prof. Dr. Sinan OLKUN

Editor in Chief

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EARLY CHILDHOOD PRESERVICE TEACHERS' PERCEPTIONS ON CHILDREN'S PLAY

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Abstract

The purpose of this participant selection model mixed methods study was to investigate early childhood education preservice teachers' perceptions on children's play. The study was conducted at one of the Midwestern universities' early childhood undergraduate education program in the United States. Within the program, 241 students at different stages within the program (Cohort I, Cohort II, Cohort III, Cohort IV, and Cohort V) participated in the quantitative phase of the study. The survey results demonstrated that concept of play does not have a shared definition. Play is viewed as social and physical activity but less cognitive. It was also found that participants at earlier stages within the program are more inclusive toward play and the participants at the later stages perceive play in more rigid and strict ways. The seniors tend to be focused on a specific outcome rather than viewing play as process-oriented activity within the early childhood classroom.

Keywords: Pre-school education, mixed methods, pre-service teachers

INTRODUCTION

Extensive body of research suggest that play offers a multi-faceted educational impact and educates children intellectually, emotionally, socially and physically (Bergen, 2009, Thibodeau, Gilpin, Brown, Brooke, & Meyera, 2016; Prager, Sera, & Carlson, 2016; Wood & Attfied, 2005). However, play in early childhood education is on a decline (Pistorova & Ruslan, 2017). For example, comparing public school kindergarten classrooms between 1998 and 2010 using two large, nationally representative data sets, Bassok, Latham, and Rorem (2016) found that, in the later period, kindergarten teachers emphasized advanced literacy and math content, teacher-directed instruction, and assessment and considerably less time spent on art, music, science, and child-selected activities. As kindergarten has become heavily focused on teaching literacy and other academic skills, "preschools are rapidly moving in that same direction" (Miller & Almon, 2009, p. 7).

Researchers maintain that the majority of the early childhood teachers believe in play and the advantages it offers (Lynch, 2015; McLane, 2003; Nicolopoulou, 2011; Sisson & Kroeger, 2017). However, constraints of time and resources in combination with the pressure of accountability and testing seem to compel teachers to return to a back-to-basics curriculum and to focus on narrowly defined outcomes (Lynch, 2015; Nicolopoulou, 2011). Even when practitioners may be willing to adapt numerous roles in play-based learning, as results of ameta-synthesis of 62 studies from 24 national contexts demonstrate, they are unsure about how and when to get involved (Bubikova-Moan, Hjetland & Wollscheid, 2019).

To reverse this negative tendency, early childhood teacher educators in many universities work diligently to teach preservice teachers about the importance of play during a child's early years. Yet, when placed in schools for their student teaching fieldwork, many pre-service teachers align their perceptions about play

with the reality they observe, in which play is devalued (Jung & Jin, 2015; Jung & Jing, 2014; Pistorova & Ruslan, 2017. Therefore, the challenge today is to prepare preservice teachers for the education field in which, "child-initiated play-based curriculum, standards-based curriculum, and accountability issues frequently collide" (Jung & Jin, 2014, p. 358).

Teacher Education and Play

Although there has been considerable evidence supporting the effectiveness of learning through play, scholarly discussion of play in teacher education is still limited (Blom & Damico, 2019, Miller & Almon, 2009, Jung, Zhang & Zhang, 2016). Close examination of existing studies on preservice teachers' beliefs on play indicates that play, as a concept, does not have a shared meaning. Multiple meanings and contradictions present within the preservice teachers' beliefs about play highlight the challenges of defining and conceptualizing play within teacher education (Altun, 2018; Klugman, 1996; Sherwood & Riefel, 2010). Yet, it is important to understand how preservice teachers perceive play since, as research shows, the perspectives they hold as future educators before beginning intensive instruction will have a vital role in how they will be able to link play and curriculum in an early childhood setting (Jung & Jing, 2014; Klugman, 1996; Jung, Zhang, & Zhang, 2016).

In this study, "preservice teachers" specifically refers to those individuals seeking initial licensure in a four-year higher education program leading the students to a Bachelor of Science in Education degree in Early Childhood Education (ECED) preparing teachers for preschool through third grade. All pre-service teachers complete field and practicum experiences with students at earlier stages of the program being placed in toddlers, preschool, kindergarten and primary grades classrooms as they move up within the program.

As for the concept of play, in the context of school, play is best viewed as a continuum with guided play on one end and free play on the other (Miller & Almon, 2009). Typically, playful learning includes both guided play and free play (Bodrova & Leong, 2010; Reed, Hirsh-Pasek, & Golinkoff, 2012). Usually play is described as an intrinsically motivated, enjoyable, process-oriented, non-realistic, and self-chosen activity (Hirsh-Pasek et al., 2009; Krasnor & Pepler, 1980). Play as "playful learning" is a focus of this study.

The concept of perception, according to Leibniz is "the expression of many things in one" (as cited in Kulstad, 1982, p. 66); in other words, a sensation along with an image. In its relevance to this study, perception includes the meanings of knowledge, beliefs, attitude, value, feeling, thinking, and implicit theory.

Purpose of the Study

The aim of this participant selection model mixed methods study is to better understand preservice teachers' perceptions on play and elucidate their preconceived notions on this term before they enter their own classrooms. Research is required to examine the ongoing variance in preservice teachers' perceptions on play and how these views change throughout the duration of the teacher education program. The expectation is that such understanding of preservice teachers' mental images about play might assist early childhood teacher educators in addressing this complex area of early childhood education in their preparation programs.

METHODS

Research Model

Sequential mixed method participatory selection model: This study is a part of a larger participant-selection model mixed methods investigation. Participant-selection model is a variation of the sequential explanatory mixed methods research design that prioritizes the qualitative phase of the study instead of the

initial quantitative phase (Creswell & Plano Clark, 2007). The study was conducted at one of the Midwestern universities' early childhood undergraduate education programs in the United States. Within the program, 241 students at different stages, Cohort I (second semester, sophomore year), Cohort II (first semester junior year), Cohort III (second semester junior year), Cohort IV (first semester senior year), and Cohort V (second semester senior year), completed two online surveys – Instrument I (Part A & B) and Instrument II (Future Professionals' Survey). The results of the surveys were used for the selection of 10 participants for the qualitative segment of the study. The participants were selected from the sample pool of 71 survey respondents, who provided contact information and also indicated that they were willing to participate in a follow up interview. The criteria for the inclusion was the "extreme or outlier cases" (Creswell, 2014). Thus, two participants from each cohort, one demonstrating the most positive attitude (highest mean score on the survey) and the least positive attitude towards play (lowest mean score on the survey) were selected and interviewed for the qualitative part of the study.

The study utilized mixed method. The quantitative question aimed to explore how the preservice teachers' attitudes towards play and the role of play in learning and curriculum differ among five cohorts of students. The qualitative inquiry focused on preservice teachers' beliefs about play and the factors that contributed to their understanding of play. Finally, the mixed methods segment was designed to explain perspectives on how play contributes to children's learning by comparing and contrasting the qualitative findings with the quantitative results.

Participants

Normally, within an Early Childhood Education program, students form a cohort to complete a five-cohort sequence of courses, while gaining teaching experiences linked to coursework. Specifically, **Cohort I** (second semester, sophomore year) coursework focuses on Child Development, Integrated Expressive Arts and Social Studies, Early Math and Science, Preschool Education, and the focus of the fieldwork is on preschool (nine hours for 14 weeks). **Cohort II** students' (first semester, junior year) study focus is on Music and Rhythms, Language & Literacy, Partnerships & Guidance, and Integrated Preschool Curriculum. Students spend 20 hours per week for 15 weeks in preschools, affiliated schools, including the campus lab school, Head Start, public schools' preschools settings. **Cohort III** (second semester, junior year) coursework relates to Phonics, Mathematics, Online course IB-PYP, Home-School Community Partnerships and Integrated Social Studies. Cohort III students usually spend two days a week in urban schools with additional focus fields in math and literacy, public primary schools. **Cohort IV** (first semester, senior year) students' coursework focus is on reading and writing, developing a balanced literacy program, and math and science. For fieldwork, these students are placed in kindergarten and primary classrooms for two days per week for 14 weeks. **Cohort V** (second semester, senior year) students teach in a kindergarten or primary class for five days per week throughout the length of one semester (15 weeks) and take a Student Teaching Seminar class.

The participants in this study included 241 students (Cohort I, Cohort II, Cohort III, Cohort IV, and Cohort V). Demographic questions, including those related to age, gender, ethnicity, and education levels (Cohort) were asked in a separate section of the survey research. Of the participating students, 233 (96.7%) were female and 8 (3.3%) were male. Additionally, 54 (22.4%) Cohort I, 41 (17%) Cohort II students, 61 (25.3%) Cohort III, 44 (18.3%) Cohort IV and 41 (17 %) Cohort V students completed the study surveys. Participants' ages ranged from 19 to 38 with an average age of 21.1 (*SD* = 1.795). Of the group, 137 students (231) were White, 10 (4.1%) were nonwhite. The population demographic data including gender, race, place of birth, and class rank is shown in Table 1.

Table 1. Demographics of sample

	N	%
Gender		
Female	233	96.7
Male	8	3.3
Race		
White	231	95.9
Nonwhite	10	4.1
Born in the United States		
Yes	239	99.2
No	2	.8
Class rank		
Cohort I	54	22.4
Cohort II	41	17.0
Cohort III	61	25.3
Cohort IV	44	18.3
Cohort V	41	17.0
Age	241	Mean: 21.01 sd: 1.795 Min: 19 Max: 38

Note: For Age, the % column shows mean and sd.

Data Collection

The quantitative data was collected using two Likert Scale instruments - Instrument I (Part A & B) and Instrument II (Future Professionals' Survey). For the purposes of the present study, only Instrument I (Part A & B) data and results will be described.

Instrument I Likert Scale questionnaire was composed of two parts—Part A and Part B. The Part A scale was focused on *adjectives describing play* and Part B measured *activities defined as play.* Initially, this instrument was created by Sherwood and Reifel (2010), who interviewed seven preservice teachers about adjectives describing play as well as activities constituting play. Later, Lewis (2014), using the results of Sherwood's and Reifel's study, modified this instrument with permission from the original authors. Lewis (2014) tested the instrument by conducting a pilot study in which 24 participants completed the questionnaire. The pilot study provided important information that led to modification of the instrument. The Likert-type Scales were updated to be more definitive and provide a wider range of possibilities for the participants to choose from. The items from the original study's instrument remained unchanged. The survey questions design was guided by conceptual and educational literature.

Instrument I—Part A and Part B

Part A Likert Scale instrument ranging from 1 to 3 was used to identify the *adjectives describing play* in the early childhood classroom. The participants were presented 20 adjectives that can be used to describe play with a statement to follow the prompt: "Play is…" and choose 1 (*Disagree*), 2 (*Neutral*), or 3 (*Agree*) to indicate their level of agreement with the statement. The survey questions are presented below:

Play is…

1. Something children do because they want to
2. A creative process
3. Imaginative
4. Enjoyable for those involved
5. Serious
6. Focused on a specific outcome
7. Physically active
8. Socially interactive
9. Academic
10. A reward
11. Passive learning
12. Driven by rules
13. Relaxing
14. Difficult for the teacher to find time for
15. Important for learning
16. Teacher-directed
17. Educational
18. Stimulating
19. The job of the teacher
20. Something that can be done alone

Part B Likert Scale instrument was used to measure the *activities identified as play*. Using a 4-point Likert-type Scale, 1 (*Never Play*), 2 (*Seldom Play*), 3 (*Often Play*), or 4 (*Always Play*), participants were asked to rate the extent to which they believed each given activity constitutes play. Participants were provided with the following list of 25 activities that could constitute play:

1. Dancing
2. Arts and crafts
3. Reading a book
4. P.E. (Physical Education)
5. Show-and-tell
6. Asking for a turn on the swings
7. Singing the ABCs
8. Looking around while in the hallway
9. Pretending to be a teacher and calling a student “stupid”
10. Counting to 100
11. Being read to
12. Centers
13. Talking to a friend
14. Working on a puzzle
15. Doing a science experiment
16. Listening to music
17. Feeding a classroom pet
18. Cutting out pictures that begin with the letter B
19. Listening to a book on tape
20. Figuring out how to join a group already in an activity.
21. Getting one’s feelings hurt
22. Learning about other cultures

23. Pretending to be a character from a violent movie
24. Eating lunch
25. Telling another child that s/he cannot join a board game

Data Analysis

Instrument I Part A (Adjectives describing play) - For analysis purposes, 20 adjectives were classified into five main groups - Developmental Adjectives, Independence Adjectives, Structure Adjectives, Pleasure Adjectives, Teacher's Role Adjectives—identified by previous researchers (Lewis, 2014). The scores of each of the subscales, organized into the following five groups, were summed: Developmental Adjectives (Physically active, Socially interactive, Academic); Independent Adjectives (Imaginative, Educational, Something that can be done alone); Structure Adjectives (Focused on a specific outcome, Driven by rules); Pleasure Adjectives (Something children do because they want to; Enjoyable for those involved); Teacher's Role Adjectives (Teacher-centered, The job of teacher).

Instrument I Part B (Activities identified as play) - For analysis purposes, the 25 items were organized into four main groups: Cognitive Activities, Negative Activities, Socio-Emotional Activities, Hands-On Activities identified by previous researchers (Lewis, 2014). The scores of each of the subscales, organized into the following four groups, were summed: Cognitive Activities (e.g., singing the ABCs, counting to 100, being read to, cutting out pictures that begin with the letter "B," listening to a book on tape); Negative Activities (e.g., pretending to be a teacher & calling a student "stupid," getting one's feelings hurt, pretending to be a character from a violent movie, telling another child s/he cannot join a board game); Socio-Emotional Activities (e.g., talking to a friend, listening to music, feeding a classroom pet, learning about other cultures); and Hands-On Activities (e.g., physical education, centers, working on a puzzle, doing a science experiment).

The quantitative data were analyzed using SPSS statistical software and various tests such as histogram, skewness, kurtosis, Kolmogorov-Smirnov that test statistical assumptions for a one-way analysis of variance (ANOVA) that include normality, heterogeneity of variance, and independence. In this study, the significance level was accepted as .01.

RESULTS

Preservice Teacher Ratings of Adjectives Describing Play – Instrument I Part A

For Instrument I Part A, the scores of items on each scale were averaged for mean values of the data. Descriptive information about these ratings, including means, standard deviations are presented in Table 2. For all items, N = 241.

Table 2. Descriptive statistics for items on the adjective scales

	Mean	SD	Alpha
Developmental Adjectives			.753
Physically active	2.60	.515	
Socially interactive	2.75	.454	
Academic	2.71	.473	
Independence Adjectives			.308
Imaginative	2.98	.157	
Educational	2.83	.398	
Something that can be done alone	2.71	.583	

Structure Adjectives			.375
Focused on a specific outcome	1.60	.638	
Driven by rules	1.27	.489	
Pleasure Adjectives			.336
Something children do because they want to	2.90	.346	
Enjoyable for those involved	2.87	.359	
Teacher's Role Adjectives			.493
Teacher-directed	1.31	.531	
The job of the teacher	1.78	.715	

Note: For all items, N=241.

Preservice Teacher Ratings of Activities Identified as Play – Instrument I Part B

For Instrument I Part B, the scores of items on each scale were averaged for mean values of the data. Descriptive information about these ratings, including means, standard deviations on preservice teachers' beliefs about how often items in the set of provided activities constitute play can be seen on Table 3. For all items, N = 241.

Table 3. Descriptive statistics for items on play activities scale

	Mean	SD	Alpha
Cognitive Activities			.802
singing the ABCs	2.30	.803	
counting to 100	1.84	.695	
being read to	2.16	.769	
cutting out pictures that begin with the letter B	1.71	.747	
listening to a book on tape	2.02	.803	
Negative Activities			.630
pretending to be a teacher and calling a student "stupid"	1.95	1.007	
getting one's feelings hurt	1.52	.764	
pretending to be a character from a violent movie	2.99	.977	
telling another child that s/he cannot join a board game	1.63	.817	
Socio-Emotional Activities			.683
talking to a friend	2.99	.733	
listening to music	2.97	.715	
feeding a classroom pet	2.37	.817	
learning about other cultures	2.48	.801	
Hands-on Activities			.667
P.E. (physical education)	3.32	.695	
centers	2.92	.817	
working on a puzzle	3.14	.709	
doing a science experiment	2.89	.767	

Results of Inferential Statistics

One-way ANOVA was used to test if there was a difference in preservice teachers' levels of agreement with the play scales by cohort. Descriptive information about the ratings, including means, standard deviations, p-value and F-test can be seen in Table 4 below.

Table 4. Descriptive statistics of means for each scale and one-way ANOVA results for differences between class groups (Cohorts)

Scales	Cohort I (*N* = 54)	Cohort II (*N* = 41)	Cohort III (*N* = 61)	Cohort IV (*N* = 44)	Cohort V (*N* = 41)	F test
Developmental Adjectives	2.61 (.39)	2.73 (.37)	2.67 (.40)	2.70 (.42)	2.75 (.38)	$F_{(4,236)} = .940$, $p = .442$
Independence Adjectives	2.85 (.26)	2.86 (.22)	2.89 (.19)	2.88 (0.24)	2.70 (.40)	$F_{(4,236)} = 3.678$, $p = .006$
Structure Adjectives	1.38 (.42)	1.41(.39)	1.35 (.43)	1.40 (.45)	1.70 (.47)	$F_{(4,236)} = 4.571$, $p = .001$
Pleasure Adjectives	2.86 (.26)	2.90 (.23)	2.90 (.23)	2.88 (.29)	2.89 (.36)	$F_{(4,236)} = .278$, $p = .892$
Teacher's Role Adjectives	1.53 (.48)	1.67 (.55)	1.56 (.51)	1.44 (.45)	1.55 (.58)	$F_{(4,236)} = 1.073$, $p = .371$
Cognitive Activities	2.21 (.57)	2.26 (.64)	2.01 (.53)	1.76 (.41)	1.73 (.49)	$F_{(4,236)} = 9.373$, $p < .001$
Negative Activities	1.88 (0.61)	2.18 (0.69)	2.14 (0.53)	1.99 (0.61)	1.91 (.65)	$F_{(4,236)} = 2.292$, $p = .060$
Social-Emotional Activities	2.80 (0.56)	2.90 (0.66)	2.70 (0.49)	2.53 (0.51)	2.55 (.47)	$F_{(4,236)} = 3.712$, $p = .006$
Hands-On Activities	3.17 (.54)	3.20 (.53)	3.09 (.46)	2.99 (.53)	2.83 (.55)	$F_{(4,236)} = 3.458$, $p = .009$

Note: The nonparametric Kruskal-Wallis test was used instead of one-way ANOVA for the Independence Adjectives variable that violated the equal variances assumption required by ANOVA. The Kruskal-Wallis test result for Independence Adjectives variable was not significant (p = .026, respectively), implying that there is no difference in the mean score between the five cohorts (see Table 5). Because the Kruskal-Wallis test results were non-significant, multiple comparisons tests for Independence Adjectives were not conducted.

Table 5. Kruskal-Wallis test results for independent adjectives scale

Variable	H	Df	p-value
Independence adjectives	11.096	4	.026

The multiple comparisons test results indicated that Cohort V students had a significantly higher Structure Adjectives score than students in Cohort I and Cohort III (p < .001). Moreover, students, in Cohort IV and Cohort V had significantly lower Cognitive Activities scores than Cohort I and Cohort II participants (p<.001). Post Hoc test results across two instruments are presented in Table 6 below.

Table 6. ANOVA post hoc test results

Dependent Variable	Sample 1-Sample 2	Mean Difference (1-2)	Sig.
Structure Adjectives	Cohort I–Cohort V	-.31549	.005
	Cohort III–Cohort V	-.34266	.001
Cognitive Activities	Cohort I–Cohort IV	.45118	.000
	Cohort I–Cohort V	.48311	.000
	Cohort II–Cohort IV	.49978	.000
	Cohort II–Cohort V	.53171	.000

DISCUSSION

Table 7 represents the summary of the overall significant findings of the study. The multiple comparisons test results indicated that Cohort V students had a significantly higher Structure Adjectives score than students in Cohort I and Cohort III ($p < .001$). Moreover, students, in Cohort IV and Cohort V had significantly lower Cognitive Activities scores than Cohort I and Cohort II participants ($p < .001$).

Table 7. Summary of significant findings

Variable	Test used	Conclusion
Structure Adjectives	One-way ANOVA	Significant difference ($p < .001$)
Cognitive Activities	One-way ANOVA	Significance difference ($p < .001$)

Results of Instrument I Part A - Preservice Teacher Ratings of Adjectives Describing Play

Overall evaluation of mean values across Table 2 illustrating results of descriptive statistics, shows that there is not a single play adjective that held the entire range of responses (1–3) and was agreed upon wholly by the participants. Out of the 20 adjectives provided to the participants, there were two that indicated highest level of agreement: "Play is imaginative" ($M = 2.98$) and "Play is something children do because they want to" ($M = 2.90$). Among the other 18 items, there was more variety, with participants' responses varying in level of agreement. For example, the items "Enjoyable for those involved" ($M = 2.87$) and "Play is educational" ($M = 2.83$) had higher means, while items such as "Play cannot be driven by rules" ($M = 1.27$) and "Play cannot be teacher-directed" ($M = 1.31$) had the lowest means. Overall, the data shows that preservice teachers view play as an imaginative, independent, pleasurable, self-chosen activity that belongs to children.

Also, the high mean value on item "Play is educational" ($M = 2.83$) shows the relative consensus among participants that play relates to learning, while the lower mean values on items like "Play cannot be driven by rules" ($M = 1.27$) and "Play cannot be teacher-directed" ($M = 1.31$) indicate that most of the participants rejected the idea of play being goal-oriented, structured, or teacher-directed.

This perception of play is in congruence with the widely accepted definition of play as an intrinsically motivated, enjoyable, process-oriented, non-realistic, and self-chosen activity (Hirsh-Pasek et al., 2009; Krasnor & Pepler, 1980). In addition, the fact that there was not one item on this part of the survey that all

students agreed upon supported the idea that the construct of play is a "roomy subject, broad in human experience, rich and varies over time and place" (Eberle, 2014, p. 214), which is difficult to define. This supports previous researchers' findings (Lewis, 2014; Sherwood & Reifel, 2010) and indicates preservice teachers' diversity of beliefs and opinions about play.

The Post Hoc test results indicated that Cohort V students had significantly higher Structure Adjectives (for example, "Focused on specific outcome," "Driven by rules") mean scores than participants in Cohort I and Cohort III. The higher Structure Adjectives mean score implies that participants' view of play becomes somewhat narrow as they advance through the program. It can be inferred that these differences are a result of time spent in the teacher education program. Unlike Cohort I and Cohort III participants, Cohort V appears to focus on rules and the end product in play. The differences were statistically significant (see Table 6). Lewis (2014), who originally developed the Instrument I Part A and B, also found this difference between two cohorts on the item "Play is focused on a specific outcome," with participants in Cohort III tending to agree more with this statement than participants in Cohort I (Note that there were four groups of students in the program that was studied by Lewis, while this study had five groups of students in the program).

One possible explanation is that with the extensive student teaching experiences and substantial exposure to math, science, language, and other content knowledge in the last few semesters of college, the seniors' thinking is more focused on organization of play for achieving a learning outcome. Yet, this might imply that preservice teachers' view of play and education of young children, in general, becomes somewhat narrow as they advance through the program. Unlike the newer students to the program, seniors appear to focus on rules and the end product in play. This is important to consider for early childhood teacher education programs that prepare teachers for education of young children where open-ended, process-oriented and inquiry-based education is more important than teaching for narrowly defined outcomes.

Results of Instrument I Part B - Preservice Teacher Ratings of Activities that Constitute Play

Overall evaluation of mean values across Table 3, illustrating the results of descriptive statistics, demonstrates that none of the 25 items held the entire range of responses (1–4) and were agreed upon wholly by the participants. Out of the 25 activities provided to the participants, there were two that indicated the highest level of agreement upon what constitutes play: "P.E. (physical education)" (M = 3.32) and "Working on a puzzle" (M = 3.14). On the other 23 items, there was a range of responses as well with items such as "Pretending to be a character from a violent movie" (M = 2.99) and "Talking to a friend" (M = 2.99) having higher means, or agreement among the five groups, and the negative items like "Telling another child that s/he cannot join a board game" (M = 1.63) and "Getting one's feelings hurt" (M = 1.52) having the lowest means. The participants also agreed less on the Cognitive Activities scale that include items like "Counting to 100" (M = 1.84), "Cutting out pictures that begin with the letter B" (M = 1.71) or "Listening to a book on tape" (M = 2.02) and agreed more on Socio-Emotional Activities ("Talking to a friend," "Listening to music," "Feeding a classroom pet" and "Learning about other cultures") and Hands-On Activities ("P.E. [physical education]," "Centers," "Working on a puzzle," "Doing a science experiment") scales.

Thus, in general, the results indicate that participants are more likely to perceive activities like physical education, working on puzzles, centers, doing a science experiment, or talking to a friend as play rather than activities related to school such as singing ABCs, counting to 100, or reading. Therefore, there is a tendency in preservice teachers' perceptions to view play as a physical, social, hands-on, and emotional activity but less cognitive and educational. This trend in perceiving play as less related to formal learning was also captured by previous researchers (e.g., Klugman, 1996). In his study, Klugman found that the participants did associate play with learning and development—in particular, social development.

However, only 48 out of Klugman's 168 respondents believed that children can learn more through play, and eight respondents agreed that play contains some elements of formal learning.

Thus, it can be concluded that the link between play, learning, and development for the study participants is not well established. In addition, the fact that there were so many items in which at least one participant believed the activity was *never* play and at least one participant believed the activity was *always* play indicate that there is no universal agreement among the participants on what constitutes play. This goes along with the aforementioned notion that the construct of play is difficult to define.

The results of the multiple comparisons test indicate that participants in Cohort IV and Cohort V had significantly lower mean scores on the Cognitive Activities Scale ("Singing ABCs," "Counting to 100," "Being read to," "Cutting out pictures that begin with the letter B," or "Listening to a book on tape") than their peers in Cohort I and Cohort II. Lewis (2014) also came to similar results finding significant differences on the Cognitive Activities item between Cohort I and Cohort IV with Cohort I gravitating more toward considering these activities as play and Cohort IV participants agreeing less to accept these activities as play.

One possible explanation of these results is the participants' coursework and field placements. These participants at the advanced stages of the program have completed the Preschool Education course offered in Cohort II in which they may have been put into a mindset that not all activities are play while the Cohort I and Cohort II participants have not completed that course yet. Cohort IV students' coursework focus is on reading and writing, developing a balanced literacy program, and math and science. For fieldwork, these students are placed in kindergarten and primary classrooms for two days per week. Thus, the educational environment the participants are placed in where they might not see play at all and focus on academics, may also have influenced their perceptions on play in an adverse way.

It can be inferred from these results, that while the underclass students hold an open and inclusive view of play, the upperclassmen's perceptions of play become stricter and somewhat narrow as they progress in the program. Even though it can be argued that the survey items are not truly representative of play in its purest sense, the differences in mean scores between the groups is a clear indication of some tendency in upperclassmen's perspectives to perceive play in a narrow way.

It is well known that students entering teaching profession come to the program of study with set beliefs about education (Donaghue, 2003; Fajet, Bello, Leftwich, Mesler, & Shaver, 2005; Klugman, 1996; Ng, Nicholas, & Williams, 2010; Pajares, 1992; Richardson, 2003). These beliefs and perceptions largely come from the 12 or 13 years of schooling experience they gained before coming to college through the "apprenticeship of observation" and personal biographies (Lortie, 1975) that are often hard to elicit and identify. However, it is through these lenses, preservice students view and comprehend any new concepts presented to them in their college classrooms and/or field experiences that nevertheless, come to light when the students teach in their own classrooms (Pajares, 1992; Sanger & Osguthorpe, 2011).

Play perceptions are not exception. Students come to college with deeply seated beliefs about play originated in childhood (Sherwood & Reifel, 2010; Klugman, 1996). Unfortunately, these beliefs are difficult to dislodge (Leaupepe, 2009). When the preexisting knowledge is not fully challenged it creates barriers for understanding. Accordingly, concepts of play, learning and development cannot be fully integrated in participants' minds if play is just play and fun. Therefore, as researchers suggest, while students do gravitate toward progressive college agenda that emphasizes constructivist and inquiry play-based learning and teaching during their college training (Cevher-Kalburan, 2015; Charko, Fraser, Jones, & Umangay, 2016; Jung & Jin, 2014; Jung & Jin, 2015; Nicholson & Shimpi, 2015; Nicholson, Shimpi, & Rabin, 2014; Ridgway & Quinones, 2013; Van der Aalsvoort, Prakke, Howard, König, & Parkkinen,

2015), it is unclear whether they will apply the gained knowledge on play in teaching and curriculum making in their future classrooms (Ahn, 2008; Jung & Jin, 2015; Jung, Zhang & Zhang, 2016).

In this study, perhaps due to the gap in knowledge the study participants' perceptions about play became somewhat narrow, close to graduation, as they immersed in the current test-driven educational environment. Encounters with the "realities" in the field, where play is not commonly in practice, possibly further deepened their confusion. Therefore, it can be predicted that it is more likely that preservice teachers will align their perspectives with those in the field and continue to perpetuate the existing practice in which play is devalued. Without adequate training and preparation of teachers, this trend is going to continue. It is therefore the responsibility of early childhood teacher educators to establish early years' practitioners as play professionals who have a clear understanding of both play and learning, their relationship to one another, and the role of the teacher in facilitating play (Howard & King, 2015).

Limitations of Study

In addition to not having qualitative data, there were some limitations in this study related to reliability and homogeneity of variance. The survey instruments used in this study had previously reported Cronbach's alpha values in the acceptable range. In this study, while some alpha coefficients matched or were relatively close with the previous researchers' alpha scores (all of which had been above or near the acceptable level), several of the subscales on Instrument I were well below the acceptable threshold of reliability.

One of the possible reasons of low Cronbach's alpha values for some subscales is that the items had three scale points, so there is very small range of variation. Cronbach's alpha assumes that the items are measured on a ratio scale (or can be assumed to be measured on a ratio scale). The "best" number of scale points to use is between 5 and 7 (Preston & Colman, 2000). However, some of the original subscales used three points or four points (Instrument I Part A and Part B, respectively). Additionally, some of the subscales only had two items (Pleasure Adjectives, Structure Adjectives, Teacher Role Adjectives) while appropriate number of items (or appropriate minimum number of items) needed to measure a given construct is four to five (Hinkin, Tracey, & Enz, 1997).

Additionally, certain statistical tests require meeting certain assumptions about the distribution of the data in order for the inferences drawn to be valid. Analysis of variance (ANOVA) is a parametric statistical test, and as such, requires several assumptions to be met in order to use it. The assumptions are independence of the observations, normality, and homogeneity of variance. While there was no problem with independence, the assumptions of normality and homogeneity of variance were not met for some dependent variables. According to the Kolmogorov-Smirnov test, virtually all of the dependent variables were not normally distributed, and according to Levene's test, Independence Adjectives variable did not meet the assumption of homogeneity of variance. ANOVA is typically robust to violations of the assumption of normality, but it is less robust when there are violations of the assumption of homogeneity of variance. Therefore, the Kruskal-Wallis test was used for the Independence Adjectives variable with non-constant variance. Thus, it is not recommended using the study instruments, Instrument I Part A and B, in future studies without considerable improvement of the survey.

Implications and Recommendations

The study findings illustrate the absence of uniformity in perceiving play in early childhood education. For example, reading a book was considered by one participant as play and was not considered as play by another. The absence of a shared definition of play makes it challenging to incorporate it into the teacher education program to establish the critical link between play and learning. The prospective teachers have a good sense of what is play, even though their perspectives vary. What needs to be clarified then is the concept of learning.

Teacher education

In the light of the findings, it is suggested to re-direct the focus of early childhood teacher education program from teaching play to teaching learning. A change in language should address the confusion between the two concepts, consequently deepening preservice teachers' understanding of developmental and learning process that take place in children's play. Students' ability to clearly define the concept of learning will allow them to re-construct their preconceived notions of play. When students have a clear understanding of how young children learn, develop and construct knowledge, play-based pedagogy and curriculum will, hopefully, become a part of formal teaching and learning in a test-driven environment. This shift in language and fundamental knowledge hopefully will help solve the widespread problem of academization in early childhood education as well as problems of teaching diverse learners (such as English Language Learners, children with special needs, children with trauma, children in poverty, etc.).

Due to the absence of a single definition of play, early childhood teacher education programs should determine their own definition based on the context of the university, their students and their own research and teaching goals. This definition should be broad and holistic and distinctively defined from other developmental stages. Based on this definition, teacher educators need to come to decide what teaching texts, approaches, methods and experiences they will prioritize in teaching future teachers to foster a holistic vision of child development and learning.

Moreover, the students should be exposed to the most updated neuroscience research to establish the critical links between the body and brain. The aim is to unfold the concept of cognitive and intellectual development for the future professionals to gain a better understanding of how children learn at early stages. The results of this study demonstrated that students at earlier stages of the teacher education program hold more inclusive attitude toward play. Therefore, to preserve, deepen, and further develop their perspectives, it is recommended using "play *as* educational practice" (Wood, 2014) that drives the learning and pedagogy verses using it as "play in educational practice" where instructors choose and plan activities to achieve a specific outcome. Play *as* education approach should aim to engage students' bodies and activate senses using various forms of arts, music, and movement. Such holistic and creative approach to teaching and learning will allow the future practitioners to experiment and explore the social, cognitive, physical and emotional aspects of learning processes and experience what children undergo in play. Engaging in creative learning and teaching at the college level will create the most beneficial learning environment that fosters future teachers' intellectual development and help them to manage their own mental, emotional and physical well-being.

Policy making

Although the National Association for the Education of Young Children (NAEYC) continues to emphasize the critical importance of play in children's lives and education (Copple & Bredekamp, 2009), the findings of this study illustrate the difficulty of defining and conceptualizing play in early childhood education. Therefore, it is recommended that leading organizations would clearly define the concept of learning in its main documents and standards, approaching it broadly and holistically. Learning in early childhood education cannot be limited to seeing it as "increasing quantity of (surface) knowledge and skill" (Niikko & Ugaste, 2019, p.48). Hence, the concept of learning should be defined distinctively within and between ages and stages in early childhood. These changes will hopefully result in new understanding of teaching in early childhood that meets the needs of a whole child who learns and develops through play.

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IMPACT OF MOTHER TONGUE ON PRIMARY PUPILS' LITERACY AND NUMERACY SKILLS IN OSUN STATE

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Abstract

The study was conducted to determine the effectiveness of mother tongue instruction on the achievement of primary five (V) pupils in literacy and numerical skills in Osun state. It also examined the moderating effect of gender. The Cummins interdependence theory provided the framework, while the pre-test/post-test control group quasi experimental design was adopted. Two Local Government Areas in Osun state were randomly selected. From each LGA, three public primary schools were randomly selected, while an intact class of primary V pupils was selected from each school, totalling 233 pupils. The instruments used were Pupils literacy (α=.82), Pupils numeracy skills (α=.89) Questionnaires and instructional guides. Data were subjected to Analysis of covariance at .05 level of significance. 53.5% of the participants were females. There was a significant difference in the achievement of pupils taught with mother tongue and conventional strategies in literacy and numeracy skills ($F_{(2,232)}$=27.94; p<.05, partial η^2=.20). Pupils exposed to mother tongue strategy had highest post mean literacy and numerical skills (70.47). Mother tongue strategy enhanced pupils' literacy and numerical skills in primary schools in Osun state, regardless of their gender. Teachers should adopt these strategies to improve pupils' achievement in literacy and numerical skills.

Keywords: Mother tongue, literacy skills, numeracy skills, primary school, Osun State

INTRODUCTION

The importance of language in the development of education in any nation has long been stressed by linguists. The use of the appropriate language in teaching learners greatly contributes to academic performance and success in school. Language plays a vital role in the learning process of the elementary learners. Teachers must ensure that the language to be used in the different subject areas are the language first heard at home (Benson, 2004). In relation to this fact, the Federal Government of Nigeria made special provisions for the teaching of language across the educational levels in the country's educational system. The National Policy on Education (NPE 1981, revised 2013) gave great encouragement to the study of indigenous language. The emphasize laid on the indigenous languages by the Government explains why more attention is placed on the three major languages.

The development and the growth of the society largely depend on the language which links the people together. In other words, people's culture cannot be fully appreciated without the use of language, which conveys such culture. Therefore, people that lose its language will be people without a culture and once people have no culture, they cannot be identified as people; it becomes people without a future and identity. Language education is the most important vehicle of people's culture, the most distinctive of all the traits which separates human being conceivable. In other words, it is that tool which differentiates the human from other animals; language forms the basis for translating taught, discoveries and an invention to reality from one generation to another. It is language that defined human's humanity.

The National Policy on Education (NPE, 2013), affirmed that Government recognizes the importance of language as means of promoting social interaction, national cohesion and preservation of our culture. The policy endorsed the need for every child to learn the language of the immediate environment, which is the first language (FL), home language, native language or vernacular used by every individual at home (Sumbalan, Caterial, Jimeno & Balane, 2017). In the interest of national unity, it is expedient that every child shall be required to learn one of the three major Nigerian languages Hausa, Ibo or Yoruba. It is not surprising that many children cannot speak any of the indigenous languages including their Mother tongue. World Bank (2005) estimated that half of the out-of-school children globally do not have access to the language of school in their home lives, indicating the significance of language barriers in education.

The use of indigenous language as a means of instruction in all subjects alongside with English Language at any level of education will not only overturn a long held dismissive attitude towards Nigerian Languages, but immensely strengthen the status of indigenous languages across in the by providing a positive result in the performance of every learner. It provides an opportunity for the children to exercise their right to learn in their first language (Sumbalan et al., 2017). It will enforce additive bilingualism, address the goal of social equity as well as forge equal access to education and equal language rights for all citizens of the democratic country. In this 21st century, Nigeria should place emphasis on right policies that promotes not only access but inclusion and quality (Elumelu, 2017).

Nolasco (2012) found that when pupils use and master their first language used in their immediate environment or the entire country. Pupils are able to develop critical, reasoning and problem-solving skills that they can use for life-long learning. As emphasized by Malone (2010), indigenous language is language education program that helps build a strong educational foundation, then bridge successfully into one or more school languages, and then use both or all their languages for life-long-learning.

In Nigeria today, especially in the south western Nigeria, Yoruba language has attracted much research attention across the fields of linguistics, literature, culture as well as Yoruba language Education. Thus, Yoruba has features prominently in education from the primary to the tertiary levels and has been a compulsory subject as well as a medium of instruction in some schools and colleges. There are huge number of researches that cited that language proficiency affects learners' achievement for children. Hence, it is not surprising to find a vast volume of literature on the language learning relationship because language is believed to be the gateway for learning and the vehicle that facilitates acquisition of new knowledge through direct and indirect interaction with teachers and peers, as well as through the reflective processes of introspection (Francis & Rivera, 2007; Fernando, 2020). Researchers like Akinola (2009), Ojo (2009), Oladokun & Adekunle (2010), and Alimi (2012) acknowledge the use of mother tongue in teaching pupils in both pre-primary and primary schools. Also, Adeyinka (1998) states that 'if the Nigerian child is to develop curiosity, manipulative ability, spontaneity, flexibility, intuitive, manual dexterity should acquire these skills and attributes through the mother tongue as a medium of education or instruction which is the natural way of learning.

Literacy is critical in helping us make sense of our world. From the time we wake up to the time we go to sleep, we are constantly making meaning of the world around us. Literacy has traditionally been thought of as reading and writing. Although these are essential components of literacy, today our understanding of literacy encompasses much more. Alberta Education defines literacy as the ability, confidence and willingness to engage with language to acquire, construct and communicate meaning in all aspects of daily living.

Language is explained as a socially and culturally constructed system of communication. Literacy development does not take place in just the Language Arts classroom. It is a shared responsibility among all educators. Although specific knowledge and skills are taught primarily in Language Arts, every subject area teacher is responsible for further developing, strengthening and enhancing literacy. Every subject area has its own unique literacy demands. Content area teachers know their subject matter and their programs of study. They are aware of the literacy requirements of their subject and understand that it is through literacy that meaning is made within their subject area content. Students need to be taught how to read different kinds of text, write and express themselves in the formats associated with each subject, and use content-specific vocabulary (Alberta Education). Alberta Education defines numeracy as the ability, confidence and willingness to engage with quantitative and spatial information to make informed decisions in all aspects of daily living. A numerate individual has the confidence and awareness to know when and how to apply quantitative and spatial understandings at home, at school, at work or in the community.

Quantitative information refers to information that can be measured and expressed as an amount. This includes:

- having a sense of the magnitude of numbers;
- using numbers in real-life situations;
- estimating amounts;
- interpreting statistical information;
- recognizing patterns;
- determining probability

Spatial information refers to the physical location of objects or people, or the relationship between objects or people. This includes:

- understanding shape and space;
- measuring time, weight, height or amounts;
- determining location and direction;
- interpreting and creating maps and schematic diagram;
- visualizing shapes from different perspectives;

Every day we are presented with quantitative or spatial information that needs to be interpreted and used in order to help us make sense of our world. As we go through life, our need for numeracy skills evolves.

- Young children develop numeracy as they judge the distance needed to grasp a toy, recognize patterns and routines or learn how to manipulate shapes to complete a puzzle.
- Older children use numeracy to play board games, estimate the cost of a purchase with tax, judge how far to kick a ball or determine when to leave to arrive on time.
- Young adults require numeracy to interpret sports statistics, navigate their way to a destination, track cellular data usage, or budget to save up for a special purchase.

Adults need numeracy to compare costs, choose a cell phone plan, interpret statistics, park a vehicle, double the ingredients for a recipe or engage in home renovation projects.

Literature Review

Theoretical framework

The Cummins (1979) interdependence theory explains how to positively transfer literacy skills from L1 to L2. He claims that the level of literacy competence in L2 that a child attains is partially a function of the level of competence the child has in L1 at the time L2 teaching begins intensively. This implies that, if an education system submerges learners in L2 without first trying to further develop the skill they already have in L1, the school risks impeding their competency in L2 for years to come, while also limiting continued, autonomous development of their L1 (Ricablanca, 2014). This is because the sustained use of a foreign language of instruction in schools negatively impacts the way children, earn to think, thus inferring with their cognitive development (Wigglesworth & Simpson, 2008). Therefore, when education system imposes a foreign language on children, disregarding their initial contact with a language and pattern of processing new information, inhibits their development of cognitive function (Ricablanca, 2014).

Once the learners have a basic literacy skill in the L1 and communicative skills in the L2, they can begin reading and writing in the L2, efficiently transferring the literacy skills they have acquired in the familiar language. The pedagogical principles behind this positive transfer of skills are Cummins' (1991, 1999) interdependence theory and the concept of common underlying proficiency, whereby the knowledge of language, once oral L2 skills are developed, and no re-learning is required. According to June Jordan (2009), "You will never teach a child a new language by scoring, ridiculing and forcibly erasing his first language." At the beginning of education, mother tongue instruction is very important not only to develop a strong educational foundation, but also to strengthen the cognitive development of learners (Ricablanca, 2014). Unless the mother tongue is used in education, there is a big gap between the student's home and the school. By developing literacy skills in the first language, mother tongue-based multilingual education helps strengthen the first language and provides a smooth transition from L1 (first language) to L2 (national language) or L3 (international language) to be used as a medium of instruction (Ricablanca, 2014).

Conceptual framework of the study

Mother Tongue: This is the local language which an individual possesses consciously or unconsciously. It is an indispensable cultural legacy with which all forms of human interactions are carried out, it is the most effective engine of a people's culture (Adeleye and Ogunremi, 2017). Olaoye (2013) submits that mother tongue is the key to the heart of the people, if we lose the key, we lose the people, if we treasure the key and keep it safe, it will unlock the door to wealth and affluence. Benson, Anyalebechi and Ariole (2017) submit further that education through the indigenous languages in Nigeria will stimulate learners' productivity more than the foreign language, and making learning more functional.

In Nigeria, the issues of indigenous languages and English language have been debated by so many scholars. For some scholars, the use of mother tongue or Nigeria languages in modem education is one of the problems militating against qualitative teaching and learning of the English language (Kolawole and Dele 2002). Some other researchers have claimed that when a person is taught in the mother tongue, such a person understands what is being taught faster and easily than when he/she is taught in another language. This is also established by the Ife Six Year Primary Project (SYPP) when learners achieved better when taught in their mother tongue (MT) or the language of the immediate community than in a foreign language (Adeleye and Ogunremi, 2017).

Literacy: the ability to read, view, writes, design, speak and listen in a way that allows you to communicate effectively. The power to literacy lies not just in the ability to read and write, but rather in a person's capacity to apply these skills to effectively connect, interpret and discern the intricacies of the world they live. Beyond it conventional concept as a set of reading, writing and counting skills, and literacy is now understood as a means of identification, understanding, interpretation, creation and communication in an increasingly digital, text-mediated, information-rich and fast-changing world (en.unesco.org).

Numeracy: the ability to understand and work with numbers/or the ability to reason and to apply simple numerical concepts. It also means ability to use mathematics in everyday life. Being numerate means having the confidence and skill to use numbers and mathematical approaches in all aspects of life- at work, in practical everyday activities at home and beyond, as consumers, in managing our finances, as parents helping our children leam, as patients making sense of health information, as citizens understanding the world about us.

Statement of the problem

Students' performance in literacy and numeracy has been consistently poor over the years. Several reasons have been adduced as the cause of this abysmal performance, one of which is the language of instruction. One of the major issues that students faced in learning is related to the inadequate grasp of the language of instruction that plays an important role in the students' development of conceptual understanding. Hence, students learning with a language background other than the Mother Tongue at the earlier stage might be faced with tremendous difficulty in comprehending the textbooks, teaching aids and discussions in an unfamiliar language. This study, therefore, determined the impact of mother tongue on pupils' literacy and numeracy skills with the view to enhance and promote pupils' understanding and assimilation of learning of concepts in their native language before teaching them in another language.

The findings of this study hoped to serve as a baseline data in the achievement of the pupils in mother tongue-based instruction. It would lead to the improvement in pupils' literacy and numeracy skills and create a positive attitude in pupils. The study would also lead to the production of literate individuals who would help in driving the country march towards scientific and technological development. It would also lead to the country self-reliance. Lastly, with the result of this study, curriculum makers and researchers would be given a feedback with regards to the implementation of mother tongue based-instruction as part of the primary school curriculum.

Hypotheses of the Research

The following hypotheses were formulated to guide the study and analysed at .05 level of significance.

Ho1: There is no significant difference between pupil's achievement of those taught with mother tongue and with those not taught with mother tongue in Literacy and Numeracy skills.

Ho2: There is no significant difference in the achievement of male and female pupils in literacy and numeracy skills.

METHODOLOGY

Study Area

The location of the study is Osun State. There are 30 local government areas in Osun State. Six schools were randomly selected from two local government areas of Osun State; Osogbo and Olorunda local government where the facilities and the environment are convenient for effective monitoring and implementation of the research are available.

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Research Design

This study adopted the pre-test/post-test control group quasi experimental design. The design adopted follow normality test by first determined sample data which were drawn from a normally distributed population (with some tolerance). The empirical distribution of the data with p-value of .003<.05 shows no significant departure from normality. The study determined the impact of mother tongue on pupils' literacy and numeracy skills in Osun State.

The schema manipulation of the research design is presented as follows:

P_1 X_1 P_4	Experimental Group 1 (E_1)
P_2 X_2 P_5	Experimental Group 2 (E_2)
P_2 X P_6	Control Group (C)

Where P_1, P_2, P_3 represent the pre-test scores for experimental group 1 and 2 and control group respectively. P_4, P_5, P_6 represent the post-test score for experimental group 1 and 2 and the control group respectively.

E_1 represents Experimental treatment of mother tongue strategy
E_2 represent Experimental treatment of mother tongue and conventional teaching strategy
C represents Control treatment of conventional teaching strategy.

X_1, X_2, X are treatments.

A 3x2 factorial matrix was adopted with instructional strategies manipulated at three levels, moderating variable gender at two categories (male and female).

Variables of the Study

The variables in the study are as follows:

1. Independent variables: This is the instructional strategy manipulated at three levels
    a. Mother Tongue instructional Strategy
    b. Mother Tongue and Conventional Strategy
    c. Conventional Strategy
2. Moderator variable: Gender (Male and Female)
3. Dependent variable:
    a. Literacy and Numeracy skills

Selection of Participants

The participants consisted of primary five (5) pupils. Six schools were randomly selected from two Local Government Areas of Osun State. An intact class in each of the selected primary schools was used. One school was assigned to the mother tongue strategy, mother tongue and conventional strategy and conventional strategy in each local government area. The teachers were Mathematics teacher teaching primary five pupils in each school.

Research Instruments

1. Pupils literacy skills questionnaire

This is a 30 item multiple choice test with four options A, B, C and D developed by the researchers to measure the pupil's literacy skills. The instrument consisted of two sections: Section A comprises demographic data of pupils' name, gender, and name of school. Section B comprises of 30 multiple items drawn to measure pupils' literacy skills during the experiment. The instrument was designed to measure literacy skill, knowledge, understanding and thinking. Scoring was done by awarding one mark to ach question answered correctly, which gave a maximum of 30 marks. The face and content validity of the instrument were equally determined. The test was trial tested on 30 pupils from another school which was

not part of the study. The reliability index of .82 was obtained using Kuder-Richardson formula 20 (KR-20), while item difficulty index ranges between .40 – .70.

2. Pupils numeracy skills questionnaire

This is a 30 item multiple choice test with four options A, B, C and D developed by the researchers to measure the pupils' numeracy skills. It comprises of 30 multiple items drawn to measure pupils' numeracy skills during the experiment. The instrument was designed to measure numeracy skill, knowledge, aptitude and thinking. Scoring was done by awarding one mark to ach question answered correctly, which gave a maximum of 30 marks. The face and content validity of the instrument were equally determined. The test was trial tested on 30 pupils from another school which was not part of the study. The reliability index of .89 was obtained using Kuder-Richardson formula 20 (KR-20), while item difficulty index ranges between .30 – .70.

3. Teachers instructional guide for mother tongue strategy (TGMTS)

The TIGMTS was prepared by the researcher for Mathematics teacher (in mother- tongue language) that handled the instruction for the duration of the treatment. The main features for the guide include, eko, ọjọ′, isẹ, kilaasi, ori ọrọ isẹ, eka ori oro, akoko, iwe itọkasi, erongba akẹẹkọ, imọ atẹyinwa, ohun elo ikẹẹkọand igbekalẹ isẹ ni isisẹ. The instructional guide was given to two lecturers in science, mathematics and technology education department, faculty of education, university of Ibadan; their suggestions was incorporated into the final draft of the guide.

4. Teachers instructional guide for mother tongue and conventional strategy (TIGMTCS)

The TIGMTCS was prepared by the researcher for Mathematics teacher that handled the instruction for the duration of the treatment. The main features for the guide include, date, subject, class, topic, sub-topic, duration, period, reference book, behavioural objectives, instructional material, introduction and presentation in steps. The instructional guide was given to two lecturers in science, mathematics and technology education department, faculty of education, university of Ibadan; their suggestions was incorporated into the final draft of the guide.

5. Teachers' instructional guide for conventional strategy (TGCS)

The TGCS was prepared by the researcher for Mathematics teacher that handled the instruction for the duration of the treatment. The main features for the guide include, date, subject, class, topic, sub-topic, duration, period, reference book, behavioural objectives, instructional material, introduction and presentation in steps. The instructional guide was given to two lecturers in science, mathematics and technology education department faculty of education, university of Ibadan; their suggestions were incorporated into the final draft of the guide.

6. Teachers evaluation performance sheet (TEPS)

This was the guidelines for evaluating performance of the trained teachers on the effective use of these strategies: Mother tongue Strategy; Mother tongue and conventional Strategy; and Conventional Strategy respectively. This rating scale was made up of two sections. Section A contained information on the personal data of the trained teacher containing name, school, period, class taught, date, topic and sub-topic of the concept discussed in the class. While section B comprises of items to be evaluated. The scoring of TEPS was done on 5 very good, 4 for good, 3 for average, 2 for poor and 1 for very poor. For the purpose of validation, expert's attention was drawn to ascertain the appropriateness of the concepts and methods to the target population. Their suggestions were used to re-construct the rating scale. The instruments were tested to ensure its reliability. The inter-rater reliability was estimated using Scott's π which gave .76 for mother tongue strategy, .78 for both Mother tongue and conventional strategy and .81 for conventional strategy.

Methods of Data Analysis

The data obtained from the pre-test and post-test was analysed using inferential statistics of Analysis of Co-variance (ANCOVA) at .05 level of significance. Estimated marginal mean was used to determine the means of different groups in order to find the magnitude of the difference among the groups. Bonferroni post-hoc test was used to determine which of the group that caused the significant main effect.

RESULTS

Ho1: There is no significant difference between pupil's achievement of those taught with mother tongue and with those not taught with mother tongue in literacy and numeracy skills

Table 1. Analysis of covariance (ANCOVA) of post-literacy and numerical skills by treatment and gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5112.551	6	852.092	9.763	.000	.206
Intercept	172720.823	1	172720.823	1978.895	.000	.898
Pre-test	1238.063	1	1238.063	14.185	.000	.059
Treatment	**4876.765**	**2**	**2438.383**	**27.937**	**.000***	**.198**
Gender	14.773	1	14.773	.169	.681	.001
Treatment x Gender	47.939	2	23.970	.275	.760	.002
Error	19725.608	226	87.281			
Total	1041635.000	233				
Corrected Total	24838.159	232				

R Squared = .21 (Adjusted R Squared = .19) * denotes significant p<.05

Table reveals that there is a significant difference between pupil's achievement of those taught with mother tongue and with those not taught with mother tongue in literacy and numeracy skills ($F_{(2, 232)}$ = 27.94; p<.05, partial η^2 = .20). Table 1 indicates that the effect is 20.0%. This means that 20.0% variation in pupils' post-literacy and numerical skills scores in this ANCOVA model is as the results of the significant difference between the treatment on pupils' achievement in literacy and numerical skills. Therefore, hypothesis 1 was rejected. In order to explore the magnitude of the significant differences across treatment groups, the estimated marginal means of the treatment groups were carried out and the result is presented in Table 2.

Table 2. Estimated marginal means for post-literacy and numerical skills by treatment and control group

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Mother Tongue Strategy (MTS)	70.47	1.04	68.43	72.52
Mother Tongue plus Conventional Strategy (MTCS)	68.03	1.09	65.88	70.17
Conventional Strategy (CS)	58.93	1.16	56.65	61.20

Table 2 reveals that pupils in the Mother Tongue Strategy (MTS)treatment group 1 had highest adjusted mean score in their post-achievement in literacy and numeracy skills (70.47) followed by those in the Mother Tongue plus Conventional Strategy (MTCS) treatment group 2 (68.03) and their counterparts in the Conventional Strategy (CS) control group (58.93). This order is represented MTS > MTC > CS. To determine which of the groups causes this significant difference across treatment on pupils' achievement

in literacy and numeracy skills, the Bonferroni post-hoc test is carried out across the groups, while the result is presented in Table 3.

Table 3. Bonferroni post-hoc analysis of post-achievement by treatment and control group

Treatment	Mean	MTS	MTCS	CS
Mother Tongue Strategy (MTS)	70.47			*
Mother Tongue plus Conventional Strategy (MTCS)	68.03			*
Conventional Strategy (CS)	58.93	*	*	

Table 3 indicates that the post-achievement mean score in literacy and numeracy skills of pupils in the Mother Tongue Strategy (MTS) is not significantly difference from the post-achievement of their counterparts in the Mother Tongue plus Conventional Strategy (MTCS) but significantly different form their counterparts in the Conventional Strategy (CS). Table 3 also indicates that the difference in the post-achievement mean scores of pupils exposed to mother tongue plus conventional strategy and their counterparts in the conventional strategy is significant. This indicates that the significant difference indicated by the ANCOVA result is not due to the difference between the treatment groups (mother tongue, and mother tongue plus conventional strategies) but between the treatment groups and the control group as pupils' post-achievement scores in literacy and numeracy skills is concerned.

Ho2: There is no significant difference in the achievement of male and female pupils in literacy and numeracy skills

Table 1 shows that there is no significant difference in the achievement of male and female pupils in literacy and numeracy skills ($F_{(2, 232)} = .17$; $p>.05$, partial $\eta^2 = .00$). Hence, hypothesis 2 was not rejected. This means that there is no gender differences in the achievement of pupils in literacy and numeracy skills.

DISCUSSION and CONCLUSIONS

Treatment and Pupils' Achievement

Finding from the study showed a significant main effect of treatment on primary pupils' achievement in mathematics. Pupils exposed to the mother tongue strategy (MTS) had the highest adjusted post-achievement mean score in mathematics followed by those exposed to mother tongue and conventional strategy (MTCS), while the Conventional Strategy (CS) which was the control Group had the least adjusted post-achievement mean scores in mathematics. This finding supports the argument of Attwood (2014) that appropriate teaching strategy employed increase deep understanding in Mathematics.

The efficacy of MTS over MTCS in terms of pupils achievement could have been as a result of the engage of pupils in their mother language where they were taught with their immediate language and questions were asked in the same language in order to stimulate and establish a link between the new knowledge to be learned and their immediate environment. The opportunity for pupils to engage in classroom interaction, and participating actively through their mother tongue may have also contributed. This may due to the fact that the use of mother tongue enables young learners to immediately construct and explain without fear of making mistakes, articulate their thoughts and add new concepts to that which they already knew (Nolasco, 2010).

This finding supports the assumption of the interdependence theory of positive transfer of literacy skills from L1 to L2 which states that a child attains a partially a function of the level of competence the child has in L1 at the times L2 teaching begins intensively. If an education system submerges learners in L2

without first trying to further develop the skill they already have in L1, the school risks impeding their competency in L2 for years to come, while also limiting continued, autonomous development of their L1. This efficacy of mother tongue is in line with findings of Aguja & Prudente (2018) that pupils tend to perform better in mathematics when the mother language (Filipino) is the medium of teaching and learning, that pupils' first language positively affect their mathematics achievement especially where application skills were required. The findings were in consistent with the findings of Adeleye & Ogunremi (2017) that learners achieved better when taught in their mother tongue than in a foreign language. This is in line with the reports of DepED (2016) that mother tongue improved achievement in various learning areas including mathematics. Ricablanca (2014) found that the pupils' achievement in the mother tongue-based instruction was significantly higher than the achievement of those who were in the English Instruction both in the post-test and in the retention test. This finding lay credence to the assertion of UNESCO (2008) that mother tongue instruction is a key factor for literacy and learning. This negates the findings of Ife (2017) that mother tongue has no significant main effect on pupils' achievement in mathematics.

The mother tongue and conventional strategy was found to be more effective in improving pupils' achievement in mathematics than the conventional strategy. This supported the findings of Alinab, Aguja & Prudente (2018) that mathematics pupils when exposed to either English or mother language exhibited good performance on items in the remembering and understanding levels while fair performance was noted in items where applying skills were required. This negates the findings of Fernando (2020) that elementary grade pupils mathematics achievement rose high in English language instruction than the mother tongue mediated instruction.

Gender and Pupils' Achievement

The findings of the study revealed that the main effect of gender on pupils' achievement in mathematics is not significant. This implies that pupils' gender has no effect on their achievement in mathematics. This could be as a result of equal opportunities and conditions given to the pupils to actively engage and participate in the learning processes. This Finding of non-significant main effect of gender support that of Ricablanca (2014) who found in his study that there was no significant difference in the achievement of the pupils when they were grouped according to gender. This is in agreement with the findings of Ife (2017) that gender has no significant main effect on pupils' achievement in mathematics. This is in consistent with the findings of Abubakar & Oguguo (2011) that gender has no influence on academic achievement of learners in mathematics. This is not in support of Anjum (2015) that gender has significant effect on pupils' achievement in mathematics in favour of the girls. This finding is not in consistent with the findings of NCERT (2014) that gender has significant effect on pupils' achievement. Abubakar & Oguguo (2011) found that gender is a better predictor of achievement in mathematics.

Conclusion

The following conclusions are drawn based on the findings of the study:

Girls are more than the boys in the selected schools and intact classes used. When the pupils are exposed to mother tongue-based instruction, their level of achievement in the post-test improved more than the achievement of the pupils in the mother tongue and conventional strategy, and the conventional strategy. Although the mean score obtained by the pupils in the mother tongue- based instruction are not significantly difference from that of mother tongue and conventional strategy but still it outperforms the scores obtained by the pupils in the mother tongue and conventional strategy.

There is a significant higher achievement of the pupils in literacy and numerical skills when taught using the mother tongue as medium of instruction compared to those pupils who are taught in conventional strategy as medium of instruction. This implies that they preferred to be taught in mother tongue in their

literacy and numerical skills. Also, there is no significant difference in Mathematics achievement of pupils by gender.

Recommendations

i. Additional trainings in form of workshops, symposium and seminars for the in-teachers and preservice teachers to enhance their level of proficiency of teachers in respect to mother tongue and its implementation as a medium of instruction in the classroom.
ii. Yoruba is the mother-tongue in the schools used, this language must be utilized in Literacy and numerical skills enhance the learner's understanding of the concept.
iii. Researchers in the field may conduct a similar study to determine other related and intervening factors towards the achievement of the pupils in Mathematics using mother tongue as medium of instruction.

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PROBLEMS OF SOCIAL SKILLS IN EARLY CHILDHOOD EDUCATION PROGRAM IN ETHIOPIA

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Abstract

The study aimed at assessing Problems of Social Skills in Early Childhood Education Program in Ethiopia. Descriptive survey research design was employed through using stratified random sampling procedure to collect the survey data from 280 teachers recruited from early childhood education programs across three cities: Dire Dewa (130 teachers; 10 schools); Chiro (40 teachers; 6 schools); and Harar (110 teachers; 8 schools). They completed a questionnaire by starting filling the demographic information and a 5-item measure in which they rated problems influencing socials skills in early childhood education program. Firstly, about 89% of early childhood education teachers were not trained in the program. Secondly, about 64% of the early childhood education curriculum was highly influencing children's social skills. Finally, it was found that children were unable to cooperate during learning social skills with their classmates, and they were unable to solve social problems during playing with their classmates. Therefore, to ensure quality of early childhood education, education stakeholders, parents, teachers, administrators, non-government and ministry of education of the country at large need to improve teachers' training and curriculum under usage to improve and to fit to children's social skills in early childhood education programs.

Keywords: Early, childhood education, problems, social skills, teachers.

INTRODUCTION

The adolescents of 2035 are now in their early childhood years, still on the threshold of entering primary school. Quality pre-primary education is one of the best investments available for ensuring their future success and that of those who will follow in their footsteps. Universal pre-primary education of good quality will bring enormous benefits to children, families, education systems and society at large (UNICEF, 2019). Across widely differing countries and circumstances, students equipped with quality early childhood education are better prepared for the transition to primary school. They reach higher levels of education and are more likely to develop the skills that the modern job market demands, including critical thinking, collaboration, resilience and creativity (UNICEF, 2019; and World Bank, 2018).

Quality pre-primary education sets the stage for a positive transformation in learning outcomes throughout a child's lifetime. Successful students move more efficiently through the education system, which makes investing in quality early learning opportunities cost-effective, lessening the need for remedial efforts and resources to make up for lost learning (García, Jorge, and Luis, 2016). Quality pre-primary education also supports country goals for economic growth. Children's participation in pre-primary education offers mothers and other caregivers opportunities to participate in the workforce and increase their earnings, Naudeau and Sophie (2020), facilitating the upward mobility of two generations. In the long term, pre-primary education can contribute to the framework of well-being throughout a country by enhancing labour force productivity and reducing the social costs of crime and health care. But if access to pre-primary education is only available to comparatively well-off families, pre-primary programs can widen the gap in opportunities between children from the poorest and wealthiest households (Michelle, Neuman & Lynette, 2019).

The role of the school is to stimulate student's integral skills within three domains of knowledge: affective, cognitive and psychomotor. It is expected from the teachers to equally stimulate all students' capabilities (Mijatović, 1999) and to observe the student as a human and social being

(Previšić, 1999). In accordance with the above, more and more classes are being affirmed that are oriented to the child (Walsh, 1997) as well as pro-social classes (Čudina-Obradović & Težak, 1995) that encourage social learning as a part of overall learning. Children's social skills, which represents the skills of capabilities of understanding social relations and suitable psychosocial functioning, includes behaviour, attitudes and affects united into children's interaction with adults and peers (Brajša-Žganec, 2003). Numerous researches that were involved into children's social skills indicate to positive influence of teachers, parents and peers on the social skills of the students (Buljubašić-Kuzmanović, 2008, Buljubašić-Kuzmanović & Livazović, 2010) emphasizing how socially developed child acquires good developing results that enable satisfying and competent participation in the community that they belong to (Katz & McClellan, 1997; Raver & Zigler, 1997; Rose-Krasnor, 1997). Katz and McClellan (1997) emphasize that the community is the basis for creation of a context of social skills, and the communities could be families, school and peer groups.

In the period of middle childhood, the influence of family, teachers and peers is of an extreme importance (Vizek-Vidović, 2003). The results showed that the children that created a relationship of trust with teachers are more socially competent in the relationships with the peers (Klarin, 2006), and it is especially emphasized the importance of emotional literacy of parents on social skills of the students and the quality of adjustment (Buljubašić-Kuzmanović, 2008). The school has a role to prepare the student for the future profession, but also to work in the community (Rychen & Salgnik, 2003; Ten Dam & Volman, 2007). The teachers need to have an educative effect, encourage students to work in groups, and to base their classes on interaction, partnership and cooperation (Buljubašić-Kuzmanović, 2012). The school as the community of upbringing into the centre of the educational process sets the students and their integral skills, and to the social skills, as a significant factor of growing up and success, attaches a special attention. In order to contribute to better children's social skills, the teachers need to know theories of social skills well. Knowing the theories of the social skills, they can create, with more quality, the school activities that will stimulate children's social skills, as well as the integral skills in general.

Doing business as usual is not working! There must be a definite shift in thinking about how, when, and where resources for early childhood education (ECE) should be invested. Until African leaders begin to step back, reflect, and make conscious policy decision to invest in human resources to build human capabilities through specific targeting of 3-6 year olds and their mothers, vision of a developed and prosperous Africa will continue to remain a vision. Without transforming human resources into human capital, African countries in general and Ethiopian in particular will continue to struggle to provide the basic necessities for their citizens (UNESCO, 2010; World Bank, 2018)).

The researcher believes that early childhood education is the cornerstone for the next stage of development (psychosocial, physical, moral & personality) and learning. This is only possible where child-centered curriculum has been in the position, but this is very thin and very shallow in Ethiopia context. As the experienced teacher in Ethiopia, the researcher has critically observed that early childhood education was lacked attention from parents, government, non-governments, privates and religious institutions. These problems initiated the researcher to investigate the extent to social so skills of the children have been affected by irrelevant curriculum, poor teachers training and lack of collaboration among the stakeholders.

Review of Related Literature

This part of the paper mainly dealt with the theoretical framework of reviewing different literature for the purpose of getting pertinent evidence from previously conducted research products. It contains views of children's social skills, developmentally appropriate curriculum and social relevance of the curriculum to quality early childhood education in study area.

Theoretical views of the children's social skills

When we analyze children's social skills and the influence of the family, peer and school on them, it is important to know the basics of the theory of the social skills. Some of the theories emphasize the

importance of the family for the children's social skills, while the others emphasize the influence of the child's social environment. The theory of commitment of the theorist Bowbly (1969) emphasizes the importance of early relationship with parents (guardians) in child's skills and great influence on social relationships in the whole life. Ainsworth, Blehar, Waters & Wall (1978) discovered that children that are tightly connected to their mothers as babies have a tendency to develop stronger self-respect and better self-confidence, to be independent, better in school, have successful social relationships and experience less depression and anxiety.

Schaffer and Emerson (1964) based on researches concluded that children that grew up in orphanages can also manage to develop a feeling of trust, but it is then important factor of a care quality. When guardians react fast and prompt, children learn to rely on people who are responsible for their care, and in contrary, the children that do not gain a trust early in their life can have a negative influence in a later childhood and during the life when different types of behaviour disorder appear. Socio-cultural theory of Lev Vygotsky (1978) belongs to the early theories of social constructivism according which for the skills of more cognitive functions social environment in which the child acquires experiences is important. He further emphasizes the importance of cognitive processes for children's social behaviour and social interactions, wherein the child learns new social and cognitive skills through interactions with adults and elder children (Brajša–Žganec, 2003).

Bronfenbrenner ecological theory (1995) emphasizes the importance of the environment for children's social skills. Within the ecological theory of skills, he identified four levels of environmental influences on child: Microsystems (family, kindergarten, school), Mesosystem (mutual action of different Microsystems), Exosystem (wider environment) and Macrosystem (features of certain culture: education, religion, social system) (Brajša-Žganec, 2003). Paquette and Ryan (2001) analyzing ecological theory suggest that the child is in the centre of the system, while the layers of the environment are getting wider around him/her in concentrated circles, and they stronger and weaker influence on his/her skills. Bronfenbrenner also underlines that overall the context in which the children's skills is carried out importantly influences the course of skills and skills outcomes, and without neglecting individual features of the child and believes that the skills is a result of interaction of child's features and environment in which the child grows (Bronfenbrenner & Morris, 2006).

When we speak about social skills, it is also important to mention the theory of cognitive skills of Jean Piaget that emphasizes how children cannot achieve maximal possible degree of cognitive skills without exposing to stimulating experiences in the social environment (Piaget, 1987). With his theory, known as socio-constructivist, he emphasized that the construction of knowledge happens during the interaction with social environment and active actions of the child. The implications of the Piaget's theory for education are visible in a change of a role of the teacher that does not have to be the transmitter of the knowledge but moderator and creator of the conditions for acquiring knowledge of the children. During such organization of the classes, it is important that the teacher, besides of ensuring the conditions for acquiring knowledge of the students, needs also to provide conditions for the social skills of the children (Vass, 1998).

Social skills in the middle childhood

In the period of the middle childhood, the extremely important one is social skills, which represents the skills related to the skills of child's capability of understanding of social relations and suitable psychosocial functioning (Brajša-Žganec, 2003). Even though in these developments period the children spend less time with family, the influence of the family is not decreased (Klarin, 2002). The parents represent to the child a model, as in behaviour also for attitudes and the parents provide them the feeling of being a shield of their immediate environment, permanent feeling that they are worried, cherished and protected (Buljubašić-Kuzmanović, 2012).

Starting the school an important leap in the skills of social relations simultaneously occurs because the child from simple and familiar situation of family, where he/she was protected and privileged often, passes into new, complicated and unpredictable situation where he/she has to fight for his/her position

in the big group of equal peers (Andrilović & Čudina-Obradović, 1990). The main features of the social skills in the middle childhood are: forming of the first friendships, growth of self-respect, differentiation of capabilities, effort and happiness during the success and failure, regulating emotions, understanding of connection between moral regulations and social conventions, appearance of peer groups, mutual trust (Berk, 2008; Dowd, 2016).

Developmentally appropriate curriculum

When one speaks about developmentally appropriate curriculum, one speaks about curriculum planned to be appropriate for the age span of children within the program (Chinyani, 2013). One also needs to be aware that once a teacher begins to work with a group of children and begins to learn more about individual children within the group, the curriculum might change drastically. Curriculum should be driven by the different needs, levels of functioning, and interests of the children in the group. Curriculum planned in the summer before a teacher even knows the children in the class is curriculum that will not be sensitive to individual learners. Curriculum developed under those conditions is also curriculum bound to fail because it was not designed specifically for the group (Yigzaw, 2018). When planning developmentally appropriate curriculum, all aspects of skills need to be taken into consideration.

Developmentally appropriate curriculum focuses on integrating learning rather than departmentalizing learning. Children learn through interaction with children, materials, and adults. In developmentally appropriate curriculum, children learn through direct experiences not by learning about persons, places, and things from someone always telling them about them. In a developmentally appropriate environment, children learn science, social studies, language arts, and math through reading books and listening to stories, engaging in sensory experiences, participating in cooking experiences, being involved with art activities, taking part in dramatic play, using manipulative, taking field trips, building, creating, and sharing all of these experiences with their peers and the adults in their classrooms (Chinyani, 2013).

Statement of the Problem

Children aged 3 to 6 years constitute a large section of the Ethiopian population according to the national census conducted by Central Statistics Agency (CSA, 2009). Over 16% percent of the then, 74 million populations, that is, more than 11.8 million were under this age category and above 10% were in the ages 4 to 6 years. However, Early Childhood Education (ECE) is one of the most neglected areas in Ethiopia. As to the Annual Educational Statistical Abstract of Ministry of Education, 2013), the gross enrollment rate of Kindergarten (KG, ages 4 to 6) was only 6.2% and mainly concentrated in urban areas. Moreover, extremely very thin preprimary school teachers have been trained in early childhood education in the country (Woldehanna, Mesele and Araya, 2017).

In tune with the international commitment, the Ethiopian Government has embarked on a continuous process of reengineering the issue in its education and training policy and in the past five Education Sector Development Plans (ESDPs). The first five-year plan of the Education Sectors Development Plan (ESDP-I) was launched within the framework of the Education Training Policy (ETP, 1994) and the following three year ESDP-II plans did not consider Early Childhood Education (ECE) as absolutely necessary. Not until the third five year ESDP-III plan, Early Childhood Education (ECE) was given the needed policy support by the government to create conducive policy environment and support mechanisms for the participation of various stakeholders which was not implemented as immediate as possible. Moreover, nothing has been said about the preprimary school teachers' training even if it has been the cornerstone in the early childhood education program (Dowd, 2016).

ECE received much focus in ESDP-IV (2010 to 2014/15), which provided a useful analysis of lessons learnt from ESDP-III (2005/06 to 2010/11). Tangible program outcomes and targets were set than ever before the preceding ESDPs through different approaches to meet the objective of ECE as stipulated in Education for All (EFA, 2000) Dakar documents. It has placed mainly two key outcome targets to increase Gross Enrollment Rate (GER) from 6.9% in 2009/10 to 20% in 2014/15 and to establish a pre-primary class in all rural and urban primary school compounds (MoE, 2018;

Woldehanna, Mesele and Araya, 2017). Despite the presence of these statements in different sectors of governmental policy and the comprehensive inclusion of ECE in the ESDP- IV, ECE in Ethiopia was one of the most neglected areas of educational programs in the country.

It is clear that the different regions of Ethiopia have adopted the education sector development program prepared at the federal government. Among these regions Oromia, Harari and Dire Dewa City Administration are also the one that is implementing the program to address the issue of early childhood education programs in all zones of the region. Based on this reality, investigating problems of social kills in early childhood education program in Ethiopia was attempted at Chiro, Dire Dawa and Harar Towns.

Purpose of the Study

The purpose of this study was to investigate how the problems of social skills in early childhood education program in Ethiopia is affecting preschoolers in in teaching-learning processes in schools**.** Specifically, this study was intended to;

- identify the extent to which early childhood education teachers were qualified and trained to the required social skills in their professional competence
- assess the preprimary school teachers' perceptions towards the relevance of curriculum in Harar, Chiro and Dire Dawa Towns
- pinpoint the relevance of curriculum in supporting children's social skills in early childhood education
- explain the extent to which curriculum relevance affects children's social skills
- compare whether there was statistically a significant mean difference exist among the three centers.

METHODS

The research design was descriptive survey research design, where schools were purposively selected and the participants were randomly selected through stratified random sampling techniques: (1) Dire Dewa Center (130 teachers; 10 schools), (2) Chiro centers (40 teachers; 6 schools), and (3) Harar centers (110 teachers; 8 schools). All data presented in this study were collected in January, 2020.

Sample Size Estimation

Randomization was conducted at the school level and stratified by three city centers. A sample size of 24 schools with approximately ten teachers per school was assumed. To do this, Yamane's (1967) sample size determination formula was employed to determine the sample size of preprimary school teachers under the study.

$$n_i = \frac{N_i}{1+N_i(\alpha^2)} = \frac{996}{1+996(0.05)^2} = \frac{996}{1+996(0.0025)} = \frac{996}{1+2.49} = \frac{996}{3.49} = 286$$ where N_i is the total preprimary school teachers in the three cities; n_i is the total sample size to be taken at $\alpha = .05$.

Sampling Procedures

Three of the nine cities in the Eastern Ethiopian where early childhood education has been practiced were selected. These cities were rated as the most disadvantaged districts on the 2014 UNICEF District League Table (a social accountability index that ranks regions and districts based on skills and delivery of key basic services, including education, health, sanitation, and governance). These three schools were purposively selected, where these schools were found within five-hours driving distance from Hararamaya University where the researcher permanently lives.

School Sample

All schools in the three cities were identified using the Educational Management Information System database, which lists all registered schools in the eastern part of the country. Schools were then

randomly sampled and stratified by city and within city by public schools. Eligible schools had to be registered with the government and have at least one preprimary schools class. A school listing was then conducted to confirm the presence of each school and to obtain information on each school's principal. There were 40 public schools across the three cities where every public school was sampled. Then, 24 schools were sampled from 40 schools.

Teacher Sample

All preprimary school teachers in schools selected for the study were invited to participate in the study. The majority of schools had less than ten preprimary school teachers although the range was from nine to twelve. If there were more than nine preprimary school teachers in the school, nine of them were randomly sampled per school for filling the survey. The final sample included 286 teachers out of which six of them did not fill the survey correctly and they were left out during analysis. Therefore, the analyses were only made on the 280 preprimary school teachers.

Preprimary school teacher's level of training about children's social skills

Preprimary school teachers answered a survey in Afan Oromo, Somali, Harari and Amharic (the language of Ethiopia's early childhood education system in these three cities). Items were multiple choices which were selected by the preprimary school teachers. First, the researcher prepared 5 items which talked about teachers'- social skills questionnaires with teachers to assess whether they understood each question, both consistently across constructs and in the way the item was intended. Secondly, five Likert scales items taking about the relevance of curriculum in supporting children's social skills in early childhood education program were surveyed. The items were summed and analyzed. Thirdly, five Likert scales items were surveyed to measure the extent to which relevance of curriculum affects children's social skills. Finally, he piloted the survey by administering it to 20 teachers (14 females and 06 males) and assessed the distribution of responses for each item. From these exercises, he concluded that all items were suitable for use in this sample. Items were answered on the following scale: Strongly disagree (1), Disagree (2), Undecided (3), Agree (4) and Strongly agree (5).

To interpret the data descriptively, if the calculated mean score is between 1.00-1.50, it would be strongly disagree; if the calculated mean score is 1.50-2.50, it would be Disagree; if the calculated mean score is 2.50-3.50, it would be Undecided; if the calculated mean score is between 3.50-4.50, it would be Agree; if the calculated mean score is between 4.50- 5.00, it would be Strongly agree. A pilot study was conducted on twenty preprimary school teachers (14 males and 06 females) who represented the population character but not the sample to check the reliability of the items by using Cronbach alpha value. Accordingly, the researcher was able to decide the characteristics of the questionnaire that needed to be adjusted or remained or to be changed in some technical words or phrases that seemed to be technical for these participants. The reliability of the three sections of the questionnaire was indicated in the following tables as follows.

Table1. Reliability test result

Items and alpha value	Items and alpha value
Number of items	5
Cronbach alpha	.88

Therefore, the computed alpha values (.88) given in this section of the questionnaire was highly reliable. Therefore, it was safe to use them with a little modification. The validity was tested by expert and well experienced teachers over the area. The questionnaire was administered on face to face basis so that the distributed questionnaires were collected from these participants after they were completed filling them. Descriptive statistics such as frequency, percentages, means, coefficient of variation and standard deviation were used to summarize the participants' response to children's social skills in early childhood education in Eastern Ethiopia while inferential statistics (one way ANOVA and factor analysis) were used to show the mean differences among groups and the explained variables of the study respectively. The level of significance was set to be $\alpha = .05$.

RESULTS AND DISCUSSIONS

This chapter presents the analysis and interpretation of the main findings**.** Questionnaire was distributed to 286 preprimary school teachers from 24 pre-primary schools; 280 (97.90%) copies were returned. The collected quantitative data were analyzed quantitatively using frequency, percentage, mean, standard deviation, coefficients of variation, one way ANOVA, and Factor analysis. The analyzed data were compiled and organized in a way that it suits the interpretations of the results in addressing the research objectives. In this way, 9 tables were constructed in categorizing the objectives of the study in thematic groups in details to deal with the responses of participants. The quantitative data obtained from participants were analyzed using the Statistical Package for the Social Sciences (SPSS-version 20).

Table 2. Qualifications & training versus pre-primary school teachers' cross-tabulation

Qualification	**Pre-primary School Teachers**				**Percentage (%)**
	Dire Dawa	Chiro	Harar	Total	
Grade ten Complete	42	10	34	86	30.71
Grade twelve Complete	24	7	30	61	21.79
Early Childhood Education Certificate (ECEC)	20	6	10	36	12.86
(TTC) Diploma	20	6	10	36	12.86
10 + 3 graduate (TVET)	10	6	12	28	10.00
Others if there is any	8	4	10	22	8.46
12 Grade Complete and ECEC	4	2	3	9	3.22
12 Grade Complete and TTCC	2	1	1	4	1.43
Total	130	40	110	280	100

From Table 2 shown, 86 (30.71%) of the pre-primary school teachers were a grade ten complete; 61 (21.79%) of them were a grade 12 complete; 36 (12.86%) of them were an Early Childhood Education Certificate (ECEC) complete; 36(12.86%) of them were a diploma complete from Teachers' Training College (TTC) complete; 28(10.00%) of them were a 10+3 graduate in Technical and Vocational Education Training (TVET) complete; 22(8.46%) of them were another complete if there is any; 9(3.22%) of them were a 12 grade complete and had Early Childhood Education Certificate (ECEC) whereas 4(1.43%) of the participants were a complete of grade 12 and Teachers' Training College Certificate(TTCC). Generally, 88.74% of preprimary school teachers were not well qualified and trained in early childhood education program. This may indicate that there was no special attention has been given to social skill development to early childhood education in Ethiopia.

In opposing this finding, Dominguez, Vitiello, Maier, Greenfield, and Daryl (2010) suggested that well qualified and trained preprimary school teachers are crucial; a child-centered program requires appropriate activities for each child and teachers who guide and scaffold so that each child advances. In support of these ideas, Contemporary Maria Montessori schools still emphasize individual pride and achievement, presenting many literacy-related tasks (e.g., outlining letters and looking at books) to young children (Lillard, 2005; 2013). Moreover, Gibson (2013) highlights three key attributes that professionals should have. First, they must have expert skills in a particular field. Second, they must possess a body of knowledge related to this field; and third, the professionals must be able to make decisions and solve problems with this set of knowledge and skills. Oberhuemer (2008) emphasizes the need for professional traits such as professional relationships with students, parents, administrators, fellow teachers, and community members; a strong foundational knowledge; and practical skills of ECCE. These views make the role of the ECCE professional more complex and multi-dimensional than a list of standards.

The ECE educator's sense of professional self in the community embodies collaborative relationships with colleagues, parents, the management and the community beyond the centre. It comprises being

able to work for the advantage of children, staff, management and community, modelling good practices, working in teams, and making links with the community (Dalli, 2008). Studies have also shown that teachers' sense of partnership with fellow teachers is essential in fostering teachers' sense of professional self, supporting the importance of encouraging professional collaboration and professional communities (Guo, Justice, Sawyer, & Tompkins, 2011).

Table 3. Problems of social development in early childhood education program

	Children did not develop	M_i	SD_i	CV%
1	cooperating during learning different skills with their classmates	3.65	.71	19.75
2	solving social problems during learning and playing with their classmates	3.70	.78	21.08
3	protecting and respecting their cultures	3.74	.79	21.12
4	respecting diversity in class and out of classrooms	3.75	.82	21.87
5	a communication skills	3.78	.86	22.75

As it was indicated inTable3, the computed mean scores (M_1= 3.65, M_2 = 3.70, M_3 = 3.74, M_4 = 3.75, and M_5 = 3.78) of the participants were clearly explained that early childhood education curriculum were irrelevant in supporting children's social skills in classrooms in terms of (i) cooperating during learning different skills with their classmates, (ii) solving social problems during learning and playing with their classmates inside and outside of the classroom, (iii) protecting and respecting their habits, custom and cultures, (iv) respecting diversity in class and out of classrooms and (v) a communication skills with classmates, teachers and school community at large in understanding different social taboos. However, the computed coefficients of variations indicated that there was the highest variation (CV_1 = 22.75%) among the preprimary school teachers' responses on the relevance of curriculum in supporting children's social skills on a communication skills whereas there was the most consistent coefficient of variation (CV_1 = 19.75%) among participants in cooperating during learning different skills with their classmates. It is possible to say that there was almost not as such variability among the participants on the five variables cited in Table 3 above.

In opposing of these findings, David (2016) suggested that the social skill and emotional competence is an important part of children's early skills and learning. As to him social and emotional competence means the ability to understand and manage emotions and behavior to make decisions and achieve goals, and to establish and maintain positive relationships, including feeling and showing empathy for others. Developing these capacities is important for children's learning and academic success. Social and emotional competence give children the capacity to engage in academic tasks by increasing their ability to interact constructively with teachers, work effectively with peers, and dedicate sustained attention to learning. The social and emotional support and security provided by positive relationships contributes in many different ways to young children's learning success. For instance, children who have secure relationships with their parents develop greater social skills with adults and peers and greater social and emotional understanding of others, show more advanced moral skills, and have a more positive self-concept (Santrock, 2009). Therefore, a well-designed and planned relevance of curriculum to early childhood education is too fundamental for the benefit of the children in this age in general and the nation in particular.

On the other hand, the previous research by David (2016) again showed that preschoolers identified as academically at risk based on demographic characteristics and reports of problems by their kindergarten teachers were followed to the end of first grade. The children with first-grade teachers who provided high amounts of instructional and emotional support had achievement scores comparable to their low-risk peers. A child's ability to regulate his or her emotions, thoughts and behaviors in different situations, managing stress, controlling impulses, and working toward goals can affect learning and relationships with adults and peers. Children who lack effective self-regulation do not participate in a productive way in learning activities. They may act disruptively and aggressively; they then receive less support from their peers, which in turn may undermine their learning. Young children are better able to exercise self-regulation in the company of educators who have developmentally appropriate expectations for their self-control, provide predictable routines, and offer

guidance that scaffolds their developing skills of self-management, especially in the context of carefully designed daily practices in a well-organized setting.

Generally speaking, relevance of curriculum must create learning environments that are well-structured and predictable, provide support for children's self-regulatory capacities, and offer secure and warm relationships with educators will benefit children's social and emotional skills, as can some curricula and interventions designed to promote social and emotional learning. These supports in the learning environment can also be a buffer for the negative effects children experience as a result of chronic stress and adversity (Santrock, 2018). However, such children, as well as other children facing challenges with their social and emotional skills, may have other specific needs for support.

Child mental health consultants and referrals to specialized services can be resources for educators in supporting children's social and emotional skills. Consultants can provide educators with guidance on classroom management and instructional practices for all children, as well as individualized consultation for particular children based on classroom observations. So, early childhood education curriculum must be relevant, developmentally appropriate, and socially & emotionally responsive for positive relationship, self-regulating and self-managing, cooperative and experiential in learning among children in schools and out of schools.

Table 4a. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.74
Bartlett's Test of Sphericity	Approx. Chi-Square	269.64
	df	10
	Sig.	.00

As it was seen from Table4a, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) reported a value of .74 which were very excellent as it was approached one. Any value greater than .60 KMO measures of sampling adequacy is considered to be an indication that the data are suitable for factor analysis (Everitt & Hothorn, 2011). The next test result is for Bartlett's Test of Sphericity, which reported a chi-square test of 269.64 at degree of freedom (df = 10) and a significance level of .00. This is a positive result, and the researcher felt more confident that his final factor analysis was going to yield useful information about the factor analysis so as to identify the explain variable under the study.

Table 4b. Rotated component matrix

	Component		
	1	2	3
protecting and respecting cultures	**.759**	-.062	.223
cooperating during learning different skills	**.754**	.010	-.230
communication skills	-.114	**.905**	.004
solving social problems during learning & playing	.484	**.495**	-.029
respecting diversity in class and out of classrooms	-.009	-.005	**.965**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 4 iterations.

As the Table 4b indicated, the three rotated components are just good components in explaining and reproducing the observed correlation matrix. In the rotated components, protecting & respecting cultures, and cooperating during learning different skills with their classmates all have high positive loadings on the first component, (and low loadings on the second and the third components); communication skills, and solving social problems during learning & playing have high positive loadings on the second components, (and low loadings on the first and the third components) whereas respecting diversity in class and out of classrooms have very high positive loadings on the third components (and low loadings on the first and second components).

Literature shows that the teaching profession is often viewed to have a lower status than many other professions (Ingersoll & Mitchell, 2011). When the profession is considered in subgroups of pre-school, primary and secondary teachers, it is argued that pre-school teachers have the lowest status (Chan, 2018). Foundational to the sense of professionalism in EC is the dominant theme of mothering, underpinned by women's intrinsic and natural connection to children. Osgood's (2012) work on EC professionalism and identity in a UK context highlighted how materialistic discourses are embraced and how they inform and limit teacher professional identities. However, internationally as well as in Singapore, efforts have been made to raise the professional status of EC teachers with the setting of prescribed criteria such as knowledge, expertise and training, based on sector-agreed competencies and standards of practice for specific job roles in the field (Feeney & Freeman, 2018).

Table 4c. Component transformation matrix

Component	1	2	3
1. Sharing, cooperating and protecting cultural values	**.958**	.273	-.089
2. Communicating and problem solving skills	.265	**-.718**	.644
3. Respecting diversity	-.112	.640	**.760**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Here, the researcher has named the 5 items into three components as per the rotated component matrix of Table 4b. Component-1 includes two items (1 and 2) named as "Sharing, cooperating & protecting cultural values" and Component-2 includes two item (3 and 4) and named as "Communicating & problem solving skills," and Component-3 has one item (5) and named as "Respecting diversity".

Table 4d. Total variance explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.42	28.44	28.44	1.39	27.83	27.83
2	1.06	21.19	49.63	1.07	21.35	49.18
3	1.02	20.26	69.89	1.04	20.71	69.89

Extraction Method: Principal Component Analysis.

As it was seen from this Table4d, the researcher clearly saw the eigenvalues for the 5 items out of which only three most important components were extracted. Look at the column called Initial Eigenvalues, and notice the value of 1.42 for Component-1. This eigenvalues (1.42) is equivalent to 28.44% of the total variance when all 5 items are considered. The second row shows the eigenvalues of 1.06 for Component-2, which means that it accounted for 21.19% of the total variance for all 5 items. The third row shows the eigenvalues of 1.02 for Component-3, which means that it accounted for 20.26% of the total variance for all 5 items. These percentages were not related to the variance of the first component and the second extracted factors all together; therefore, cumulatively, these components were accounted for 69.89% of the variance for all the 5 items whereas 30.11% of the variances were not explained.

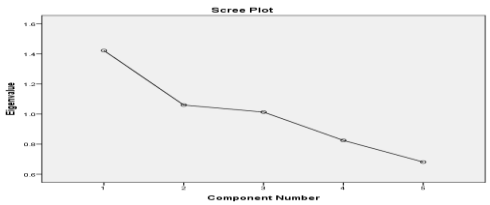

Figure 1. Scree plot

The scree plot is shown in Figure1, which graphs the eigenvalues on the y-axis and the 5 component number on the x-axis. The scree plot is a widely accepted aid in selecting the appropriate number of components when interpreting factor analysis. The researcher simply selected those components above the "elbow" portion-in this case, components-1, component-2 and component-3. As it was seen in the same Figure 1, components-1, component-2 and component-3 were accounted for 69.89% of

the variances that have been explained in the study. It can be said that this scree plot provides additional evidence in supporting of a three- components solution for the factor analysis problem.

Table 5. The extent to which irrelevant of curriculum affect children's social skills

Extent		Frequency	Percentage (%)	Cumulative Percent
1	Low	40	14.29	14.29
2	Moderate	54	19.29	33.58
3	High	186	66.42	100.0
	Total	280	100.0	

From the results given under Table 5, it is clear that 186 (66.42%) of the preprimary school teachers responded that irrelevance of curriculum in early childhood education program were highly affecting children's social skills; 54 (19.29%) of them were moderately affected children's social skills development in early childhood education; 40 (14.29%) of them were lowly affected children's social skills development. From these results, it is clear that 85.00% (19.29% + 66.42%) of the preprimary school teachers rated that irrelevance of curriculum in early childhood education program were either moderately or highly affecting children's social skills development.

Seminal contributions have been made by Previšić (1999) explained that school is needed today is the school that encourages overall skills of the children, respects diversity, and encourages individualization and socialization of the classes. In the school, the children have to, with an active role, acquire knowledge and develop creativity, and preprimary school teacher needs to encourage social sensitiveness and partnership between the parents and the school. School is needed as a modern institution that is, besides acquiring knowledge, oriented to the skills of the children's personality and his/her individuality as a complete young person that is an equal member of the social community. The early childhood education program curriculum should be well organized in such a way that it can attract today's youth and actively respond to their needs and expectations (Buljubašić-Kuzmanović, 2012).

Day, Kington, Stobart, and Sammons (2006) suggest that national support and policies constitute key parts of the network which impact on the sense of professional self of teachers. They further argued that the teachers' multi-dimensional roles are represented within the several layers of these network structures. The structures can be identified in school culture as well as inter-personal knowledge construction among the teaching community (Day et al., 2006). The societal and political dimensions, as such, can impact and transform the professional profile within the society. This expansion of the roles to include how EC teachers are professionally understood and positioned in terms of quality outcomes for children and the nation, shifts from that of materialism and child-minding to that of professional frameworks that are tied to reporting structures, training, pedagogy and outcomes for children (Millei & Jones, 2014). Paradoxically, despite the disempowering effect of earlier links to mothering and child-minding, care and concern should be considered as key traits for the early childhood professional (Dalli, Miller, & Urban, 2012).

Jónsdóttir & Coleman (2014) explored how views of ECE teachers and how stakeholders' perceptions affect their sense of the profession. The findings showed that the stakeholders did not seem to recognize the ECCE teachers' expertise in their educational work with children. While professional status is often judged by remuneration, degree of content knowledge and qualification level, the feeling of being valued and respected by society was considered the ultimate gain in professional status (Fuller, Goodwyn, & Francis-Brophy, 2013). There seems to be a gap between how the ECE teachers view themselves, as professionals, and the perspectives of stakeholders, particularly parents and politicians.

The researcher used an established technique, namely one way Analysis of Variance (ANOVA) so as to analyze the existing mean differences among the three towns (Chiro, Dire Dewa & Harar) on the two dependent variables as they have been indicated under Table6. Accordingly, it was found that

there were statistically significant mean differences among the three towns on irrelevance of curriculum in early childhood education, $F_{(2, 277)} = 3.03$, $p<.05$, one tailed. This clearly implied that these three towns had different problems on irrelevant of curriculum. Moreover, there was statistically a significant mean difference among the three towns in the children's social skills in early childhood education, $F_{(2, 277)} = 11.86$, $p<.05$, one tailed.

Table 6. Analysis of variance (ANOVA) among the three towns on children's social skills

Variables	SV	SS	df	MS	F	Sig.
1	Between Groups	285.69	2	142.85	3.03	.04*
Irrelevant of curriculum (IR)	Within Groups	12989.12	277	46.89		
	Total	13274.81	279			
2	Between Groups	162.46	2	81.23	11.86	.00*
Social skills development	Within Groups	1897.08	277	6.85		
	Total	1959.54	279			

*p<.05

The previous studies by (Santrock, 2009) suggested that more comprehensive description was found. He alleges by researching that children's social skills in the middle childhood and how it is important for the encouraging socio-emotional skills of the child to adjust to child's skills needs. Furthermore, he alleges the necessity of encouraging peer interaction, enhancing social skills and positive social relations in the school. He emphases the importance of the school as it is the place that stimulates the skills of positive characteristics of child's personality, self-respect, emotional intelligence and modeling of pro-social behaviour. The school is expected that in the co-creation of the school curriculum puts students in the center and their integral skills, multisource and multidimensionality of didactic-methodological design of the classes.

Kelchtermans (2009) suggests that the formation of the professional self consists of related domains and it evolves as the teacher develops. These domains include self-image: how teachers describe themselves in their profession; self-esteem is the evolution of self as a teacher, defined by both self as well as others; Motivation to teach: reasons for teachers' retention and attrition; Task perception: the expectation of teachers of their tasks and roles; and Future perspective: teachers' perception for their professional. Hilferty (2008) argues that a teacher's sense of professionalism is a social setup ''that is being defined and redefined through educational theory, policy and practice'' (p. 53). ECE teachers' professional perceptions are defined by impacts across a variety of dimensions (Tukonic & Harwood, 2015; Dowd, 2016). From the perspective of an ECCE teacher this may encompass behaviours to improve and achieve best practices and which includes their professional role of respect, work ethics, development, and professional interactions (Tukonic & Harwood, 2015; Dowd, 2016).

Martin, Meyer, Jones, Nelson, and Ting (2010) examined factors, which contributed to perceptions of professionalism of EC teachers. They found that the teacher's sense of commitment seem to have the strongest impact on the perceptions of professional self. Other factors that were significant included years of experience in early child care, enjoyment of work, professional development, parents turning to the child care professional for information, and feeling qualified. This sense of one's professional self is also the result of interactions between beliefs of the society, personal philosophies, professional development and practice (Moloney, 2010). The ECCE teachers' perception of themselves as professionals, their perceptions of how they are viewed by others and their work conditions can affect the development of their professional identity.

CONCLUSIONS

By collecting data from the participants through questionnaire about the children's social skills and the theories of the social development, it is evident how the children's social skills is under the influence of preprimary school teachers' qualification, training, and relevance of curriculum especially in the period of early childhood education program. In the period of early childhood education, influence of the preprimary school teachers' perception is still crucial even though the

influences of the relevance of curriculum too crucial. The preprimary school teachers by their support and cooperation with the school can help with right children's social skills development whenever preprimary school teachers are well qualified and trained in early childhood education. Their mutual cooperation in particular can be manifested during the creation of school activities that will encourage social interactions between children.

Especially important role is a role of the teacher in the creation of the classes that need to be enriched with activities that encourage the cooperation and mutual respect between the children. The classes that encourage the social development need to be led by humanistic and holistic approach encouraging the quality of social skills. It is of great importance the influence of the relevance of curriculum on the social development in the period of early childhood education because it is the period of creating the first friendships. Considering the aforementioned, it is more and more necessary to make relevance of curriculum and teachers' perceptions encourage interaction-communicational education related to the interpersonal relations, the quality interaction and communication as well as readiness for the cooperation.

By researching the children's social development in early childhood education, Santrock (2006) alleges how it is important for the encouraging socio-emotional skills of the child to adjust to child's developmental needs. Furthermore, he alleges the necessity of encouraging positive teachers' perception, enhancing social skills and positive social relations in the school. He emphases the importance of the school, as it is the place that stimulates the development of positive characteristics of child's personality, self-respect, emotional intelligence and modeling of pro-social behaviour. Therefore, the school should be expected to the co-creation of the relevance of curriculum puts children in the center and their integral development, multisource and multidimensionality of didactic-methodological design of the classes. The classes should be enriched with variety of teaching methods, procedures and social forms of work, which will contribute to the social interactions and the quality of children's social skills.

Limitations of the Study

Some of the limitations of this study also need to be addressed. First, besides any possible limitations of the databases used, the researcher only searched for research written in English. This may imply a bias connected to language-spheres and traditions of how research is published. Second, the decision to only include research published in peer-reviewed research journals was meant to ensure scientific quality although these have excluded research published in books and dissertations. Thus, a synthesis has the advantage of offering a more comprehensive view; theory development and generalizability of quantitative research that can make the findings more practically applicable, but at the same time were not too far removed from the first and second level interpretations. However, at the same time, quantitative meta-synthesis excludes qualitative studies, which in this case resulted in only 23 studies meeting the inclusion criteria. Third, doing a meta-synthesis of primary articles with disparate designs, different styles of writing and variations in the extent of the presented is an additional challenge. Moreover the data were not collected as per the schedules and plans because the then existing and time bore problems in the country. As a result the study was delayed for a year.

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THE EFFECTS OF GEOMETRICAL-MECHANICAL INTELLIGENCE GAMES ON THE SPATIAL ABILITIES[1]

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Abstract

In this research, it was intended to determine the effects of geometrical-mechanical intelligence game activities on the spatial abilities of secondary school seventh grade students. The research was designed according to quasi-experimental design with pre-test and post-test control groups and conducted with two experimental and two control groups. The study group of this research included a total of 117 seventh grade students who took and did not take elective intelligence games course in a secondary school located in Turkey. In the study, experimental-I group played intelligence games activities with concrete materials, experimental-II played intelligence games on PC, control-I group played intelligence games that were recommended by the Ministry of National Education and control-II group did not play any of the intelligence games. Before, and after the empirical processes that lasted nine weeks, "Spatial Visualization Test", "Spatial Relations Test" and "Spatial Orientation Test" were used as data collection tools. Paired samples *t*-test and one-way analysis of variance for independent samples were used in data analysis. The results obtained from the research showed that the spatial visualization and spatial relations skills of students have significantly improved according to the activities recommended by the Ministry of National Education in both concrete materials and computer games.

Keywords: Intelligence games, Geometrical-mechanical game, Spatial ability, Spatial visualization, Spatial relations, Spatial orientation.

INTRODUCTION

Spatial ability is a mental process that establishes the interaction between knowledge and mechanisms included in spatial cognition (Hauptman, 2010). Spatial ability is the ability to mentally represent and manipulate two or three dimensional images (Wang & Carr, 2020). This ability is an important building block of general cognition, as it provides the perception, storage, recalling, reconstruction, regulation and transmission of the spatial images (Osberg, 1997). Spatial ability can be perceived as a unique type of intelligence that can be distinguished from other types of intelligence, such as verbal ability and reasoning ability. It is not a monolithic and static trait, but it consists of sub-skills that are related to each other and that can be developed throughout a person's life (Shamsuddin & Din, 2016). Factor analysis and meta-analysis studies led to the emergence of many spatial ability models, each with different spatial skill classifications (Gilligan, 2019). For example, Lohman (1979) emphasized the existence of three major components of spatial ability as follows: "spatial relations", "spatial visualization", and "spatial orientation". He defined the spatial relations factor as the ability to solve mental rotation problems quickly, defined the spatial orientation factor as the ability to visualize how a stimulus sequence looks from another perspective, and defined the spatial visualization factor as the tasks that are relatively do not require speed and are complicated with respect to other factors. Linn and Petersen (1985), based on their meta-analysis study results, divided the spatial ability into three components as "spatial perception", "mental rotation" and "spatial visualization". The researchers defined the spatial perception component as the ability to determine spatial relations in respect to the orientation of one's own body or in the context of distracting information, defined the mental rotation

[1] This study was developed from the doctoral thesis of Neşe Dokumacı Sütçü.

component as the ability to rotate two and three-dimensional figures quickly and accurately in one's mind, and defined the spatial visualization component as the tasks that involve complex, multi-step manipulations of the information that are presented as spatial. Pittalis and Christou (2010), based on their factor analysis study results, claimed that spatial ability consists of three major spatial ability factors, namely "spatial visualization", "spatial relations" and "spatial orientation", and confirmed the spatial ability model Lohman (1979) predicted with the research that they carried out.

As an alternative to factor analysis and meta-analysis studies, spatial ability classification can be derived using theoretical approaches. One such classification is Uttal et al.'s (2013) theoretical, top-down model of spatial skills. This model makes use of two fundamental theoretical distinctions. The first is between intrinsic versus extrinsic information. Intrinsic information is the specification of the parts, and the relationship between the parts, that defines a particular object. In contrast, extrinsic information refers to the relation among objects in a group, relative to each other or to an overall framework. The second distinction is between static versus dynamic tasks. Dynamic tasks require movement such as moving, rotation, combinig, bending, folding or scaling. However, static tasks do not require movement (Uttal et al., 2013). Within this classification, four different categories of spatial ability are defined as intrinsic-static, intrinsic-dynamic, extrinsic-static and extrinsic-dynamic spatial skills. Intrinsic-static skills involve "perceiving objects", intrinsic-dynamic skills involve "assembling small units into larger ones, mentally rotating 2D or 3D objects and visualizing". Extrinsic-static skills involve "understanding abstract spatial concepts" and extrinsic-dynamic skills involve "perspective taking" (Jung et al., 2020). Classifications of spatial skills based on factor analysis and meta-analysis studies can be paired onto Uttal et al.'s (2013) model of spatial skills. For example, Lohman (1979) emphasized the existence of three major components of spatial ability as "spatial visualization", "spatial relations" and "spatial orientation". Spatial visualization tasks, which are diverse in their nature, require both intrinsic-static and intrinsic-dynamic spatial skills, while spatial relations and spatial orientation fall intrinsic-dynamic and extrinsic- dynamic sub-domains respectively.

Uttal et al.'s (2013) model provides a useful framework for investigating spatial cognition. However, it is possible that the distinctions suggested by Uttal et al. are over refined and spatial thinking can also be defined using similar and broader categories. Uttal et al.'s (2013) model also aligns with spatial models based on the evolutionary origins of spatial skills (Gilligan, 2019). From an evolutionary perspective, Newcombe (2018) suggested three kinds of spatial cognition as navigation, object manipulation and spatialization. Navigation is a function necessary to a broad array of mobile species and it draws on various subsystems relevant to location and movement tracking, integrating those systems in various ways. These systems require extrinsic coding. Object manipulation involves far more than simply holding objects. Object manipulation involves the mental representation and transformation of the objects, that is, intrinsic coding. Difference between navigation and object manipulation is that navigation concerns the extrinsic spatial relations among objects, whereas object manipulation concerns intrinsic spatial relations that constitute the structure of objects. There is also a third kind of spatial cognition: Spatialization involves many kinds of spatial symbol systems, including language, metaphor, analogy, gesture, sketches, diagrams, graphs, maps, and mental images.

In this study, Lohman (1979) classification has been taken into account, as it was also considered by other certain studies (Pittalis & Christou, 2010; Risma, Van Eerde, Abel, Putri & Ilma, 2013; Ung, Ngowtrakul, Chotpradit & Thavornwong, 2016) related to spatial ability. In that case, Spatial Visualization Test was included as a measure of intrinsic-static and intrinsic-dynamic spatial skills, Spatial Relations Test was included as a measure of intrinsic-dynamic spatial skills and Spatial Orientation Test was included as a measure of extrinsic-dynamic spatial skills.

Spatial ability has a critical status in our everyday life in many activities ranging from simple to complex. For example; we use our spatial skills while assembling a furniture, studying the graphs in

newspapers, trying to find our current location, trying to find the direction using the maps (Jirout & Newcombe, 2014). Spatial ability is important for the success in science, technology, engineering and mathematics (STEM) as well as in our daily lives (Gilligan, Flouri & Farran, 2017; Kuhl, Lim, Guerriero, & van Damme, 2019; Liu, Huang, Yu, & Dou, 2020; Lubinski, 2010; Uttal & Cohen, 2012). Indeed, research on the subject has shown that spatial ability is positively related to the achievements in areas such as mathematics and geometry (Atit et al., 2020; Cheng & Mix, 2014; Gilligan, Hodgkiss, Thomas & Farran, 2019; Guay & McDaniel, 1977; Lowrie, Logan & Ramful, 2017; Lowrie, Logan & Hegarty, 2019; Turgut & Yilmaz, 2012), physics (Delialioglu & Askar, 1999, Liner, 2012), chemistry (Coleman & Gotch, 1998; Pribyl & Bodner, 1987), biology (Russell-Gebbett, 1985), science (Tracy, 1990) and engineering (Peters, Chisholm & Laeng, 1995).

Despite its importance in numerous fields, spatial ability is not adequately taught in classrooms (Clements & Sarama, 2011). Piburn et al. (2002) indicated that especially verbal and logical-mathematical skills were taught in schools, and the schools are rarely interested in spatial ability, while it could be taught. The results of the researches conducted by Tekin (2007), and Turgut and Yilmaz (2012) in Turkey show that the activities in the primary and secondary education programs are not enough to develop the spatial skills of the students. Osberg (1997) stated that, in the case of lack of spatial ability, the individual will also have difficulties in the school environment and possibly in everyday life, and therefore the emphasis should be given on how to develop and sustain spatial abilities starting at an early age.

Spatial ability is developed from birth, together with language and other specialized abilities, through interactions between inherited capabilities and experiences (Mathewson, 1999). Although there are numerous theories on why some individuals develop spatial skills and others lack the ability to develop these skills (Sorby, 1999), there are a number of studies that suggest that this ability can be improved with appropriate tools and activities (Uttal et al., 2013). For example, De Lisi and Wolford (2002) stated that computer-based educational activities could be used to improve the spatial skills of students in schools. You, Chuang and Chen (2008) stated that playing digital games can be a solution for improving the spatial skills of the students, when the game is designed and applied appropriately. Boakes (2009) stated that origami can be used as an important tool for the development of spatial skills. Jirout and Newcombe (2015) stated that the experiences with spatial toys, such as blocks and puzzles have an important influence on the development of spatial skills. Alexe, Alexe, Voica and Voica (2015) have stated that spatial learning tools for development of spatial ability and current approaches for the development of educational programs are the use of real or virtual manipulations, and the games such as Jigsaw Puzzles, LEGO, Rubik's cube, Tetris, chess, and origami. Renavitasari and Supianto (2018) stated that educational game tangram puzzle activities could be used to improve the spatial ability. Alexiou and Schippers (2018) stated that digital games facilitate the development of cognitive skills such as spatial skills; enhanced mental rotation abilities. According to Kuhl et al. (2019) play with spatial toys in early education and home settings offers a promising and underutilised avenue for supporting spatial skills. According to Toub, Verdine, Golinkoff, and Hirsh-Pasek (2019) an initial step towards providing early spatial education is ensuring access to toys like shape sorters, blocks, puzzles and origami that lend themselves to spatial play. According to the Ministry of National Education [MoNE] (2013), geometrical-mechanical intelligence games can be used effectively as the means of improving the spatial skills of the students.

Geometrical-mechanical intelligence games are games which can be played single, mutual or as a team. While playing these games, the player make use of geometrical thinking methods, spatial thinking skills, hand-eye coordination or motor skills. Pre-established game materials and digital environments can be used in most of the games. The examples of these games include tangram, polyomino, cube counting, making shape, maze games, node games, Rubik's cube, mikado, jenga and puzzles (MoNE, 2013).

In this research, by using geometrical-mechanical intelligence games for the development of spatial ability, the tasks in the games were presented to students in two different physical forms as concrete materials and in computer environment (virtual environment). Computer manipulatives are often similar to concrete manipulatives (Bouck ve Falnagan, 2010). A major difference between concrete and computer manipulatives is their physical nature (Gibson, 1962). Concrete manipulatives can be touched, held, and rearranged physically. Computer manipulatives are available via computer and closely resemble concrete manipulatives but can only be manipulated and moved on the screen (Spencer, 2008). The computer manipulatives are more interactive than a picture or video, but provides less sense stimuli than a concrete manpulatives. In other words, concrete manipulatives give children tactile experiences unlike computer manipulatives (Olkun, 2003). Active touch is an excellent channel of spatial information in that the arrangement of surfaces is readily picked up (Gibson, 1962). On the other hand intensive training in computer environment may create deeper spatial understanding than concrete manipulatives because of the opportunity to encourage students to think about spatial problems, manipulate objects directly, and navigate around in virtual environments (Osberg, 1997). In the studies about the subject, the games such as LEGO, block, jigsaw, Tetris, Tangram, and pentomino that are used in the development of spatial ability were discussed under the title of geometrical-mechanical intelligence games as stated by MoNE (2013), and the literature was examined within this scope.

In the literature, studies that examine whether or not using concrete materials as geometrical-mechanical intelligence games have any effect on students' spatial abilities have shown that these games are not related to the students' spatial abilities (Caldera et al., 1999; Grimshaw, Sitarenios & Finegan, 1995; Newcombe, 1993), while other research results (Brosnan, 1998; Cockburn, 1995; Connor & Serbin, 1977; Jirout & Newcombe, 2015; Levine, Ratliff, Huttenlocher & Cannon, 2012; Newman, Hansen & Gutierrez, 2016) have generally shown that these games are effective in the development of spatial abilities. The results of the researches examining the effects of geometrical-mechanical intelligence games played in virtual environment on the development of spatial ability (Alexiou & Schippers, 2018; Corradini, 2011; David, 2012; De Lisi & Wolford, 2002; Lin & Chen, 2016; Liu, Huang, Yu & Dou, 2020; Martin-Dorta et al., 2014; Masendorf, 1995; Moreau, 2013, Okagaki & Frensch, 1994; Osberg, 1997; Yang & Chen, 2010; You, Chuang & Chen, 2008) show that such games are effective in the development of spatial ability. When the researches that compare the effects on the development of spatial ability of geometrical-mechanical intelligence games played in the form of concrete materials and virtual environments (Olkun, 2003; Spencer, 2008; Thompson, 2016) are analyzed, it is seen that different results have been reached. In a research conducted by Olkun (2003), the effects of tangram game which was played in computer environment and as a concrete material, on the spatial visualization skills of primary school students in two-dimensional geometry were compared and after the application, although significant increases were determined in the spatial visualization skills of both groups, it was revealed that this increase was a bit more in experimental group where Tangram game was played in computer environment, but this difference was not statistically significant. In Spencer's (2008) research, the effects of concrete material and digital tangram games on the two-dimensional visualization skills of primary school teacher candidates were researched and as a result of the study, it was observed that significant improvements took place in the two-dimensional visualization skills of teacher candidates. In Thompson's (2016) study, the effects of concrete, virtual and multimodal tangram usages on the spatial skills of primary school students were examined. In the research, it was revealed that there was a statistically significant difference between the spatial skill pre and post test scores of virtual tangram group, however, there wasn't a statistically significant difference between the pre and post test scores of concrete and multimodal tangram groups. In addition to this, in the research the post test scores of the groups were compared with each other and it was determined that there wasn't a statistically significant difference between them.

A recent meta-analysis of spatial training interventions by Uttal et al. (2013) clearly indicate that spatial skills are malleable. According to this even a small amount of training can improve spatial reasoning in both males and females, and children and adults. Uttal et al. (2013) clearly demonstrated gains in spatial thinking ability through the use of various interventions ranging from the formal training through the study of technical graphic, to informal experiences that used virtual reality and/or video games. The results of the meta-analysis research conducted by Yang, Liu, Chen, Xu and Lin (2019) suggest that diverse training strategies or programs including hands-on exploration, visual prompts, and gestural spatial training significantly foster young children's spatial skills. According to Hawes, Tepylo & Moss (2015) construction play affords opportunities to develop spatial reasoning through physical and visual experiences involving the composition and decomposition of 3D structures, perspective taking, symmetry, and transformations. Ha and Fang (2018) determined that the use of a technological tool called interactive virtual and physical manipulatives improves the spatial abilities of middle school students.

In the literature, it was revealed that the geometrical-mechanical intelligence games, which are played in the form of concrete materials or in virtual environments, usually have a positive effect on the development of spatial ability. The results of the studies comparing the effectiveness of geometrical-mechanical intelligence games played with concrete materials and virtual environments are very limited and the results of these studies are differ. In these studies, it was observed that the Tangram game was applied to primary school students and preservice teachers. In this research, the effects of Katamino, Q.bitz Extreme, Architecto and Soma Cube games, which are geometrical-mechanical intelligence games, are examined on the spatial skills of secondary school students by using in both physical form. According to Piaget, in the development the spatial abilities that require abstract thinking skills secondary school period is very important, due to the fact that this is the period that students' abstract thinking skill start to be formed (Senemoglu, 2012). On the other hand, the Intelligence Games Course has been taught in secondary schools as an elective course in our country within the body of the MoNE since the 2012-2013 academic year. The Intelligence Games Course Curriculum is designed as a flexible framework program that needs to be structured by teachers rather than a standard program. Research conducted on the Intelligence Games Course (Adalar & Yüksel, 2017; Aslan, 2019; Sargın & Taşdemir, 2020) revealed that teachers had difficulties in practicing intelligence games. Therefore, the training was designed to guide teachers for the geometric-mechanical intelligence games unit of the program. According to the MoNE (2013), pre-built game tools and digital environments can be used in most of the games. On the other hand, Gecu-Parmaksiz and Delialioglu (2019) state that both physical and virtual manipulatives are the supportive teaching tools used in teaching. Therefore, the activities are designed in two different physical forms with concrete materials and in the computer environment. In the teaching design, activity plans and worksheets of the geometric-mechanical intelligence games Katamino, Q.bitz Extreme, Architecto and Soma Cube were developed. Three applications were performed including experiment-I and experiment-II in order to compare the effectiveness of the activities carried out with concrete materials and in the computer environment, and the control-I where the activities performed depending on the initiative of the teacher in line with the MoNE (2013) in order to determine the effects of the activities carried out with concrete materials and in the computer environment. For these reasons, in this research, it was aimed to compare the spatial abilities of seventh graders in which environment they are more effective and useful. For this purpose, the answers for the following questions are sought.

- Is there a statistically significant difference between the mean of the pre and post test scores of experimental and control group students' spatial visualization test?
- Is there a statistically significant difference between the mean scores of experimental and control group students' spatial visualization test differences?

- Is there a statistically significant difference between the mean of the pre and post test scores of experimental and control group students' spatial relation test?
- Is there a statistically significant difference between the mean scores of experimental and control group students' spatial relations test differences?
- Is there a statistically significant difference between the mean of the pre and post test scores of experimental and control group students' spatial orientation test?
- Is there a statistically significant difference between the mean scores of experimental and control group students' spatial orientation test differences?

METHODS

Research Model

In a study, experimental patterns are used to measure variables and to reveal cause-effect relationships between these variables (Çepni, 2014). It is possible to find different classifications of experimental patterns in the literature. A classification widely accepted in the literature and applications is as follows; real experimental designs, quasi-experimental designs and weak experimental designs (Büyüköztürk, 2014). Since the classes were previously established by the school administration, researchers did not have the opportunity to create classes through random assignment. For this reason, unpaired pre-test and post-test control group pattern, among the quasi-experimental designs, was preferred in the research. In these designs, one or multiple experimental and control groups are selected. Random distribution is not used in the formation of groups and no effort is spent for random assignment (Çepni, 2014). In accordance with the purpose of the study, two experimentals, and two control groups were randomly selected from the available classes.

Study Group

The study group of this research included a total of 117 seventh grade students who took and did not take elective intelligence games courses in a secondary school located in Turkey during the academic year of 2016-2017. 61 of the students were male and 56 were female. Students' ages ranged from 12 to 13 years old. The study group was selected by considering the developmental characteristics of the students. Since the fifth and sixth grade students are at the beginning of the transition from abstract thinking to concrete thinking, the seventh grade students, who were in the process of abstract thinking, were selected as the study group, in order to develop their spatial skills, which required abstract thinking skills. As a result of the research, three classes, who took the intelligence games course from the same teacher to minimize the situations that may arise from the teacher differences, were chosen as the study groups. Of these three classes, experimental and control groups were chosen randomly as experimental-I, experimental-II and control-I groups. A randomly selected class among the classes that do not choose this course was also selected as control-II group. In the study, experimental-I group played intelligence games activities with concrete materials, experimental-II played intelligence games on PC, control-I group played intelligence games that were recommended by the MoNE (2013) and control-II group did not play any of the intelligence games.

The purpose of using experimental-I and experimental-II groups in this study was to compare the effectiveness of the activities that are performed using the concrete materials and in the computer environment designed by the researchers. The reason for choosing the control-I group is to determine the effects of the activities carried out by using the concrete materials and in the computer environment, by the experimental-I and experimental-II groups. The reason for the selection of the control-II group is to control the situation, in which the progresses that may occur due to any reason such as maturation of the students during the nine-week experimental practice and may affect the results of the research.

Data Collection Tools and their Development

Spatial visualization is defined as the tasks that include complex and multi-step manipulations of information that are presented as spatial (Linn & Petersen, 1985). When the items in standard tests that measure this skill are examined, it is observed that it includes mental activities such as mental folding, mental integration and transforming from two-dimension to three-dimension (Pellegrino et al., 1984). Spatial relations are the ability to conduct the conversion or rotation processes of an object in the mind quickly and correctly. In standard tests which are used to measure this skill, it is required from students to decide which of the object is the rotated version of the two or three-dimensional object that were given to students on paper. These tests consist of questions such as two-dimensional mental rotation, three-dimensional mental rotation and cube comparison (Pellegrino et al., 1984). Spatial orientation is the ability to visualize the image of an object from a different perspective in the mind (Contero, Naya, Company, Saorin & Conesa, 2005). When the tests that are used to measure this skill are examined, it was observed that they require the visualization of how an object is seen from a different perspective and to decide from this aforethought perspective (Pittalis & Christou, 2010).

In the literature there are tests that were developed by different researchers for the purpose of applying on different samples in order to measure spatial visualization, relations and orientation. Among the tests in the literature, there weren't any tests that are appropriate for seventh grade students (12-13 years old) and measure many of the two and three-dimensional spatial skills in the same test. For example, two or three-dimensional spatial skills such as folding paper, forming cube, mental degradation, mental integration which were included in spatial visualization test that were developed by the researchers, were measured with different spatial visualization tests and appropriate for different grades. In addition to this, Minessota Paper Form Board Test (Likert & Quasha, 1941), Differential Aptitude Test: Spatial Relations (Bennett, Seashore & Wesman, 1974), Purdue Spatial Visualization Test (PSVT): Visualizations (Guay, 1976), Spatial Visualization Test (Alias, Black & Gray, 2002), French Reference Kit (FRT) Paper Folding and Surface Development Test (Ekstrom, French & Harman, 1976) which are intended to measure the spatial visualization skills in the literature are appropriate for high-school and college students. Middle Grades Mathematics Project Spatial Visualization Test was developed by Winter, Lappan, Philips and Fitzgerald in 1986 for middle-school students. However, as a result of pilot scheme that was conducted on seventh grade students, it was observed that students could not answer the questions. As stated by Robichaux (2000), since most of the shapes in the questions are complex, it was not found suitable to include it in this research. Thurstone's Primary Mental Abilities Test (Thurstone, 1938), Mental Rotation Test (Vandenberg & Kuse, 1978); PSVT: Rotations (Guay, 1976), FRT Card Rotation and Cube Comparison Test (Ekstrom, et al., 1976) which are tests that are intended to measure the spatial skills are appropriate for high-school and college students. Similarly, Object Perspective/Spatial Orientation Test (Kozhenikov & Hegarty, 2001), PSVT: Views (Guay, 1976) which are tests intended to measure the spatial orientation skills of students are appropriate for high-school and college students. For this reason, in spatial visualization, relations and orientation tests which were developed by the researchers, questions that measure two and three-dimensional spatial skills and were appropriate for seventh grade students were included together and comprehensive multiple-choice tests were developed in which different question types are included.

Using the relevant literature spatial visualization test (SVT), spatial relations test (SRT) and spatial orientation test (SOT) were developed by taking into account the relationship between the geometrical-mechanical intelligence games presented in Table 1 and the spatial skills considered to be developed with these games. The selection of geometrical-mechanical intelligence games and the relationship between the selected games and the skills related to the spatial ability are designed by researchers together with the opinions of seven faculty members in the field of mathematics education and two mathematics teachers. The reason for these games to be chosen is that they are in the category of geometrical-mechanical intelligence games and require the use of spatial skills. Table 1 is shown below.

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Table 1. Relationship between geometrical-mechanical intelligence games and the components of spatial ability

Geometrical-Mechanical Intelligence Game	Spatial Ability														
	Spatial Visualization								Spatial Relations				Spatial Orientation		
	2D Spatial Visualization			3D Spatial Visualization					2D Spatial Relations		3D Spatial Relations		2D ↕ 3D		
	Mental İntegration	Mental Separations	Paper Folding	Mental İntegration	Mental separations	Cube Consisting	Cube Counting	Surface Development	Mental Rotation		Mental Rotation	Cube Comparison	Perspective	Construction Plan	
Katamino	X	X	X						X						
Q.Bitz Extreme	X	X						X	X			X			
Architecto				X	X						X		X		
Soma Cube				X	X	X	X				X		X	X	
Number	6	6	4	4	4	2	2	4	12		8	4	8	4	
Total				32						24			12		

In the first stage, SVT consisted of a total of 38 items, SRT consisted of a total of 30 items and SOT consisted of a total of 12 items. The tests were submitted to the opinions of nine faculty members, eight of whom work in the field of mathematics education and one in the field of measurement and evaluation, and two secondary school teachers, for the validity of the content. Master and doctoral dissertation of a lecturer in the field of mathematics education are about spatial skill and has many researchers in this field. In accordance with the feedbacks obtained from the faculty members and teachers, six items were removed from SVT and SRT on the grounds that the number of items in SVT and SRT were high and necessary corrections were made on the remaining items. In addition, the tests were applied to three students in order to determine whether the items in the tests were understandable for students, and necessary corrections were made in places where the items were not understood.

As shown in Table 1, there are 32 questions in the Spatial Visualization Test, 24 in the Spatial Relations Test, and 12 in the Spatial Orientation Test, which were to be applied to the students for validity and reliability studies after getting the opinions of the experts. The questions in the tests were prepared in such a way that there would be at least two questions for each skill, using the SketchUp drawing program and the NCTM ILLUMINATIONS online isometric drawing tool (https://illuminations.nctm.org/activity.aspx?id=4182). KR-20 internal consistency coefficient was calculated as .78 for SVT, .74 for SRT and .71 for SOT.

Spatial Visualization Test (SVT)

After having received the expert opinions, at first the EFA was performed to determine the factor structures of the 32 item test. As a result of the EFA, a two-factor structure "Two-Dimensional Spatial Visualization" consisting of 15 items and "Three-Dimensional Spatial Visualization" consisting of 16 items were obtained by excluding the 6^{th} item from the test. With the exclusion of the 6^{th} item from the analysis, it was observed that the factor loadings of the remaining items varied between .43 and .72 for the first factor and between .44 and .68 for the second factor. Furthermore, it was seen that the explained variance ratios were 20.80 % for the first factor, 15.42 % for the second factor, and total variance was 36.22 % for both factors. In order to determine whether the two-factor structure that was obtained from the result of the EFA was verified as a model, the items (11 and 20) that were proposed to be connected with more than one item, which were theoretically close to each other, were extracted

from the test, and the modifications were made on the items (15 and 16, 24 and 25, 30 and 32) close to each other theoretically. After the 11th and 20th items had been removed from the test and after the modifications had been performed, it was seen that the two-factor structure obtained consisting of the remaining 29 items had sufficient fit index (χ^2/sd:1.26, RMSEA:.029, GFI:.96, AGFI:.95, SRMR:.074, NNFI:.92, CFI:.93). Item analysis was performed for the remaining 29 items; the test, which consisted of items with different difficulty levels, was found to be moderately difficult and highly distinguishing. The KR-20 internal consistency coefficient was calculated to be .78 for the first factor that consist of 14 items, and .78 for the second factor that consist of 15 items. The KR-20 internal consistency coefficient belonging to the entire test was calculated as .78.

Spatial Relations Test (SRT)

After having received the expert opinions, at first the EFA was performed to determine the factor structures of the 24 item test. As a result of the EFA, a two-factor structure involving "Two-Dimensional Spatial Relations" consisting of 11 items and "Three-Dimensional Spatial Relations" consisting of 11 items were obtained by excluding the 8th and 18th items from the test. With the exclusion of the 8th and 18th items from the analysis, it was observed that the factor loadings of the remaining items varied between .36 and .85 for the first factor and between .44 and .73 for the second factor. Furthermore, it was seen that the explained variance ratios were 23.37% for the first factor, 18.54% for the second factor, and total variance was 41.91% for both factors. As a result of the CFA which was made to determine whether the two-factor structure obtained from the result of the EFA was confirmed as a model, since the factor loading of the 11th item was less than .30 and the error variance was greater than .90, the 11th item was extracted from the test and it was seen that the two-factor structure had sufficient fit index (χ^2/sd:1.38, RMSEA: .035, GFI: .97, AGFI: .96, SRMR: .073, NNFI: .91, CFI: .92). Item analysis was performed for the remaining 21 items; the test, which consisted of items with different difficulty levels, was found to be moderately difficult and highly distinguishing. The KR-20 internal consistency coefficient was calculated as .79 for the first factor that consist of 10 items, and as .73 for the second factor that consist of 11 items. The KR-20 internal consistency coefficient belonging to the entire test was calculated as .74.

Spatial Orientation Test (SOT)

After having received the expert opinions, at first the EFA was performed to determine the factor structures of the 12 item test. As a result of the EFA, a one-factor structure was obtained. It was observed that the factor loadings of the items varied between .47 and .81. Furthermore, it was seen that the explained total variance is 43.98 %. In order to determine whether the one-factor structure that was obtained from the result of the EFA is verified as a model, the items (4 and 10) that were proposed to be connected with more than one item, which were theoretically close to each other were extracted from the test, and the modifications were made on the items (2 and 5, 9 and 11) that were close to each other theoretically. After the 4th and 10th items were removed from the test and after the modifications were performed, 10 items had sufficient fit indexes (χ^2/ sd: 2.14, RMSEA: .062, GFI: .98, AGFI: .97, SRMR: .056, NNFI: .90 and CFI: .92). Item analysis was performed for the remaining 10 items; the test, which consists of items with different difficulty levels, was found to be moderately difficult and highly distinguishing. The KR-20 internal consistency coefficient belonging to the test was calculated as .71.

Preparation of Activity Plans

In the first week of the application, there was a PowerPoint presentation prepared for both experimental groups on what the geometrical-mechanical intelligence games are, commonly known geometrical-mechanical intelligence games and the basic rules of these games. In the subsequent weeks of the application, four activity plans were prepared for each game for two weeks. The activity plans were designed by the researchers by taking in the account the rules assigned by the MoNE (2013) and the rules of each game. The tasks in the activity plans were presented at three levels as beginner, intermediate and advanced, from easy to difficult, in accordance with the step-by-step teaching approach. Then, two faculty members and two mathematics teachers were asked to examine

the activity plans for each game. In line with the feedbacks, necessary adjustments were made to the activity plans.

Preparation of Worksheets

Considering the relationship between geometrical-mechanical intelligence games and spatial skills which were aimed to be developed, four in the total, one for each game, worksheets were prepared by the researchers. Two faculty members and two mathematics teachers from the field of mathematics education, were asked to review the draft worksheets. On the feedbacks, necessary corrections were made and the worksheets were finalized. The worksheets were applied to the students individually after each game.

Development of Games in the Computer Environment

Katamino, Q.bitz Extreme, Architecto and Soma Cube games, which are sold in the market were purchased as concrete materials with the support of Dicle University Scientific Research Projects Coordinator's Office. It was investigated whether there are versions of these games that can be played on the computer. It was seen that only the Soma Cube game has the Android app which was developed by Martin Florek in 2016. Using the BlueStacks program, which is a free Android simulator for playing Android games on the computer, it was possible for students to play this game on their computers. Thus, there was no need to develop the Soma Cube game. Katamino, Q.bitz Extreme and Architecto games to be used in this study were developed by the cooperation of the researchers and a computer engineer, in the way that they would be the same games in the market. For the development of games, Blender, Paint.Net, Unity 3D 5.3. 1f1 version, C# and Microsoft Visual Studio programs were used. The following is the brief information on the development process of the games.

- Blender, which is a free three-dimensional modeling and animation program for tissue dressing, was used.
- Paint.Net, which is a free image and photo editing program for user interfaces and design, was used.
- After all the modeling and designs were prepared, they were transferred to version 5.3.1f1 of Unity 3D, which is a free gaming engine, and part and UI (User Interface) designs were made on Unity 3D.
- In Visual Studio environment, games were coded with C #.
- The compilation of the game was made to be played on the computer.

Implementation Process

The application, which was two hours per week, lasted nine weeks in total during the first semester of the 2016-2017 academic year. Before the application, SVT, SRT and SOT were applied as pre-test on the experimental and control groups. In the first week of the practice, PowerPoint presentations on geometrical-mechanical intelligence games were performed to both experimental groups on the smart board. In the following weeks, Katamino, Q.bitz Extreme, Architecto and Soma Cube games and worksheets related to each game were applied for two weeks for each game in both groups. The applications performed in the experimental study process were the same for experimental-I and experimental-II group. The only difference between them was that the tasks assigned to the experimental-I group are presented to the students with concrete materials and the tasks assigned to the experimental-II group were presented on the computer environment. Implementation process is given Table 2.

Table 2. Implementation process

		Experimental-I Group	Experimental-II Group
	Pre-test	SVT, SRT, SOT	SVT, SRT, SOT
NOVEMBER 2016	1.Week	PowerPoint presentation on geometrical-mechanical intelligence games	PowerPoint presentation on geometrical-mechanical intelligence games
	2. Week	Katamino activities with concrete materials + Katamino worksheet	Katamino activities in computer environment + Katamino worksheet
	3. Week		
	4. Week	Q.bitz Extreme activities with concrete materials + Q.bitz Extreme worksheet	Q.bitz Extreme activities in computer environment + Q.bitz Extreme worksheet
	5. Week		
DECEMBER 2016	6. Week	Architecto activities with concrete materials + Architecto worksheet	Architecto activities in computer environment + Architecto worksheet
	7. Week		
	8. Week	Soma Cube activities with concrete materials + Soma Cube worksheet	Soma cube activities in computer environment + Soma Cube worksheet
	9. Week		
	Post-test	SVT, SRT, SOT	SVT, SRT, SOT

In the experimental-I group consisting of 30 students, intelligence game activities took place on Fridays in 4th and 5th class hours in Technology and Design Class. In experimental-II group consisting of 29 students, intelligence game activities took place in computer environment on Friday 6th and 7th class hours, at the Information Technologies Class. The installation of the games except for the Soma Cube game was quite simple, thus no other program was required to be installed on the computer. However, for the Soma Cube game, the BlueStacks program was first installed on the computers. During both applications, students played all games individually. After the application, the same tests were applied to the experimental and control groups as the post-test.

In the intelligence games course, it is appropriate to use a layered curriculum approach since there will be students with different competence levels in the same class (MoNE, 2013). Because the layered curriculum approach, which adopts the student-centered model (Nunley, 2003), considers that pre-learning levels, learning styles, intelligence areas and thinking systems of the students may be different, so it is based on organizing learning experiences in accordance with individual differences. This approach predicts the realization of beginner, intermediate and advanced level activities instead of one-dimensional activities in the intelligence games course (MoNE, 2013). Learners are responsible for fulfilling the activities expected of them at each step. These steps steps follow a path from grasping basic knowledge and skills to high-level thinking skills (Basbay, 2005). The MoNE (2013) describes the levels as follows;

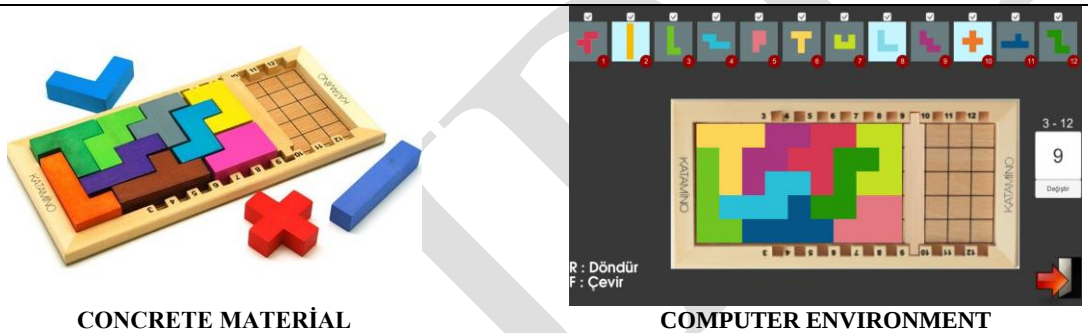
Level 1-Beginner Level: Includes learning the rules of the games, acquiring basic knowledge and skills, playing beginner level games.
Level 2-Intermediate Level: Includes logical deductions, starting from the right place in puzzles, playing intermediate level games.
Level 3-Advanced Level: Includes gaining high-level knowledge and skills and playing advanced level games.

As MoNE (2013) stated, the tasks in the games were presented to the students in the direction of activity plans at beginner, intermediate and advanced levels. Information about games and application process is given below.

In Katamino game, each student was given 12 pentominoes in different colors, 1 playground, 1 separatrix and 1 game booklet. Pentamino is the shape which is created by adjoining five squares

which has at least one common edge and penta is the group that consists of pentaminoes which completes a rectangle area that is formed in the location of separatrix. Each pentaminoes occupy a place of five-unit squares in the playground. The purpose in the game is to complete the penta by using pentaminoes. For example, for penta 3, the separatrix is placed between 3 and 4. In the rectangular area which is limited with the separatrix, three pieces of pentamino are placed appropriately.

Katamino game was applied on experimental-I and experimental-II group in three levels. In the beginner level, at first, it was required from students to create free shapes by using pentaminoes in order for them to get used to pentamino pieces and then they were required to create the figures of elephant, kangaroo and camel. In intermediate level, it was required from students to create penta 3 and 4 by using the pentaminoes that were chosen by them and stated in the booklet and in advanced level it was required from students to create penta 5, 6, 7, 8 and 9 by using the pentaminoes that were chosen by them and stated in the booklet. As the number of required penta increases, the number of pentamino that would be used increase as well. Therefore, the difficulty of the task increases equally. Students are expected to create up to penta 9, in accordance with their levels. Figure 1 gives two different physical forms of Katamino as concrete materials and computer environment.



CONCRETE MATERİAL **COMPUTER ENVIRONMENT**

Figure 1. Two different physical forms of Katamino

In Q.bitz Extreme game, each student was given a table, 16 pieces of cube and game cards. 14 of the cubes are the same and the other 2 cubes are same with one another. In each surface of the cubes there are different shapes. The purpose of the game is to make the same designs on the game cards by using the 16 cubes.

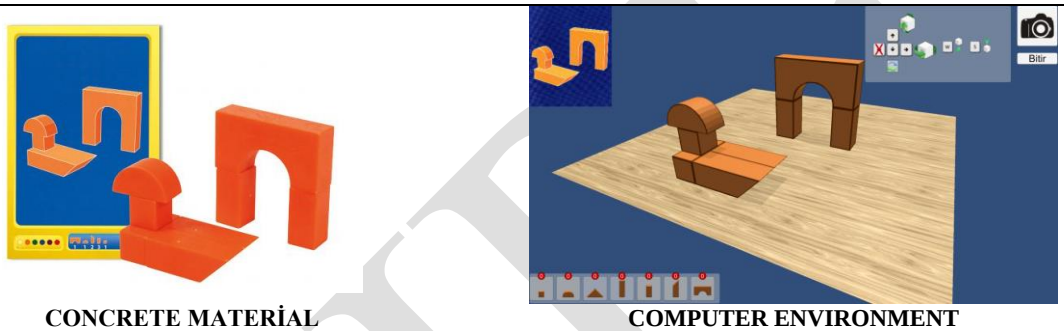
Q.bitz Extreme were applied on experimental-I and experimental-II groups in three levels. In the beginner level, students were required to create significant designs of their own in order to recognize the surface of the cubes and in intermediate level, they were required to make the designs on 15 game cards. In advanced level, students are required to create the design on the randomly chosen game card as much as they remember after examining them in the given period. Figure 2 gives two different physical forms of Q.bitz Extreme as concrete materials and computer environment.

CONCRETE MATERİAL **COMPUTER ENVIRONMENT**

Figure 2. Two different physical forms of Q.Bitz Extreme

In Architecto game, each student was given 18 building block and 1 booklet. Building blocks are three-dimensional geometrical shapes which are proportional with each other such as cube, cylinder, rectangular prism and bridge. The purpose in the game is to create three-dimensional models with given building blocks for each model in the booklet. The type and number of blocks which would be used in the structuring of each model are shown in a window under each page. There are six difficulty levels, starting from yellow (easy) to red (difficult).

Architecto was applied on experimental-I and experimental-II groups in three levels. Students were required to make a total of 15 model pictures as five pictures for each difficulty level in order for it to be appropriate for the level of the students. In the beginner level, students were required to make free models in order to recognize building blocks and then make the five models in the yellow difficulty level. In intermediate level, students were required to make five models in orange difficulty level and in advanced level they were required to make five models in green difficulty level. Figure 3 gives two different physical forms of Architecto as concrete materials and computer environment.



CONCRETE MATERİAL COMPUTER ENVIRONMENT

Figure 3. Two different physical forms of Architecto

In Soma Cube game, each student was given a Soma Cube and shape cards. Soma cube was made of 27 small cubes which are equal to each other and consists of one piece that consists of three small cubes and six pieces that consist of four small cubes. The purpose in the game is to create a cube of 3x3x3 by using seven pieces. This cube is called as Soma Cube. Soma cube can be created with many different ways depending upon the array of seven pieces. Furthermore, apart from the cube, with the pieces of Soma Cube many models such as bridge, pyramid, snake etc. can be made.

Soma Cube was applied on experimental-I and experimental-II groups in three levels. In beginner level, students were required to make the shape of a cube by being guided step by step. In intermediate level, students were required to make the models that consist of the combination of few soma cube pieces (2, 3, 4, 5 and 6 pieces) and in advanced level they were required to make the advanced models by using all of the seven pieces. Figure 4 gives two different physical forms of Soma Cube as concrete materials and computer environment.

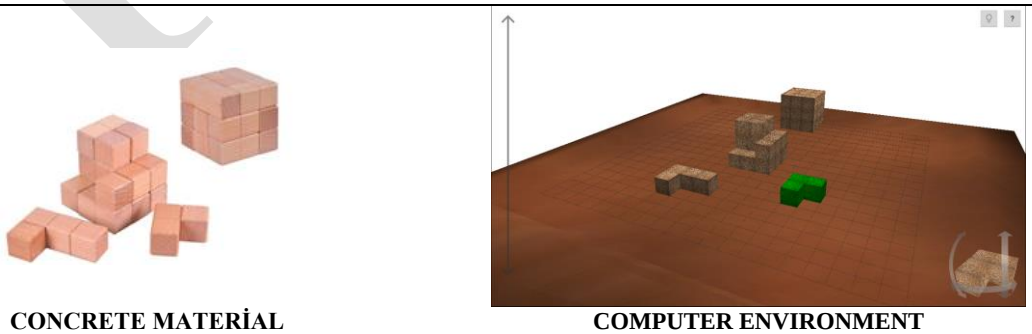


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Figure 4. Two different physical forms of Soma Cube

The curriculum of the intelligence games courses was designed as a flexible framework program that needs to be structured by the teacher according to the interests and developmental characteristics of the students rather than a standard program. The teacher should design and plan his/her time and activities to be devoted to different units according to student interests, educational environment and materials. In addition to this, for the geometrical-mechanical games unit, MoNE suggested games such as tangram, polyomino, cube counting, making shapes, maze games, node games, Rubik's cube, mikado, jenga and puzzles (MoNE,2013). During the application, the courses of the control-I group was not interfered in any way and the application process of the geometrical-mechanical intelligence games activities suggested by MoNE (2013) was left to the teacher's initiative. Control-II group consists of students who didn't choose the elective course of intelligence games and no activity was performed in the group about intelligence games.

Data Analysis

In the development of spatial ability tests which were used as data collection tools in the study, first the students' responses to the tests were artificially double-categorized into a combinatorial mode as "1" for the correctly answered items, and "0" for the wrongly answered and left blank items. Later, the normal distribution of the scores obtained from the tests was tested by using the "SPSS 21" package program and the normality of the scores obtained from the tests was examined by taking into consideration the histogram, normal Q-Q, box-line charts, the kurtosis and skewness values (Cokluk, Sekercioglu & Büyüköztürk, 2012). Since the responses of the students to the items were artificially transformed into two categories in the form of 1-0, EFA was performed over the tetrachoric correlation matrix to determine the factor structures of the tests (Baykul & Güzeller, 2014). For this, "FACTOR 10.3.01" and "SPSS 21" package program were used. In order to determine whether the factor structures obtained as a result of EFA were validated as a model, CFA was applied. For this, "LISREL 8.54" program was used. In this study, the Asymptotic Covariance Matrix and the Weighted Least Squares Method were used in the CFA because the answers were converted into two categories as 1-0 (Kline, 2011). After EFA and CFA, item analysis was carried out using the "ITEMAN 3" program through the data that were processed as A, B, C, D, in order to present the findings related to difficulty level of items and distinctiveness. The KR-20 (alpha), internal consistency reliability coefficient, was calculated by "ITEMAN 3" program in order to determine the reliability of the test.

The "SPSS 21" package program was used in the analysis of the data which were obtained from the research. The value of 0.05 was taken as the level of significance. One of the analyses that can be used in the comparison of pre-test and post-test score means of experimental and control groups in themselves is paired samples *t*-test. One of the analyses that could be used to test the effect of experimental procedures was one-way analysis of variance (ANOVA) on the difference between the students' pre-test and post-test (gain-access) scores (Büyüköztürk, 2014; Tabannick & Fidell, 2013). In order to use paired samples *t*-test, it is required for the data set which consist of the differences between the pre-test and post-test scores of students, to show normal distribution. In order to use ANOVA over the difference scores, it is required to show the normal distribution feature of the data set which is formed by the differences between the pre-test and post-test scores and the variance of the groups had to be equal. Since the number of students in the group was less than 50, the Shapiro-Wilk test was used to test whether the difference scores obtained showed normal distribution characteristics. In addition, the histogram, normal Q-Q, box-line charts and the kurtosis and skewness values were examined and whether the scores exhibited normal distribution was determined. The Levene's test was used to examine whether the variances of the groups were equal (Büyüköztürk, 2011). For students in the experimental and control groups, the difference scores for each dimension of each data collection tool showed normal distribution characteristics and it was found that the variances of the groups were equal. For this reason, paired sample *t*-test and ANOVA was used in data analysis.

RESULTS

The mean SVT pre-test and post-test scores of the students in experimental and control groups were compared with *t*-test and findings obtained were presented in Table 3.

Table 3. *T*-test result of the mean SVT pre-test and post-test scores of the students in experimental and control groups

	SVT		N	Mean	Std Deviation	df	*t*	Sig.
Experimental-I	2D	Pre-test	30	6.97	2.16	29	4.15	.000
		Post-test	30	9.37	3.38			
	3D	Pre-test	30	7.77	2.61	29	4.42	.000
		Post-test	30	10.33	3.06			
Experimental-II	2D	Pre-test	29	6.38	2.80	28	7.06	.000
		Post-test	29	10.41	1.59			
	3D	Pre-test	29	8.03	3.35	28	4.47	.000
		Post-test	29	10.83	2.25			
Control-I	2D	Pre-test	30	7.67	2.97	29	2.02	.053
		Post-test	30	8.57	3.73			
	3D	Pre-test	30	8.77	4.02	29	2.50	.018
		Post-test	30	9.80	3.48			
Control-II	2D	Pre-test	28	6.21	2.60	27	.46	.649
		Post-test	28	6.46	2.85			
	3D	Pre-test	28	7.86	2.21	27	1.24	.226
		Post-test	28	7.29	2.75			

When Table 3 is examined, it was observed that there was a statistically significant difference between the pre-test and post-test score means of spatial visualization dimension of two-dimensional [$t_{(29)}$=4.15, p<.05] and three-dimensional [$t_{(29)}$=4.42, p<.05] of experimental-I group students' SVT and two-dimensional [$t_{(28)}$=7.06, p<.05] and three-dimensional [$t_{(28)}$=4.47, p<.05] of experimental-II group students' SVT. According to this, it can be stated that the intelligence games activities which were performed both with concrete materials and in computer environment, significantly improve the two and three-dimensional spatial visualization skills of students.

In Table 3, it was observed that there wasn't a statistically significant difference between the pre-test and post-test score means of control-I group students' SVT in terms of two-dimensional [$t_{(29)}$=2.02, p>.05] spatial visualization dimension, however, there was a significant difference in terms of three-dimensional [$t_{(29)}$=2.50, p<.05] spatial visualization dimension. According to this, it can be stated that intelligence games activities that are suggested by MoNE, significantly improves the three-dimensional spatial visualization skills of students. In addition to this, there wasn't a statistically significant difference between the pre-test and post-test score means of control-II group students' SVT in terms of two-dimensional [$t_{(27)}$=.46, p>.05] and three-dimensional [$t_{(27)}$=1.24, p>.05] spatial visualization dimension. According to this, it can be stated that there wasn't a significant difference depending upon a different reason in the two and three-dimensional spatial visualization skills of the students of which any activity about the intelligence games are applied throughout the application.

The mean difference scores of the students in the experimental and control groups regarding the SVT were compared using ANOVA, and the findings are presented in Table 4.

As shown in Table 4, it was revealed that there was a statistically significant difference between the means of the difference scores of the students in the experimental and control groups regarding the two-dimensional [$F_{(3,113)}$=9.726, p<.05] and three-dimensional [$F_{(3,113)}$=8.567, p<.05] spatial visualization dimension of SVT. For the two-dimensional spatial visualization, it was determined that the differences were between experimental-I with control-I, experimental-I with control-II, experimental-II with experimental-I, experimental-II with control-I, and experimental-II with control-II. According to these findings, the development of two-dimensional spatial visualization skills of the

experimental-I group students was significantly higher than that of the control-I and control-II group students, the development of two-dimensional visualization skills of the experimental-II group students was higher than that of the experimental-I, control-I and control-II group students. For the three-dimensional spatial visualization, it was determined that the differences were between experimental-I with control-I, experimental-I with control-II, experimental-II with control-I, and experimental-II with control-II. According to these findings, the development of three-dimensional spatial visualization skills of the experimental-I group students was significantly higher than that of the control-I and control-II group students, the development of three-dimensional visualization skills of the experimental-II group students was higher than that of the control-I and control-II group students.

Table 4. ANOVA results on the mean of difference scores of the students in the experimental and control groups regarding the SVT

	Groups	N	Mean	Std Deviation		Sum of Squares	df	Mean Square	*F*	Sig.
2D	Experimental-I	30	2.40	3.17	Between Groups	245.850	3	81.950	9.726	.000
	Experimental -II	29	4.03	3.08	Within Groups	952.116	113	8.426		
	Control-I	30	.90	2.44	Total	1197.966	116			
	Control-II	28	.25	2.88						
Significant Differences: Experimental-I and Control-I, Experimental-I and Control-II, Experimental-II and Experimental-I, Experimental-II and Control-I, Experimental-II and Control-II										
3D	Experimental-I	30	2.57	3.18	Between Groups	209.247	3	69.749	8.567	.000
	Experimental -II	29	2.79	3.36	Within Groups	919.949	113	8.141		
	Control-I	30	1.03	2.67	Total	1129.197	116			
	Control-II	28	-.57	2.44						
Significant Differences: Experimental-I and Control-I, Experimental-I and Control-II, Experimental-II and Control-I, Experimental-II and Control-II										

The mean SRT pre-test and post-test scores of the students in experimental and control groups were compared with *t*-test and findings obtained were presented in Table 5.

Table 5. *T*-test result of the mean SRT pre-test and post-test scores of the students in experimental and control groups

	SRT		N	Mean	Std Deviation	df	*t*	Sig.
Experimental-I	2D	Pre-test	30	4.20	3.19	29	4.87	.000
		Post-test	30	6.73	3.51			
	3D	Pre-test	30	4.33	2.93	29	4.09	.000
		Post-test	30	6.40	3.04			
Experimental-II	2D	Pre-test	29	4.59	3.22	28	4.08	.000
		Post-test	29	7.03	2.21			
	3D	Pre-test	29	4.24	2.53	28	6.41	.000
		Post-test	29	6.76	2.67			
Control-I	2D	Pre-test	30	5.03	2.95	29	2.08	.047
		Post-test	30	5.90	3.24			
	3D	Pre-test	30	5.33	3.00	29	2.30	.029
		Post-test	30	6.17	3.18			
Control-II	2D	Pre-test	28	3.21	2.44	27	.44	.665
		Post-test	28	2.96	2.65			
	3D	Pre-test	28	3.14	2.40	27	.54	.592
		Post-test	28	3.32	1.93			

In Table 5, it was observed that there was a statistically significant difference between the pre-test and post-test score means of spatial relations dimension of two-dimensional [$t_{(29)}$=4.87, p<.05] and three-dimensional [$t_{(29)}$=4.09, p<.05] of experimental-I group students' SRT and two-dimensional [$t_{(28)}$=4.08, p<.05] and three-dimensional [$t_{(28)}$=6.41, p<.05] of experimental-II group students' SRT. According to this, it can be stated that the intelligence games activities which were performed both with concrete materials and in computer environment, significantly improve the two and three-dimensional spatial relations skills of students.

When Table 5 is examined, it was observed that there was a statistically significant difference between the pre-test and post-test score means of control-I group students' SRT in terms of two-dimensional [$t_{(29)}$=2.08, p<.05] and three-dimensional [$t_{(29)}$=2.30, p<.05] spatial relations dimension. According to this, it can be stated that intelligence games activities that are suggested by MoNE, significantly improves the two and three-dimensional spatial relations skills of students. In addition to this, there wasn't a statistically significant difference between the pre-test and post-test score means of control-II group students' SRT in terms of two-dimensional [$t_{(27)}$=.44, p>.05] and three-dimensional [$t_{(27)}$=.54, p>.05] spatial relations dimension. According to this, it can be stated that there wasn't a significant difference depending upon a different reason in the two and three-dimensional spatial relations skills of the students of which any activity about the intelligence games are applied throughout the application.

The mean difference scores of the students in the experimental and control groups regarding the SRT were compared using ANOVA, and the findings are presented in Table 6.

Table 6. ANOVA results on the mean of difference scores of the students in the experimental and control groups regarding the SRT

	Groups	N	Mean	Std Deviation		Sum of Squares	df	Mean Square	*F*	Sig.
2D	Experimental-I	30	2.53	2.85	Between Groups	155.123	3	51.708	6.301	.001
	Experimental -II	29	2.45	3.24	Within Groups	927.356	113	8.207		
	Control-I	30	.87	2.29	Total	1082.479	116			
	Control-II	28	-.25	3.03						
Significant Differences: Experimental-I and Control-I, Experimental-I and Control-II, Experimental-II and Control-I, Experimental-II and Control-II										
3D	Experimental-I	30	2.07	2.77	Between Groups	100.926	3	33.642	6.996	.000
	Experimental -II	29	2.52	2.11	Within Groups	543.382	113	4.809		
	Control-I	30	.83	1.98	Total	644.308	116			
	Control-II	28	.18	1.74						
Significant Differences: Experimental-I and Control-I, Experimental-I and Control-II, Experimental-II and Control-I, Experimental-II and Control-II										

As shown in Table 6, it was revealed that there was a statistically significant difference between the means of the difference scores of the students in the experimental and control groups regarding the two-dimensional [$F_{(3,113)}$=6.301, p<.05] and three-dimensional [$F_{(3,113)}$=6.996, p<.05] spatial relations dimension of SRT. For the two-dimensional spatial relation, it was determined that the differences were between experimental-I with control-I, experimental-I with control-II, experimental-II with control-I, and experimental-II with control-II. According to these findings, the development of two-dimensional spatial relations skills of the experimental-I group students was significantly higher than that of the control-I and control-II group students, the development of two-dimensional relations skills of the experimental-II group students was higher than that of the control-I and control-II group

students. For the three-dimensional spatial relation, it was determined that the differences were between experimental-I with control-I, experimental-I with control-II, experimental-II with control-I, and experimental-II with control-II. According to these findings, the development of three-dimensional spatial relations skills of the experimental-I group students was significantly higher than that of the control-I and control-II group students, the development of three-dimensional relations skills of the experimental-II group students was higher than that of the control-I and control-II group students.

The mean SOT pre-test and post-test scores of the students in experimental and control groups were compared with *t*-test and obtained findings were presented in Table 7.

As shown in Table 7, it was observed that there was a statistically significant difference between the pre-test and post-test score means of experimental-I [$t_{(29)}$=-3.70, p<.05] and experimental-II [$t_{(29)}$=-4.25, p<.05] group students' SOT. According to this, it can be stated that the intelligence games activities which were performed both with concrete materials and in computer environment, significantly improve the spatial orientation skills of students.

Table 7. *T*-test result of the mean SOT pre-test and post-test scores of the students in experimental and control groups

	SOT	N	Mean	Std Deviation	df	*t*	p
Experimental-I	Pre-test	30	4.83	2.15	29	3.70	.001
	Post-test	30	6.90	2.32			
Experimental -II	Pre-test	29	5.72	2.48	28	4.25	.000
	Post-test	29	7.86	1.48			
Control-I	Pre-test	30	6.30	2.67	29	1.66	.108
	Post-test	30	7.27	2.36			
Control-II	Pre-test	28	5.82	1.96	27	.823	.418
	Post-test	28	6.25	2.30			

In Table 7, it was observed that there wasn't a statistically significant difference between the pre-test and post-test score means of control-I group students' SOT [$t_{(29)}$=1.66, p>.05]. According to this, it can be stated that there wasn't a significant increase in the spatial orientation skills of the students after the intelligence games activities that are suggested by MoNE were applied. In addition to this, there wasn't a statistically significant difference between the pre-test and post-test score means of control-II group students' SOT [$t_{(27)}$=.823, p>.05]. According to this, it can be stated that there wasn't a significant increase, depending upon a different reason in the spatial orientation skills of the students of which any activity about the intelligence games are applied throughout the application.

The mean difference scores of the students in the experimental and control groups regarding the SOT were compared using ANOVA, and the findings are presented in Table 8.

Table 8. ANOVA Results on the Mean of Difference Scores of the Students in the Experimental and Control Groups Regarding the SOT

	Groups	N	Mean	Std Deviation		Sum of Squares	df	Mean Square	*F*	Sig.
SOT	Experimental-I	30	2.07	3.06	Between Groups	61.169	3	20.390	2.358	.075
	Experimental-II	29	2.14	2.71	Within Groups	977.139	113	8.647		
	Control-I	30	.97	3.19	Total	1038.308	116			
	Control-II	28	.43	2.75						

When Table 8 was examined, a statistically significant difference between the means of the SOT difference scores of the students in the experimental and control groups [$F_{(3,113)}$=2.358, p>.05] was not observed. This finding can be interpreted as there is no significant difference between the development of spatial orientation skills of students in experimental and control groups.

DISCUSSION and CONCLUSIONS

In the research, it was revealed that intelligence games activities that were performed with concrete materials and in computer environment significantly improve the two-dimensional spatial visualization skills of the students. Demirkaya and Masal (2017) also concluded that activities based on geometric-mechanical games are effective in improving the two-dimensional spatial visualization skills of secondary school students. Also, in this research the development of two-dimensional spatial visualization skills of the groups, where intelligence games activities were conducted both in computer environment and by using the concrete materials, was significantly higher than the groups, of which performed the intelligence games activities suggested by the MoNE and the group in which no activity related to the intelligence games were performed. Moreover, the development of two-dimensional spatial visualization skills of the group in which intelligence games activities were performed in the computer environment was significantly higher than that of the group where intelligence games activities were performed with concrete materials. The reason for this finding might be that students had to think in a relatively abstract way compared to the activities performed with concrete materials, since there was no use of concrete objects in computer-based activities and because students who were forced to think in a more abstract way in computer-based activities may be considered to develop two-dimensional spatial visualization skills that require abstract thinking skills. According to Clements (1999), the reason for this finding might be that computer-based applications can provide a more suitable environment to improve some aspects of two-dimensional geometry because the computer screen is inherently two-dimensional. However, Osberg (1997) stated that "intensive education in virtual environment may create deeper spatial understanding in students because of the opportunity to encourage them to think about spatial problems, manipulate objects directly, and navigate around in virtual environments." Mayer (2018) also stated that the promising cognitive outcome of playing spatial games on the computer is the development of two-dimensional spatial skills. Alexiou and Schippers (2018) stated that dijital game facilitate the development of cognitive skills such as spatial skills, enhanced mental rotation abilities. At this point, it is also observed that Olkun (2003) found similar results as well. Olkun (2003) found in his study that the Tangram game as a concrete material played by the fourth and fifth grade students caused a significant increase in the two-dimensional spatial visualization skills of these students, while this increase was higher with the same game on the computer environment. The findings obtained from this study are supported by the research conducted by Olkun (2003). According to this, it can be said that the intelligence games played in the computer environment improved the two-dimensional spatial visualization skills of the students more than the games that are played with concrete materials.

In the research, it was revealed that intelligence games activities that were performed with concrete materials, in computer environment and were suggested by MoNE, significantly improve the three-dimensional spatial visualization skills of the students. Ha and Fang (2018) determined that the use of a technological tool called interactive virtual and physical manipulatives improves the three-dimensional spatial visualization skills of middle school students. Moreover, in this research the development of three-dimensional spatial visualization skills of the groups where intelligence games activities were performed in both concrete materials and computer environments was significantly higher than that of the group where intelligence games activities proposed by MoNE were performed and the group in which no activity related to intelligence games were performed. After the applications, it was found that the development in three-dimensional spatial visualization skills of the group in which the activities of intelligence games were performed in computer environment was higher than that of the group in which intelligence game activities were performed with concrete

materials. However, it was found that the difference between them was not statistically significant, and similar findings were obtained by Drickey's (2000), and Yildiz and Tüzün's (2011) studies. Drickey (2000) investigated the effects of virtual and concrete manipulatives on visualization and spatial reasoning skills of students on the sixth-grade students in primary school in a study. As the result of this research, it was determined that the virtual manipulatives increased students' visualization and spatial reasoning skills compared to the concrete manipulatives, although the difference between them was not statistically significant. In their study which was carried out on fifth grade students, Yildiz and Tüzün (2011), compared the effects of the three-dimensional virtual unit cube simulation in computer environment and concrete unit cubes on three-dimensional spatial visualization skills of the students, and found that the use of three-dimensional virtual unit cubic simulation further improves the spatial visualization skills of the students compared to the use of concrete unit cubes, but the difference between them was not statistically significant. According to Durmus and Karakirik (2006) the reason for these findings is the fact that the virtual manipulatives are the actual models of concrete manipulatives, so that virtual manipulatives provide as much engagement as concrete manipulatives do. Because both physical and virtual manipulatives are one of the supportive instructional tools used in teaching (Gecu-Parmaksiz & Delialioglu, 2019). The findings of this study and the findings obtained from the previous studies are similar. Based on these findings, it can be said that activities in virtual environments can be used interchangeably with concrete materials in the development three-dimensional spatial visualization skills.

In the research, it was revealed that intelligence games activities that were performed with concrete materials, in computer environment and were suggested by MoNE, significantly improve the two-dimensional spatial relations skills of the students. Liu et al. (2000) investigated the effects of video game on two dimensional spatial relations skills of students in a study. As the result of this research, it was determined that video game training led to significant improvements in two dimensional spatial relations skills. Furthermore, in this research, the development of two-dimensional spatial relations skills in the group where intelligence games activities were performed both using the concrete materials and in the computer environment was significantly higher than the group where intelligence games activities proposed by MoNE were performed and the group in which there was no activity related to intelligence games. Although the development of two-dimensional spatial relations skills in the group where intelligence games activities were performed with concrete materials was higher than the group where intelligence games activities were performed in the computer, but the difference between them was not statistically significant. Verhaegh, Resing, Jacobs and Fontijn (2009) linked the fact that the intelligence games activities with concrete materials have a greater impact on the development of two-dimensional spatial relations skills than computer-based activities to concrete materials since they don't degrade the dimensionality to a flat screen, and provide a more visual-spatial freedom than the computer by adding different tactile experiences. In the research carried out by Yurt and Sünbül (2012) with sixth grade students, different results were obtained. According to the research, the two-dimensional spatial relations skills of the students in the group which use computer manipulatives were significantly higher than those in the group which use concrete manipulatives. There are situations where the findings of the study contradict with the findings obtained from the previous studies. Therefore, it seems difficult to reach a certain conclusion about what kind of activities develop the skills in two-dimensional spatial relations.

In the research, it was revealed that intelligence games activities that were performed with concrete materials, in computer environment and were suggested by MoNE, significantly improve the three-dimensional spatial relations skills of the students. VanMeerten et al. (2019) investigated the effects of a mobile puzzle game on three dimensional spatial relations skills of students in a study. As the result of this research, it was determined that a mobile puzzle game training led to significant improvements in three dimensional spatial relations skills. Moreover, in this research the development of the three-dimensional spatial relations skills in the group which use concrete materials and computer games on intelligence games was significantly higher than the group in which the activities

of the intelligence games recommended by MoNE were carried out and the group in which any of the activities related to intelligence games were performed. Although the development of the three-dimensional spatial relations skills of the group in which intelligence games activities were performed in computer environment was higher than that of the group in which the activities were performed with concrete materials, the difference between them was not statistically significant. Yildiz and Tüzün (2011) found that the use of concrete unit cubes, the use of three-dimensional virtual unit cubic simulation, improved students' three-dimensional spatial relations skills, although the difference between them was not statistically significant. From these findings, it can be stated that the concrete material and the activities performed in the virtual environment can be used instead of each other in order to develop three-dimensional spatial relations skills.

In the research, it was revealed that intelligence games activities that were performed with concrete materials and in computer environment significantly improve the spatial orientation skills of the students. At this point, it is also observed that Lowrie et al. (2019) found similar results as well. The results of the research conducted by Lowrie et al. (2019) add to evidence that a spatial reasoning enrichment program implemented by teachers in their own classrooms can enhance spatial orientation skills. But in the research, it was found that there was no significant difference in the development of spatial orientation skills of the group, in which the activities were performed computer environment, by using concrete materials and were proposed by MoNE and there was no activity related to intelligence games. This can be due to the fact that intelligence games activities, both in concrete materials and in computer environments, do not require the use of direct spatial orientation skills, because activities require the use of spatial visualization skills, such as associating and parsing direct geometric shapes in the mind, as well as spatial relations skills such as rotating the shapes in the mind to suit the purpose.

Based on the findings, it can be recommended that teachers use both concrete materials and computer-based intelligence gaming activities in the development of spatial abilities of secondary school students. In the development of two-dimensional spatial visualization, especially in the computer environment intelligence games activities can be utilized. Geometric-mechanical intelligence games in both physical forms can be used to teach geometry, which has a positive relationship with spatial ability. Geometric-mechanical intelligence games can be included in the geometry course, especially in subjects such as "Geometric Objects, Transformation Geometry, Appearances of Objects from Different Perspectives", so that middle school students can learn both by having fun and by doing and experiencing. Teachers may be specifically recommended to use Q-Bitz Extreme and Katamino games in teaching the subject of "Transformation Geometry", which includes Reflection, Translation, Image, Symmetry, and Architecto and Soma Cube in teaching the subject of “Appearance of Objects from Different Perspectives". In future studies, researches on the development of different cognitive skills can be carried out for other units of the intelligence games courses. Studies can be carried out to monitor whether the intelligence games activities carried out in computer environment or using concrete materials can be transferred to other courses in the school. Studies comparing the effects of two-and three-dimensional intelligence games individually on spatial ability can be conducted.

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A BLOOM'S TAXONOMY-BASED ANALAYSIS OF 9th and 10th GRADES ENGLISH LANGUAGE TEXTBOOKS' FINAL EXAMINATIONS AND REVISION QUESTIONS

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Abstract

This study aimed to identify and analyze the patterns of final exam questions prepared by English teachers for the 9th and 10th grades and to analyze all the revision questions presented in the English language textbooks in Jordan, based on Bloom's taxonomy to determine the nature and types of these questions. The sample of the study consisted of (63) English language teachers (31 male and 32 female teachers), the English language revision questions within the 9th and 10th grade textbooks, and questions included in the 1st semester final exams in 2018 for 9th and 10th grades. To achieve the goals of the study, the researchers developed an analytical card for the revision questions and the exams papers prepared by teachers. Results indicated that the questions of teachers' final exams' papers based on Bloom's taxonomy, remembering level had the highest relative average with a percentage of (30.75 %) and the analysis level had the lowest level with a percentage of (4.07%). Results also indicated convergent percentages among the revision questions, where both the comprehension and the application levels had the highest frequencies with a percentage of (26.56%). Moreover, results indicated no statistical significant differences, at the level of analyzes, between the questions of the final exams and the textbooks revision questions. However,, statistical significant differences were indicated between the frequencies and the percentages of the analyzed questions of the final exams and the textbooks for grade 9 and grade 10 and the highest was the remembering level with percentages of (17.19%) for the remembering within the textbook revision questions and (30.75%) for teachers' final exams. By way of concluding, this study highlights several recommendations, among which the Ministry of Education is advised to benefit from the results of such a study in developing the English language textbook.

Keywords*:* Final examinations, revision questions, English language, textbook, Bloom's taxonomy.

INTRODUCTION

In his seventh discussion paper, His Majesty King Abdullah II of Jordan (2017:1) stated that: "Building our human potential, through outstanding education and improving its output, is our gateway to the future". Moreover, his majesty highlights that: "Achieving comprehensive reform is closely linked to educational renaissance regardless of the circumstances and challenges". Thus, the Ministry of Education (Henceforth: MoE) is constantly keen to create a generation of learners capable of dealing with global continuous changes, and to provide them with knowledge, skills and values in a balanced manner to form their integrated personality to contribute to the sustainable development of society. The reform of education is important and the largest is the basis for optimal investment in human capital, which is the real national wealth, the real and sustainable strategy.

Within the context of English language as the world's major second language it is the commonest language used for international business, trade, travel, communication, among many others. Among the efforts and endeavors of the MoE in Jordan to develop the educational main components, teaching English language was considered from grade 1 through grade 12 as a prevailing foreign language in the schools' curriculum.

At this stage, it is necessary to start with the assessment and evaluation. In order to apply that on learning/teaching process, it is important to analyze and evaluate the educational components, among which, is the textbooks as they are largely used and such analysis offers insights on textbooks suitability; whether they serve the purpose they supposed to serve and accomplish their set goals (Brown, 1997). In parallel to that, exam questions should have particular features and should be formulated in a manner that serves the educational development process, been designed to, and the purposes they should achieve. Actually, school's exams considered as the basis for the measurement of achievement. In parallel, revision questions used to appear at the end of each learning material (unit) of the textbook they are important aspect of self-evaluation. Actually, they provide teachers with patterns of standardized questions to develop their mid and final exams, on one hand, and enable them to evaluate their students at all levels: pre-formative, formative and, summative, on the other hand.

Hence, it is important to report that if language was seen as an aggregate of skills of various kinds (reading, speaking, writing and listening) then assessment is likely to be in terms of classification of the aforementioned skills. Meanwhile, pedagogically speaking, assessment made to determine the extent of student learning or the extent to which instructional goals have been attained. The only way that the extent to which a test actually does this can be determined is by comparing the test results with some other outside measurement, some other way of estimating pupil ability, a way that ought to be at least as reliable and accurate as the test itself.

In this context, Geoffrey, Christopher, Roger, Peter, and Anita (2003) explained ill-prepared examination as a major cause of poor performance in English language, thus the current study aims to investigate to what extent the final examination questions and revision questions within the textbooks of English language are in line with the levels of Blooms Taxonomy, on one hand, and to what extent they are compatible with each other, on the other hand.

Statement of the Problem

Given the importance of evaluation processes in general, and the importance of examinations and the textbook evaluative/revision questions (as assessment tools), in particular, it is logically important to expect its importance and impact on increasing student achievement and develop their positive attitudes. Thus, it is necessary to ensure that the students are tested for the different cognitive levels of learning, bearing in mind that teaching/learning objectives are mainly set for Bloom taxonomy. The Bloom are applied in curriculum planning and to explore to what extent the objectives of the exams questions are aligned with revision questions (included in the textbook). However, and based on the practical experience of the researchers, by direct and indirect observations or experiences, it was noticed that there is a clear weakness in developing the final exams questions; this observation was supported by similar observations of the specialized educational supervisors. These observations focused on the inadequacy of the exams in way to reflect the learning objectives to be achieved. In parallel, it worth examining the relevance and the adequacy of revision questions. This could be supported by several studies. For instance, Geoffrey et al. (2003), reported that improper examination has been explained as a major cause of poor performance in English language. Hence, the role of researchers is to prove by the analysis of school tests to what extent the final exams questions and the analysis of revision questions, as well, are appropriately referred to Bloom's taxonomy.

Questions of the Study

This study attempts to answer the following questions:

1- What are the levels of the final examination questions for the English language of 9th and 10th grades based on Bloom's taxonomy (remembering, understanding, applying, analyzing, synthesis and evaluating)?

2- What are the levels of the revision/evaluative questions included in the 9th and 10th grades textbooks of English language in Jordan, based on Blooms Taxonomy (remembering, understanding, applying, analyzing and evaluating)?

3- What is the compatibility ratio between the levels of final exams questions and the revision/evaluative questions within the 9th and the 10th grades textbook in Jordan?

Significance of the study

The significance of this study is germane to the significance of school final examinations and the significance of the textbook revision/evaluative questions. Diagnostic and evaluative tool(s) help teachers to evaluate students' progress. Moreover, this study is directly relevant to its expected results, in particular when comparing the level of final exams questions with Bloom levels, and with the levels of the textbook revision/evaluative questions for the same grades.

Theoretical Framework

There are ongoing complaints about the inadequacy of the tests in many ways, both in terms of preparation, sometimes ambiguity, the random use of patterns and forms of questions, and their inadequacy and relevance to the desired goals. Meanwhile, several conferences and committees have been held in the local and Arab communities to identify these shortcomings in order to develop scientific plans and programs to develop tests and to sound questions. However, the results of many researches and studies presented in such conferences have shown that these researches and studies tend to develop the administrative and organizational aspects of the tests, which often deal with the laws, regulations and procedures necessary to apply the tests or the necessary conditions (Kahlout, 2000).

By the same token, it is worth noting that the exams, usually conducted within schools are the most common type of achievement test. These exams are developed by teachers to measure to what extent students are able to achieve the planned learning objectives. Final exams usually cover a broad range of formal assessment(s) that are given at various points in learning including exam questions and revision incorporated in the textbooks.

There are many definitions and descriptions for achievement tests in literature. For instance Gronlund (1977) defines it as an organized procedure to determine the amount of students' learning in a given subject in the light of the specific objectives. The benefit is to improve the learning methods and contribute to the mastery of planning, control of implementation and evaluation of achievement In addition, the school examinations are part of the achievement test, so and as it is indicated by Aldhahir et, al. (2002), it is necessary to know that school examinations are a selected sample of behavior (educational outcomes) to be measured for the purpose of determining the extent of an individual's ownership of this behavior and in turn to judge the level of the aggregate via comparing his\her performance with the his\her colleagues scores.

The Purposes of the School Examinations

As indicated by the House of Commons' Report London (2008) the purpose(s) of school exams are related to the following:

1. Measurement of students' achievement: to assess it later and to know the extent of achievement of educational goals, and this is done through final tests.
2. It provides the teachers and the learners with feedback on the process of education. If the tests reveal the students' weaknesses and strength of students, they will allow the teachers to modify them.
3. Classroom tests also provide feedback to the student, helping him\her to evaluate him\herself, organize his\her time and effort, and adopt the correct study habits.
4. Revitalizing motivation to learn: most learners do not study unless an exam is set for them. Therefore, one of the main purpose of the final exams is to encourage learners to study and memorize.
5. Admission and selection are done through the test decisions for a particular institution or job

The Importance of School Examinations

In to the light of school examinations**,** assessment procedures undertaken in school's context are of great significance. Aligned with that, Boit, Njoki and Chang'ach (2012:181) reported, "Any nation desires to have a well-educated workforce with the ability to think and analyze, using varied reasoning and problem solving skills in an integrated manner". This is necessary for national development.

Every subject in the school system should be able to provide skills like critical thinking, disaster preparedness, desirable moral standards, problem solving skills, positive attitudes, mutual respect and many others. Moreover, examination questions, as reported by Cruz (2004), represent a main tool for cognitive levels assessment. In addition, it can be claimed as Abdelhadi (2001) mentioned that exams also have a great importance in the process of students' performance assessment as they provide a clear idea about students' abilities and their levels of activity and based on the results of exams, remedial plans can be drawn and modify teaching methods' levels.

Furthermore, as Al-Saraireh (2011) highlights the importance of a set standards such as objectivity, reliability and consistency in addition to other secondary characteristics that include the easiness of application and easiness of scoring. Nevertheless, final exam questions are required to be prepared in consistence with the Bloom's Taxonomy as an appropriate option by exams developers, as it is an ideal model for application on all studying materials (Alqatami and Alqatami, 2001).

Bloom's Taxonomy for Cognitive Domain

There are three educational learning domains, the first is cognitive (about knowing), the second is affective (about attitudes, feelings) and the third is psychomotor (about doing). The cognitive domain, which was introduced by Benjamin Bloom in 1950s, emphasized that there are six levels of learning starting from the simplest to the most complex, namely; remembering, comprehension, application, analysis, synthesis, and evaluation (Bloom, 1956). Being classified into several levels, Bloom Taxonomy as variable it requires different educational delivery methods, and consequently it requires different measurement and evaluation methods. The Bloom classification can be used as a tool to assert that all levels of the field are evaluated and that evaluation methods are aligned with appropriate lessons and methodologies. In this way, taxonomy also makes it simple for teachers to maintain consistency between assessment methods, content and learning materials and identify vulnerable areas (Anderson et. al, 1992:6)

There are several reasons that encourage teacher to use Bloom's taxonomy. One of these reasons is any teacher can recognize complex and cognitive development and how to construct the lower level of thinking skills. This understanding makes it easier to prioritize materials and can guide lesson organization to increase class time. Bloom's classification provides a guiding framework for breaking these standards into accessible parts, which used to guide daily lesson plans and can be easily compared with their own classroom goals. In addition, it guides the construction of revision questions and exams development with special focus on the semester final exams (Olimat, 2015).

Revision Questions

Almost every educator knows Blooms' Hierarchy. This Hierarchy has influenced curriculum and instruction since its introduction in 1956 and its revised edition in 2001. Blooms' taxonomy helps teachers to choose the relevant teaching and the relevant evaluation techniques in a way consistent with prescribed instructional objectives. Thus, Bloom's taxonomy is a reference for educators and teachers while designing the revision questions incorporated in the textbooks and questions included on the assessment test(s). In this regard, it is worth noting that textbook attract researchers and educators' attention because it is a basic component in education and depends on both the teacher and the learner in the classroom from the pedagogy perspective, and they are crucial partners in the teaching learning process it is considered the most influential educational element among learners and it includes goals, content, activities, and evaluation (Olaimat, 2015). The first version Bloom's taxonomy employed for the purpose of this study because it is more commonly used than the second version in developing the Jordanian curriculum.

Regarding the curriculum, Shehatah (1998: 17-18) states that "a curriculum represents a collection of diverse experiences offered by the school to learners inside and outside the school to achieve comprehensive growth integrated in the construction of human beings, according to specific educational goals and scientific plan is drawn physically, mentally, psychologically, socially and religiously".

The use of textbooks needs to reflect on the content, the activities of the evaluation which in turn require the teacher and the student's interaction, and questions at the end of each learning unit, where the teacher's role is to explain the purpose and answers of these questions to students (Mara'i and Alhielah, 2005).

The activities and exercises at the end of each learning subject in the textbook are significant elements in the educational process, as it motivates students to practice and learn through work and to participate in the formulation of cognitive perceptions of language, as well as to increase students' interest in the subjects that they study (Alkurdi, 1996).

Evaluation questions or evaluation activities are practical questions contained in the textbook and include procedural steps and provide students with real experiences and solution in classroom or in the real life situations outside the classroom. Mousa (2000) and Shbair (2003) state that evaluation questions are the questions that follow each language lesson or each learning unit.

According to many researchers such as Mara'i and Alhila (2005) there are many objectives of evaluation activities and evaluation questions, among which are the followings:

1. To draw the students' attention toward the important elements and main points and ideas, in the encompassed lessons,
2. To detect mistakes and misunderstandings of students through using evaluative questions,
3. To help teachers to track the students' development related to experience in the form of questions (Alghareeb, 1981; Clark, 1981, Darwazah, 2000; Abdelrazzaq, 2003).

To sum up, evaluating English language learners, as reported by Ehlers-Zavala (2002: 8-9) is a "process of collecting and documenting evidence of student learning and progress to make informed instructional, placement, programmatic, and/or evaluative decisions to enhance student learning, as is the case of assessment of the monolingual or mainstream learner". Thus, English language teachers should possess pre knowledge regarding the aspects of the assessment they conduct. In this regard, Lenski et al. (2006) indicate that English language teachers, and before conducting an assessment or an exam, should know the answers of basic questions such as Who are going to be assessed? How to assess them? Why to assess them? What specific aspects to be assessed? When to administer the assessment? To answer such questions, teachers should investigate their students' prior schooling before assessment.

Literature Review

There are important studies that address similar question(s) or that may offer suggestions for key elements of the study framework, and more importantly, to identify a place where a new contribution could be made, among which are the following:

Nurisma (2010) studies the types of reading questions and the frequency of each type in English e-book based on levels in Bloom's Taxonomy. The sample of the study consisted of (400) questions contained in "Developing English Competencies for senior high school grade XI". The criteria of Bloom's Taxonomy were employed for analyzing the data. The results of the data analysis revealed that the reading questions in the textbook of "Developing English Competencies" covered five levels of reading comprehension based on Bloom's Taxonomy. The remembering questions dominated in the reading questions of "Developing English Competencies" followed by application, analysis, and evaluation, which were presented in a few questions.

Bani Abdelrahman (2014) examines the types and levels of questions available in the tenth grade English language textbooks, which were used in Jordan during the academic year 2012-2013. The purpose of the analysis was to determine the distribution of the questions over the six levels of the new version of Bloom's Taxonomy of the cognitive domain. The sample of the study consisted of the Tenth grade English language textbook. A study analysis sheet was prepared and used in the classification of the questions according to the new version of Bloom's Taxonomy to achieve the purposes of the study. In light of the results, the researchers recommended improving the questions in the textbooks to cover

the six levels of the new version of Bloom's Taxonomy and to train teachers and designers of curriculum to use and write questions following the new version of Bloom's Taxonomy.

Alzu'bi (2014) analyzes English questions of the Jordanian Secondary Certificate Examinations via Blooms' cognitive levels. An analysis sheet was prepared by the researchers for the purpose of the study, which was ensured to be valid and reliable. The whole questions of the general secondary examinations for English course in both levels (level three and level four) during 2010-2013 composed the sample of the study. Frequencies and percentages were tabulated to facilitate the analysis of the results. The result of the study revealed that the total percentage of the first three levels (comprehension, remembering, and analysis) is (69.6) but the total percentage of the last three levels (application, synthesis, and evaluation) is (30.4) so it indicated that the English questions included in general secondary examinations emphasize low order thinking levels.

Olimat (2015) Analyzes Action Pack Textbooks' Questions according to Revised Bloom Taxonomy for 7th, 8th, 9th, and 10th grades and to determine the frequencies and percentages of the questions in the six levels of the cognitive domain. The study consisted of two samples: English language instructors and English text books "Action Back" the population of this study consisted of the questions included in the 7th, 8th, 9th, and 10th grade English textbooks "Action Pack series. The results showed that the distribution of questions on the remembering level was nearly the same in 7th, 8th, and 9th grades, while on the 10th grade it was higher. The distribution of questions also was better in 10th grade for the application and synthesis levels. The results also showed that 8th, 9th and 10th grades got nearly the same distribution of questions on the remembering level of Bloom Taxonomy, while the 7th grade got the highest percentage where it was 14.2%.

Febrina, Usman, and Muslem (2019) investigates the three up levels of cognitive domain of revised Bloom's Taxonomy used in the textbook entitled Bahasa Inggris SMA/MA/SMK/MAK grade 11th semester 1, namely analyzing level (C4), evaluating level (C5), and creating level (C6). Using the descriptive qualitative method and content analysis, this study examined the questions in the reading comprehension tasks only to determine to what extent the reading comprehension questions emphasize on Higher Order Thinking. This research focused on analyzing the Bahasa Inggris SMA/MA/SMK/MAK textbook grade 11th semester 1 published by the Ministry of Education and Culture. The researcher collected and listed the questions in the reading comprehension tasks and then calculated the percentage and frequencies of each level of cognition in each separate book chapter and in all five combined book chapters. The results showed that the most dominant level in the textbook was higher order thinking skills HOTS). It was 66.8 % of 100 % while it was 33.4 % for lower order thinking skills LOTS). It indicated that this textbook concentrated more on higher –level thinking questions than lower lever thinking.

Comments and Conclusions on the Literature Review

Considering such studies, it can be noticed that this study is in a different league. Several studies were conducted to study questions in textbooks according to Bloom's, and most of them recognized the importance of textbooks and audit questions as in Nurisma (2010), Alzu'bi (2014), Bani Abdelrahman (2014) and Olimat (2015). Whereas, the study of Febrina et al (2019) investigates the alignment between comprehension questions and the revised Bloom's taxonomy levels.

The uniqueness of the current study emerged from its capacity in contributing to the trend of analyzing the questions of the final exams and the revision/evaluative question within the textbook. Thus, it can be claimed that this study is the first that combines the analysis of the textbooks' revision and practices questions, coupled with the analysis of final exam questions for these books. The researchers benefited from the above-mentioned studies in drawing the procedures of this study and in selecting the appropriate analytic treatments and finally in supporting the findings of this study by comparing them with the similar finding in the earlier studies.

METHODS

To achieve the goals of this study, the researchers adopted the analytical descriptive approach.

Population and Sample of the Study

The population of the study consisted of all the final exams questions prepared by English language teachers for 9th and 10th grades in Alkarak and the Southern Mazar directorates of education for the scholastic year of 2017-2018, and all the revision questions within the textbooks of the two grades, in addition to the teachers themselves. Actually, 9th and 10th grades are the end of basic education in Jordan, so the teachers' practices (germane to tests' preparation) will be more reflective, and the same applied in the quality of the textbooks in terms of included revision questions. Thus, the study consisted of two types of samples: English language revision questions within the textbook and questions, which are presented, in the semester's final exams. It is worth noting that the entire population of the study was targeted, thus the distribution of the final exam questions and final test papers for both 9th and the 10th grades are shown in Table 1 below:

Table 1. Distribution of the final exams question based on the grade variable

Grade	Number of final exam papers (Prepared by Teachers)		Number of final exam questions (Prepared by Teachers)	
	Females	**Males**	**Females**	**Males**
9th	36	28	478	298
10th	34	24	455	268
Total	**70**	**52 (122)**	**933**	**566 (1499)**

The total number of final exam papers reached (n=122), whereas the total number of questions within the final exams papers were (n=1499).

The second type of study sample is all of the revision questions presented in the English language textbook of the 9th and 10th grades (Action Pack series) based on Bloom's Taxonomy, with the total of (64) revision questions.

The textbooks used in the study and the distribution of the included questions are shown in Table 2 as they were in use during the academic year 2017-2018 at the time of the application of this study.

Table 2. Distribution of the revision questions over the 9th and 10th grade textbooks

Title of the textbook	Grade	Number of questions included	Publication year	Publisher
Action pack 9 (SB)	9th	35	2013/2014	The Ministry of Education
Action pack10 (SB)	10th	29	2013/2014	The Ministry of Education
Total		**64**		

SB = Student Book

Study Tool

The researchers have developed an analytical card for the revision questions listed at the end of the learning units and the exams' papers prepared by teachers for the 9th and the 10th grades in English language at the end of the semester. The card included the six levels of Bloom's taxonomy (analytic unit) represented by knowledge, comprehension, application, analysis, synthesis and evaluation.

Validity of the Tool:

Validity of the tool was verified as it is evaluated by faculty members in Mu'tah University specialized in curriculum and instruction and others specialized in measurement and evaluation, in addition to educational supervisions. The specialists were asked to provide feedback about the extent of the tool appropriateness for the purpose of the study, and its validity for the analysis of the targeted questions, with special reference to its ability to analyze the dimensions and the levels of the questions included

in the English language textbooks for both the 9th and the 10th grades, based on the Blooms' hierarchy. The specialists approved the efficiency of the tool and no modification was required.

Reliability of the Tool:

The reliability of the tool was verified by employing the analysis and reanalysis approach for questions within two weeks after the first analysis. For more verification for the reliability of the tool, an English language educational supervisor was asked for assistance. After reviewing the study presentation and the utilized analytical approach the educational supervisor was asked to analyze a sample of the exams' papers as well as a sample of the revision. Then agreement ratios between the three analyses were calculated using Holsti's formula as follows:

$$C.R = \frac{(2M)}{(N1+N2)}$$

Where C.R indicates the Reliability Coefficient, M: Agreement times between the researchers themselves and the agreement between the researchers and the other analyzer, N1 + N2: Total of questions analyzed (times of agreements + times of controversies) as shown in Table 3.

Table 3. Analysis reliability coefficients between the researchers, themselves, the researchers, and the other analyzer

Questions	Grade	First and the second rounds for the researchers	The researchers analysis for the first round with 2nd analyst	The researchers second round with the 2nd analyst
Final Exams' Papers	9th	.92	.87	.89
	10th	.94	.90	.86
	Average	**.93**	**.88**	**.87**
Revision questions	9th	.93	.84	.82
	10th	.95	.91	.87
	Average	**.94**	**.87**	**.85**

Table 3 shows that the total reliability coefficients analysis for test papers between the researchers and themselves was (.93), between the researchers and the specialist was (.88) in the first round and (.87) between the researchers and the specialists in the second round. Regarding the revision questions analysis' reliability, it was (.94) between the researchers and themselves, between the researchers and the specialist it was (.87) in the first time and was (.85) between the researchers and the specialists in the second round. These values are appropriate for the purpose of this study.

Procedures of the Study

To achieve the goal of the study, the following procedures have been adopted:

1-The researchers obtained an official letter facilitate their task to obtain the English language final examinations' papers from public schools of the two directorates of education in Jordan.

2- In parallel to the collection of exams' papers from the schools, the researchers collected relevant information about teachers who were teaching the ninth and tenth grades, in particular the information germane to study variables.

3- The revision questions presented in the English language textbook of the 9th and 10th grades (Action Pack series), were transcribed to facilitate the process of analyzing.

4- The collected data (final exams questions and the transcribed evaluative/revision questions) were classified according to Bloom's Taxonomy

5- Another Two teachers of English language were trained on how to classify the question based on Bloom's taxonomy classification.

6- Establishing the Coefficient reliability of the analysis process.

7- Concluding with the findings and their discussion.

Statistical Treatment

To answer the study's research questions, the researchers conducted the statistical treatments using the SPSS software as follows:

1- To answer the research 1st and 2nd questions, percentages and frequencies were calculated based on each level of questions levels.
2- To answer the research 3rd question, the independent samples test was employed.
3- To check the study tools' reliability, Holst formula was employed.
4- To describe the study samples characteristics, frequencies and percentages were calculate.

Limitations of the Study

There are several limitations that should considered while reading this study, among which are, this study was limited to the analysis of the final exam questions prepared by the English teacher for grades 9 and 10 in Jordan, during the first semester of 2017/2018. In parallel, this study is limited to the revision questions presented in the English language textbook of the 9th and 10th grades (Action Pack series) in Jordan according to Bloom's Taxonomy.

RESULTS and DISCUSSIONS

Results related to the research first question: What are the levels of English language final exams' questions for both 9th and 10th grades based on the six levels of Bloom taxonomy (remembering, understanding, application, analysis, synthesis and evaluation)?

To answer this question, the researchers analyzed (122) test papers (64) for 9th grade and (58) for 10th grade), including the total of (1499) questions. The frequencies and percentages calculated based on each level of questions' levels (knowledge, Comprehension, application, analysis, synthesis and evaluation) at the level of each studying grade and the total level as shown in Table 4.

Table 4. Percentages and frequencies for the final exams' questions of the English Language for 9th and 10th grades based on the Bloom Taxonomy six levels

Grade	Bloom 's cognitive levels						
	Remembering	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Total**
9	247	230	135	27	119	18	**776**
10	214	192	131	34	107	45	**723**
Total	461	422	266	61	226	63	1499
Ratio	**30.75%**	**28.15%**	**17.75%**	**4.07%**	**15.08%**	**4.20%**	**100.00%**

Data shown in Table 4 indicate that the sum of questions in English language teachers' test papers for 9th and 10th which were analyzed reached (1499) questions, (776) questions of them were for 9th grade which represented (52%) of the total questions and (723) questions for 10th grade which represented (48%) of the total questions analyzed and this reflects close ratios among the test papers of the 9th and the 10th grades.

For the classification of the questions of 9th and 10th grades English language teachers' final test papers based on the six levels of Boom's taxonomy, the remembering level had the highest relative average among the questions with a percentage of (30.75 %). It is followed by comprehension level with a percentage of (28.15%). Third came the application with (266) questions and a percentage of (17.75 %), then came the synthesis level with a percentage of (15.08 %), the fifth rank was occupied by the evaluation level with (63) questions and a percentage of (4.20%) and finally came the analysis level with (61) questions and a percentage of (4.07%). It can be noted that the relative averages for the 9th and 10th grades' questions are convergent for the remembering, comprehension, application, analysis and synthesis levels as the remembering level came with percentages of (53.58% and 46.42%), the comprehension level (54.50% and 45.50%), the application level (50.75% and 49.25%), analysis level (44.26% and 52.65%) and the synthesis level (47.53% and 52.65%) for both the 9th and the 10th grades

respectively while there was significant variation between the 9th and the 10th grades at the evaluation level as the evaluation questions' percentage for the 9th grade was (28.57%) and (71.43%) for the 10th grade of total classified questions at the evaluation level for both grades.

By reviewing the above mentioned results, it is clear that the most prominent dimensions within the English language test questions for 9th and 10th grades prepared by teachers were within the remembering level with a percentage of (30.75%), aligned with that is the comprehension level with a percentage of (28.15%) and with a significant difference from the other levels. These results can be attributed to teachers focus on the main concepts and terms that contribute in preparing for the other levels and can be utilized as a base for the subsequent remembering construction. Moreover, these results can also be attributed to the easiness of designing this type of questions within the remembering and comprehension levels as this is not designed and prepared in addition to teachers' lack for commitment to the steps of designing a good achievement test that takes many considerations into account such as the relative significance for studying units and Bloom's taxonomy levels when planning to construct a test as they have not often received the appropriate training for designing tests based on the good criteria for tests. If such training has been offered, as indicated by AL-Wreikat, Abdullah and Kabilan (2010), it is of that kind that prone at most to the theoretical aspect without utilizing the practical aspect and following up the training effect, which contributed in increasing the remembering, and comprehension levels among teachers' questions.

The researchers see that the low percentages/frequencies of evaluation levels among teachers' questions is due to the nature of this type of questions as the evaluation level is the highest level among Bloom's levels and requires judgments on a specific situation or a certain rule which in turn requires more effort from teachers when designing this type of questions. This result can also be attributed to the low achievement level among most students in English language, which makes teachers to avoid this type of questions, although this is a violation of teaching rules that require upgrading the student to the level of the material instead of degrading the material to students' level. This result is apparent and compatible with students' results in the national and international tests, such as the TIMSS on the international level and the Tawjihi (GSEC) tests on the national level, as most of these results indicate the students' low level in aspect of high-level questions, because they do not undergo experiences similar to this type of questions that confirm the higher mental levels in the learning process. However, the discussed results are in contrast with the results of the study of Febrina et al (2019), where higher order thinking levels of Bloom's taxonomy are more dominant in the textbook questions.

Results related to the research second question': What are the levels of revision\evaluation questions that are listed in the school lesson for the 9th and the 10th grades in English language in Jordan based on Bloom's taxonomy (remembering, understanding, application, analysis, synthesis and evaluation)?

To answer this question, the researchers analyzed the revision questions at the end of the learning units for the 9th and the 10th grades in English language textbook, and then percentages and frequencies were calculated based on each level of questions' levels, at the level of each grade and the total level as shown in Table 5 below.

Table 5. Percentages and frequencies of revision questions' levels as presented in the English Language textbook for the 9th and the 10th grades

Grade	Bloom 's cognitive levels						
	Remembering	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**	**Total**
9	6	8	7	3	3	2	29
10	5	9	10	5	4	2	35
Total	11	17	17	8	7	4	64
Ratio	**17.19%**	**26.56%**	**26.56%**	**12.50%**	**10.94%**	**6.25%**	**100.0%**

Results in Table 5 show that the analyzed questions within the revision questions, in the targeted instructional units in the English language textbook for 9th and 10th grades, were (64) questions with (29) questions for the 9th grade and (35) questions for the 10th grade with a percentage of, respectively, (45.31%) and (54.69%). These percentages reflect convergent percentages among the revision questions for both the 9th and the 10th grades.

With regard to the classification of questions listed in the revision questions based on Bloom's taxonomy, results revealed that both comprehension and application levels had the highest frequencies with (17) questions for each level with a percentage of (26.56%), followed by the remembering level with the total of (11) questions and a percentage of (17.19%), while the third rank was occupied by the level of analysis with the frequencies of (8) questions and a percentage of (12.50%), the fourth rank was occupied by the synthesis level with the frequencies of (7) questions and a percentage of (10.94%), and finally the fifth rank was occupied by the evaluation level with the frequencies of (4) questions and a percentage of (6.25%).

The aforementioned results indicated that the frequencies of the revision questions' classification for the 9th and the 10th grades were similar within the evaluation level with (50%) for each grade. Nevertheless, there was apparent differences between the 9th and the 10th grades within the other levels (remembering, comprehension, application, analysis and synthesis) as percentage of the remembering level was in favor of the 9th grade as it reached (54.55%) compared to (45.45%) for the 10th grade of the total classified questions within the remembering level while the levels of comprehension, application, analysis and synthesis were in favor of the 10th grade compared to those for the 9th grade.

In light of the aforementioned results, it is clear that, based on Bloom's taxonomy, the first rank was occupied by the levels of comprehension and the application with a percentage of (26.56%) for each level. These results reflect the frequencies that confirming the categories of lower mental levels', minimal limits (comprehension) with the maximum level was the application and the least levels were; (analysis, synthesis and evaluation) ranging from (6.25%) to (12.50%). This is in turn indicates a clear inappropriateness of the questions' sequence, which requires increased focus on the higher mental levels. This result can be attributed to the difficulty in developing questions within the higher mental levels even at the level of developing curriculum and its textbooks, and this can be extended to the result of the final exams' questions. The researchers also see that dominance of lower level of the mental levels within the revision questions may directly reflected on the questions prepared by teachers as they often tend to consider them as a model during the process of exams' preparation which made them limited to the lower mental levels when designing achievement tests.

Result related to the research third question: What is the compatibility ratio between the levels of final exams' questions and the revision/evaluative questions within the 9th and the 10th grades' textbook in Jordan?

To answer this question, the independent samples' test was conducted to identify the existence of differences in averages percentages of questions in the English language textbooks for the 9th and the 10th grades based on the Bloom's taxonomy based on the variable of questions' type (revision questions\teachers' final exams), the results are shown in Table 6.

Table 6. Independent samples' test to identify differences based on the Bloom's taxonomy according to the variable of questions' type (revision questions\teachers' final tests)

Bloom's Cognitive Levels	Type	Mean	Std. Deviation	T	Sig
Remembering	Final exams	30.75%	.09	2.15	.03*
	Revision questions	17.19%	.05		
Comprehension	Final exams	28.15%	.09	.293	.77
	Revision questions	26.56%	.02		
Application	Final exams	17.75%	.07	-1.75	.082
	Revision questions	26.56%	.30		

Analysis	Final exams	4.07%	.05	-2.68	.00*
	Revision questions	12.50%	.03		
Synthesis	Final exams	15.08%	.08	-.800	.421
	Revision questions	10.94 %	.03		
Evaluation	Final exams	4.20%	.06	-.522	.60
	Revision questions	6.25%	.04		

*p<.05

Table 6 indicates no statistical significant differences between the frequencies and the percentages of the analyzed questions of the final exams and the revision questions within the textbooks for the 9th and the 10th grade according to the Bloom's levels, in particular the levels of (comprehension, application, synthesis and evaluation) with the significance of (T) value of (.77, .082, .421, .60 respectively, and these values are attributed to the variable of questions' type (revision questions\ teachers' final exams). However, there were statistically significant differences between the frequencies and the percentages of the analyzed questions of the final exams and the revision questions within the textbooks for grade 9 and grade 10, in particular at the level of remembering questions with percentages of (17.19%) within the textbook revision questions and (30.75%) for teachers' final exams' questions. These differences were in favor of teachers' final exams as they were most prominent in the remembering level compared to revision questions, whereas at the analysis level it was in favor of the revision question with the percentage of (12.50%), while it was (4.07%) for teachers' final exams' questions. Figure (1) below shows the variation in questions' average percentages within Bloom's taxonomy based on questions' nature (revision \ teacher's final exams).

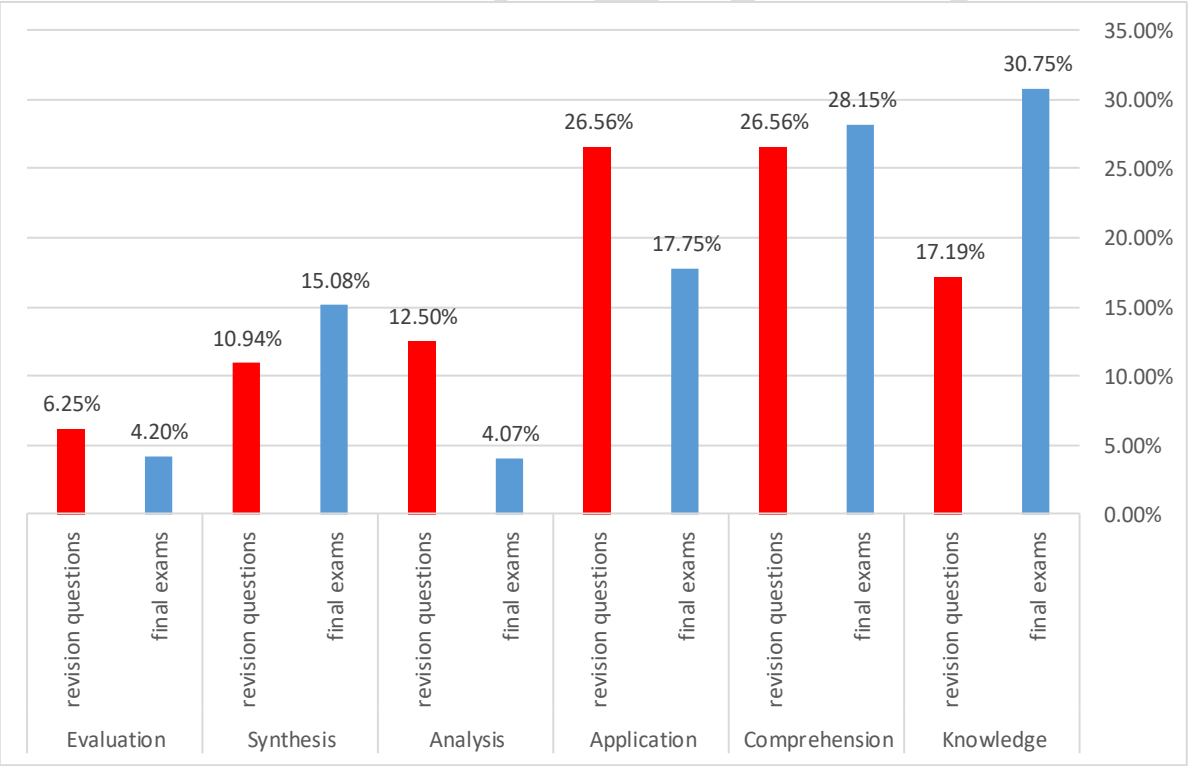

Figure 1. Variation in questions' average percentage within the Bloom's Taxonomy based on the questions nature variable (revision questions\final exams)

In light of the aforementioned results that indicates no significant statistical differences in the questions' average percentage according to Bloom's levels (comprehension, application, synthesis and evaluation). This result can be attributed to the reality that teachers when designing achievement test trying to imitate the nature of questions exist within the revision questions and prepare parallel questions for them and at the same level (as the revision questions are already standardized and its

validity and reliability were verified), in addition synthesis level was rare within revision questions based on the analysis of the 3rd research question which in turn reflected the existence of this level among teachers' questions and so there was a lack for this level in final the exams' questions.

Results also indicated significant statistical differences within the remembering and the analysis levels as differences in the remembering level were in favor of final exams questions prepared by teachers, and differences in the analysis level were in favor of revision questions. The researchers attributes this result to the easiness of questions' preparation within the remembering level which makes teachers tend to employ it more than other levels. They are required to provide more questions at the end of the educational material to cover all of its aspects in addition to their tendency to focus on the remembering level which is considered – from their perspective- as the base that can be relied on in teaching students in light of the achievement weakness in English language compared to other subjects. Moreover, researchers see that the existence of differences in the analysis level in favor of the unit revision questions due to the difficulty in constructing this type of questions which needs an extra efforts from teachers, which teachers lack for. These results reflect the nature and levels of learning materials within textbooks.

The researchers' noticed that English language teachers highly rely on the questions contained in textbooks including revision questions in designing final exams in English language and there are no studies that addressed the relationship between the revision questions in the English language textbook and the final exams.

Recommendations

In light of the results revealed by the study, the researchers suggested a group of recommendations as follows:

1. The Department of Curriculum and Textbooks in the Ministry of Education, in Jordan, expected to benefit from the results of such this study in aspect of developing the English language curriculum. In particular, special concern to be paid to the component of evaluation (the levels of the revision questions included in the English language textbooks, and to consider questions distribution based on the Bloom's levels and in accordance with the nature of goals and objectives the curriculum seeks to achieve with emphasizing or the higher mental levels' questions.
2. Involving teachers in practical training workshops to empower their ability for test items' construction that simulate the whole Bloom's levels in addition to provide them with appropriate instructions regarding a good test construction steps.
3. Conducting further analytical studies to analyze questions presented at the end of learning units in the English language textbook for other grades.

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EXPLORING PEDAGOGICAL CHANGE IN PRE-SERVICE TEACHERS' SCIENCE TEACHING ORIENTATIONS DURING ARGUMENTATION-BASED TEACHING

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Abstract

This study aims to investigate the change in the science teaching orientations of pre-service science teachers using argumentation-based teaching via multiple measurement tools. In this mixed-method research, to evaluate the change experimentally, firstly, argumentation-based teaching practices in socio-scientific issues (SSIs) were carried out. Card sorting activity and focus group discussion forms were applied with 29 pre-service science teachers pre- and post-teaching. Then, to detail the longitudinal effects of the teaching, six pre-service teachers who were selected purposively were asked to perform micro-teaching in different SSIs in the primary/secondary school science curriculum. In this process, data were obtained from the observation, interview and lesson plan. Descriptive statistics were used in the analysis of the quantitative data, whereas the constant comparative method was used with the NVivo program in the analysis of the qualitative data. Thanks to argumentation-based teaching, it was found that the pre-service science teachers' SSI-specific science orientations improved. It was also found that they related themselves to more than one reform-based SSI-teaching type. It was noteworthy that they reflected the change in science orientations on their teaching practices, and the goals of their teaching included SSI dimensions. In terms of other pedagogical content knowledge components, they made their orientations more compatible with their knowledge of teaching strategies.

Keywords: Science teaching orientations, socio-scientific issues (SSI), pedagogical content knowledge (PCK), pre-service science teachers, and mixed-method research.

INTRODUCTION

Realization of a science teaching vision of raising science-literate individuals is a process that relies on the effective integration of the science, engineering, technology, society and environmental domains (Ministry of National Education [MNE], 2006). To strengthen the human structure of the society, it is aimed to raise qualified individuals who turn knowledge into social benefit through inclusive education (Development Plan, 2019). Socio-scientific issues (SSIs), one of the learning contents of the science teaching curriculum (MNE, 2013, 2017), and teaching of SSIs play an important role in accelerating this process. This is because, with the changing community life and education approach, SSIs have importance in raising generations who are able to use scientific knowledge in solving real-life problems and equipped with pedagogical reasoning and scientific-discussion skills (National Research Council, 2011).

SSIs are controversial issues that conceptually include social scientific dilemmas, contain uncertainty in their answers, require reasoning and consist of unclear problems (Sadler, 2004; Sadler & Zeidler, 2004; Zeidler & Nichols, 2009). SSIs that take place in our daily life on the global, national and regional levels include "scientific, environmental, economic, social, ethical/moral and political" dimensions (Ratcliffe & Grace, 2003). The content of SSIs widens with the changing needs of our age. Nuclear energy, GMO, cloning, artificial intelligence, drone, robotics, and treatment methods take place among the current SSIs of recent years (Topçu, 2015). Today, because of diversity in terms of priority strategies followed against the spread of the pandemic, COVID-19 is a global socio-

scientific issue (Topçu, 2020). Therefore, to create understanding and awareness for SSIs that affect all aspects of our lives and to use high-level thinking skills, scientific knowledge in decision-making and finding solutions about SSIs (Sadler, 2011) are extremely important in preparing students for real life. In this framework, there are research results regarding teacher practices and opinions that it is difficult to integrate SSIs into education (Han-Tosunoğlu & İrez, 2017; Pitpiorntapin & Topcu, 2016; Sadler et al., 2017). Factors such as misperceptions about SSIs, lack of experience and knowledge in SSI-teaching are among the reasons for these consequences (Bayram-Jacobs et al., 2019; Topçu, 2015). In the effective integration process of SSIs into education, pedagogical content knowledge in turning of content knowledge into pedagogical knowledge (Baxter & Lederman, 1999) appears as a new and necessary knowledge base.

Pedagogical content knowledge (PCK) which entered the literature with Shulman (1986), is among the knowledge bases of teaching. PCK is the reflection of the components of knowledge and beliefs about "curricula, teaching goals and objectives (orientations), learners' understanding, instructional strategies and assessment" on science teaching. The component of science teaching orientations affects other PCK components. Moreover, it reflects the teacher's knowledge and beliefs about the goals and objectives of science teaching (Magnusson et al., 1999). In the literature, there are many terms used for the concept of orientation, such as *teaching concepts*, *teaching approaches*, *teaching objectives* and *beliefs* (P.J. Friedrichsen et al., 2009). Moreover, several models that include the science teaching orientation component of PCK have been proposed (P. Friedrichsen et al., 2011; Gess-Newsome, 2015; Grossman, 1990; Magnusson et al., 1999; Park & Oliver, 2008). The orientation types and dimensions in these models vary on a scale between *traditional-teacher-content centered orientations* and *constructivist-student-learning centered orientations* (Gao & Watkins, 2002; Käpylä et al., 2009). In this spectrum, the science teaching orientation that guides teaching approaches (Padilla et al., 2008) is an important indicator of in-class practices (Gess-Newsome, 2015) and affects professional PCK development (Brown et al., 2013).

When the literature is examined, it is noteworthy that studies focus on identification of current science orientations (Güven et al., 2019; Ladachart, 2019; Ramnarain et al., 2016; Şen & Nakiboğlu, 2019). It is also important to investigate the dynamic relationship between development in science orientations and in-class practices (Campbell et al., 2014; Luft & Roehrig, 2007). Considering the topic-specific nature of teaching orientations and the situation that multiple orientations may be obtained, it is difficult to evaluate orientations (P. Friedrichsen et al., 2011; Kind, 2009; Shulman, 2015). So, orientations are examined through multi-evaluation tools such as content representation form: CoRe, pedagogical-professional experience repertoires: PaPeRs (Loughran et al., 2006), pedagogy of science teaching test: POSTT (Cobern et al., 2014), card sorting activity (P.M. Friedrichsen & Dana, 2003), observation and interview. The finding that science teaching orientation is resistant to change (Brown et al., 2013) reveals that there is a need for professional development programs that are well-designed for future science teachers (Ladachart, 2019).

Given that teaching SSI is a new pedagogy and an educational reform (Bayram-Jacobs et al., 2019), this study is of importance in terms of examining the development of pre-service science teachers' science orientations for teaching SSI during argumentation-based practices. Besides, this study is important because the development of science orientations is determined via topic-specific multi PCK evaluation tools on theoretical and practical levels. Departing from this, we sought answers to the following questions in this study:

i. What are the effects of argumentation-based teaching practices on the change of pre-service science teachers' science orientations for teaching SSI?

ii. How do the case study findings obtained from micro-teaching practices help explain the experimental design findings obtained from the argumentation-based SSI teaching process?

METHODS

This section includes information on the sample, research design, data collection tools and data analysis with the validity-reliability process.

Research Design

This study was carried out with the *embedded mixed-method design*, where a qualitative research method was applied following a quantitative research method (Creswell & Plano Clark, 2011). The scope of this design consisted of combining a *one-group pretest-posttest experimental design* and an *embedded multiple case study design*. The reason why we preferred *a single group in the design* was the fact that it is difficult to determine orientation due to its complex nature, and comprehensive evaluation of orientation in theory and action is needed. First of all, we obtained implementation permission and ethics committee approval from the institution for this research during one academic term. We used a "one-group pretest-posttest experimental design" to determine pre-service science teachers' SSI-specific science teaching orientations and explore the change in these orientations after argumentation-based SSI teaching practices. In the design, we obtained the orientation knowledge through pretest applications of "card sorting activity and focus group discussion." Afterwards, we introduced argumentation techniques, the nature of SSI and PCK to the pre-service science teachers. Moreover, we carried out argumentation-based SSI teaching modules prepared with expert recommendations. Following these practices performed for seven weeks, we investigated the changes in orientations by repeating the posttest applications of the same tools. Finally, we used an "embedded multiple case study" design. In this design, we selected six pre-service science teachers purposively to detail the longitudinal effects of teaching practices on the science orientations in depth. We asked them to carry out micro-teaching belonging to SSIs in different learning contexts. We obtained their science orientation knowledge in action from the "observation, interview and lesson plan."

Sample

The "purposive sampling technique" was used at the experimental design stage of this study. The sample of the study consisted of 29 fourth-year pre-service science teachers enrolled at the Faculty of Education of a State University in Turkey. Our reason why we preferred fourth-year pre-service teachers was the fact that they had completed many content and pedagogy courses. We chose them under factors such as voluntariness and accessibility. 26 of them (89.66%) were female, while 3 of them (10.34%) were male. Their mean age was 21.96. They had different levels of readiness for SSI. In the case study design of the study, on the other hand, the "maximum variation sampling method" was applied. Among the participants, we selected six pre-service science teachers with heterogeneous characteristics in terms of SSI-PCK levels as the sample. One of them (16.67%) was a male pre-service teacher, and five of them (83.33%) were female pre-service science teachers.

Data Collection Tools

"Card sorting activity, lesson plan, SSI-specific observation and focus group discussion forms" were used as the data collection tools of this study. The validity and reliability of the data collection tools were provided with the pilot study and the opinions of two science education experts in terms of "clarity, suitability to the target audience, covering SSI dimensions, orientations and time needed in practice".

Card sorting activity

In this study, the card sorting activity tool consisted of open-ended questions and various scenarios representing different teaching approaches to reveal the goals of SSI teaching. First of all, we wrote the scenarios to be compatible with the nine orientation types (*process, academic rigor, didactic, conceptual change, activity-driven, discovery, project-based, inquiry and guided inquiry*) defined in the literature (Aydın, 2012; P. Friedrichsen et al., 2011; Magnusson et al., 1999). Then, we took the opinions of two experts with a doctoral dissertation on PCK and over a decade of experience in science education. According to the feedback, the "academic rigor orientation" was not compatible with the updated science curriculum (MNE, 2017), and the "guided inquiry, process, discovery

orientations" were lacking in terms of inclusion of research-inquiry and scientific process skills. In this context, the experts recommended that scenarios could be harmonized with new science teaching approaches by considering content acquisitions. Thus, we prepared the new scenarios to be compatible with "*presentation, conceptual change, project-based, inquiry, argumentation-based, problem-based, informal learning, STEM, drama/role-playing, technology-supported teaching methods*" and the nature of the SSI content. Considering the orientation types, there was a tendency from "direct teaching" towards the "reform-based approach." Some examples of the orientation scenarios from the card sorting activity are given below.

An effective way to teach students the goals-objectives of SSIs in the science curriculum is:

i. "to write the issue headings on the board and explain these issue headings in detail. To understand whether students learn scientific concepts and facts about the issue, questions are asked to students, and they are expected to answer these questions as described."

ii. "to enable students to use animations, simulations, digital narrations, social networks, tablet and smartboard applications that enable them to participate interactively in the learning process, to enable them to develop and implement multimedia-supported teaching activities."

ii. "to enable students to identify real-life problems about any SSI, to integrate mathematics, science, engineering and technology with an interdisciplinary approach, to create a model and to present this output at the end of the process."

iii. "to ask students to make their arguments about two contradictory situations on the issue by taking a leader role, to allow them to defend these claims, to ask students to discuss these situations in groups with data, evidence and confute counter-arguments."

For the application time and the clarity of the card sorting activity tool, we conducted a pilot study with two fourth-grade pre-service science teachers who did not participate in the sample. We received their confirmation regarding the comprehensibility of the tool's open-ended items and scenarios. Then, in the main implementation of this tool, we asked the pre-service science teachers to select scenarios that, *did not reflect these and that they were not sure of*. We also asked them to present reasons for their grouping in line with the literature (P.M. Friedrichsen & Dana, 2003, 2005). We applied the card sorting activity twice as pre- and posttest for one class hour.

SSI-specific PCK-based observation form

In this study, we prepared a micro-teaching observation form by considering the nature of SSI-specific PCK. We provided content validity of the form with two science education experts' opinions, the science curriculum (MNE, 2017) and the literature (Canbazoğlu Bilici, 2012; Sawada et al., 2002). Furthermore, we carried out the reliability and applicability testing of the form with two pre-service science teachers who were not included in the main study. As a result, the final version of the section representing the science teaching orientations knowledge of the form consisted of Likert-type items and multiple checkboxes. We observed six pre-service teachers' micro-teaching practices taking one class hour on average by systematic-participatory observation. We also filled out their practices in this form with two experts with doctoral degrees in science education. Besides, we recorded the micro-teaching practices with the participants' approvals and kept additional notes.

SSI-specific PCK-based focus group discussion forms

We prepared two different "semi-structured focus group discussion forms" for *the experimental and micro-teaching process* in line with two science education experts' opinions and the literature (Aydın, 2012; Canbazoğlu, 2008). We determined the comprehension of the questions and the average interview time via a pilot study. After the pilot study, we revised questions that the pre-service science teachers had difficulty understanding according to experts' feedback. In this context, the focus group discussion forms consisted of open-ended items that measured SSI-specific science teaching orientations. We completed the implementation of these focus group discussions in two class hours on average. We also recorded the discussions with the participants' approvals and kept additional notes.

PCK-based SSI lesson plan

In this study, we prepared a template of the lesson plan adapted for SSIs in line with two science education experts' recommendations and the literature (Bilican, 2017; Canbazoğlu Bilici, 2012). Firstly, we provided its applicability for different SSIs with two fourth-grade pre-service science teachers who were not included in the sample. Then, we asked six pre-service science teachers who carried out micro-teaching in SSIs to prepare their lesson plan. Thus, we aimed to determine their science teaching orientations reflected on their lesson plans. We also aimed to investigate whether there was a consistency between their lesson plans and micro-teaching practices in terms of the orientations. So, we achieved comparison of the ideal objectives in theory and the actual orientations in practice.

Data Analysis

The data analysis process was carried out in accordance with the nature of the "embedded mixed-method design." Firstly, we analyzed different types of data of the research's experimental design simultaneously and sequentially. We integrated data into each other. Then, we analyzed the qualitative data of the case study embedded in the experimental design and explained in relation to the experimental results.

We quantified the qualitative data obtained through the "observation form and lesson plan" by different analytical rubrics prepared for the data collection tools. The scoring of each section of the analytical rubric varied. For the lesson plan, the section with Likert-type expressions was scored as "0-2", whereas the section where the orientation types were specified was ranked by scoring as "0-4". For the observation form, the part with Likert-type expressions was evaluated as "0-2," and the part with checkboxes was evaluated by scoring as "0-3" according to the presence of observed behaviors (section A). The additional scoring criterion of the rubric was the level of observation in the micro-teaching of the planning in the lesson plan (section B). This level was in the range of 0-4 points. A scoring system like this is important in terms of using both theoretical and applied science teaching orientations data together by detailing each other. At the same time, the observation form and lesson plan contained different numbers of items. To make significant comparisons between the scores, we made a "standard score" calculation. The standard scores were calculated by the ratio of the total points taken by the pre-service science teachers to the maximum score that could be obtained from the tools.

We carried out an analysis of the qualitative data obtained through the "focus discussion and card sorting activity" according to the *constant comparative analysis* approach. We used the NVivo-12 Program in the analysis of the qualitative data. Besides, we used descriptive statistics to analyze the data of the card sorting activity. To ensure the validity and reliability of the results, we used the opinions of two experts with a PhD on PCK and over a decade of experience in science education. We also used the results on the internal consistency coefficient in the analysis process (Miles & Huberman, 1994). In addition to these, we made comparisons to different research results in the literature and reported direct quotations from the participants.

RESULTS

This section covers the quantitative and qualitative findings obtained from the pre-service science teachers consistently with the research questions and data collection tools.

Results Regarding the Change in SSI-Specific Science Teaching Orientations

The results regarding the change in the SSI-teaching orientations of the pre-service science teachers after argumentation-based teaching were reached via the "*card sorting activity, focus group discussion form*" of the experimental design process. Table 1 shows the descriptive analysis findings of the "pretest-posttest" phases of the card sorting activity.

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Table 1. Distribution of preference for SSI-teaching orientations (card sorting activity)

	Pretest						Posttest					
	Reflects me		Does not reflect me		I am not sure		Reflects me		Does not reflect me		I am not sure	
SSI teaching orientations	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**
1-Presentation	8	27.6	19	65.5	2	6.9	3	10.3	25	86.2	1	3.5
2-Conceptual change	24	82.8	1	3.4	4	13.8	27	93.1	0	0.0	2	6.9
3-Project-based	15	51.7	2	6.9	12	41.4	22	75.9	2	6.9	5	17.2
4-Inquiry	16	55.2	2	6.9	11	37.9	29	100.0	0	0.0	0	0.0
5-Argumentation-based	16	55.2	3	10.3	10	34.5	29	100.0	0	0.0	0	0.0
6- Problem-based	21	72.4	4	13.8	4	13.8	29	100.0	0	0.0	0	0.0
7-Technology supported	13	44.8	10	34.5	6	20.7	26	89.7	0	0.0	3	10.3
8-Informal learning based	19	65.5	2	6.9	8	27.6	26	89.7	0	0.0	3	10.3
9-Drama/role-playing	11	38.0	9	31.0	9	31	22	75.9	3	10.3	4	13.8
10-STEM	8	27.6	5	17.2	16	55.2	23	79.3	0	0.0	6	20.7

According to the card sorting activity "pretest" findings, the "presentation, technology-supported and drama/role-playing" orientations did not frequently reflect their goals-objectives of SSI teaching. It was also found that they were not sure if the "STEM, project-based, inquiry and argumentation-based" orientations reflected themselves. It was determined that the first three types of orientation preferred were the "conceptual change, problem-based and informal learning-based" orientations. Thus, we could infer that they associated themselves with more than one SSI-teaching orientation.

According to the card sorting activity "posttest" findings, it was found that the "presentation" orientation did not reflect their goals-objectives of SSI-teaching. This orientation was followed by a very low rate of the "drama/role-playing" orientation. The reasons for this finding were the factors of "difficulty in adapting drama/role-playing properly to SSIs and causing distraction." It was also found that they had doubts about the "STEM and project-based" orientations in terms of reflecting their teaching. The reasons for this finding were the factors such as "since STEM is a new application, difficulty in transferring STEM to the classroom" and "project-based practice for SSI requires more time outside the school, anxiety about reaching the right source." It was seen that the orientation types frequently preferred were equally "inquiry, argumentation- and problem-based." These orientations were followed by the "conceptual change, technology-supported and informal learning-based" orientations. Since they preferred new and multiple SSI-teaching orientations in addition to the pretest findings, the positive effect of argumentation-based teaching was understood. To explain these findings, we asked the pre-service science teachers about the common features of the card sorting sequences in the posttest and to provide justifications about their opinions. In terms of common characteristics, categories that they thought reflected their goals of SSI-teaching were the "*research-inquiry, scientific discussion, problem-solving, solving misconceptions, using technology, excursion-observation and getting expert support*" categories. When the "presentation, drama/role-playing" orientations which they thought did not reflect them were analyzed for common features, the categories of "*failure to understand the topic well, causing a distraction* and *not being suitable for every SSI*" were reached. Considering the common features of "STEM and project-based" orientations in which they were not sure about reflecting them, the categories of "*difficulties caused by being a new practice* and *requiring a long time*" were obtained. Table 2 shows the findings about the "science teaching orientations theme" of the focus group discussion data collected from purposively selected ten pre-service science teachers in the experimental design.

Table 2. Findings of SSI-teaching orientations knowledge (pre-post focus group discussion)

Sub-theme	**Category & code list (pre)**	**f**	**Category & code list (post)**	**f**
Importance	No answer	4	Developing perspective on SSIs	4
	Providing ideas about problems	1	Revealing misconceptions	3
	Providing critical thinking	1	Avoiding misconceptions	3
	Enabling the student being innovative	1	Developing an inquiring perspective	1
	Determining misconceptions	1	Raising conscious individuals	1

	Revealing student skills	1	Revealing different views	1
	Expressing correct information	1	Informing about scientific studies	1
	Talking about current developments	1	Talking about current developments	1
	Requiring learning because it is in the MNE book	1	Revealing student skills	1
			Informal learning skills	1
			Creativity/imagination skills	2
			Critical thinking skills	2
			Problem-solving skills	1
			Analytical thinking skills	1
			Reflective thinking skills	1
			Enabling the student being innovative	1
			Ensuring that students express their opinions correctly for SSI such as organ donation	1
Functionality	No answer	7	Associating with daily life	8
	Associating with daily life	2	Using in everyday situations	1
	Using in any situation in life	1	Gaining professional experience in the related issue area	1

As seen in Table 2, there were two sub-themes regarding the SSI-teaching' goals and objectives, namely "importance for the student" and "functionality of the issue." In the "importance" sub-theme of the posttest, it was seen that four categories were common with the pretest findings (*revealing misconceptions, talking about current developments, revealing student skill* and *enabling students being innovative*). Additionally, seven new categories were identified. These were "*developing perspective on SSI, avoiding misconceptions, developing inquiring perspective, raising conscious individuals, revealing different views, informing about scientific studies* and *ensuring that students express their opinions correctly."* It was observed that the two categories of the "functionality" sub-theme in the posttest were also determined in the pretest (*associating with daily life* and *using in everyday situations*). The additional category of "*gaining professional experience in the topic*" was also determined. To explain these findings, examples of direct quotations are given below.

"The purpose of SSI-teaching is to ensure that students have an idea for problems, to contribute to their critical thinking." ($PST4_{pretest}$)
"To determine misconceptions." ($PST8_{pretest}$)
"Talking about current developments and enabling the student being innovative." ($PST5_{pretest}$)
"The aim is to gain informal experience." ($PST5_{posttest}$)
"The aim is to increase the imagination and creativity skills of the student on the issues." ($PST8_{posttest}$)
"The goals of SSI-teaching are to avoid misconceptions because the issues are suitable for misconceptions." ($PST10_{posttest}$)

The "inquiry and argumentation-based" orientation types determined in the card sorting activity (posttest) and the "developing an inquiring perspective and revealing different views" categories determined in the post-focus group discussion showed similarity. So, it was revealed that the two data types consistently detailed each other.

Micro-Teaching Results Concerning SSI-Specific Science Teaching Orientations in Action

As a result of investigating the reflections of science orientations in different SSIs on micro-teaching practices, Table 3 shows the orientation scores of six pre-service science teachers.

Table 3. Science teaching orientation scores in practice obtained during micro-teaching

Level	PST	Data types	Orientation knowledge	Final total score	Orientation knowledge SS	Final total SS
L1	PST3	OF section A	3		.60	
Low		OF section B	3	6*	.75	1.35*
		LP	7	7	.58	.58
L2	PST1	OF section A	5		1.00	
Low		OF section B	4	9*	1.00	2.00*
		LP	6	6	.50	.50

L3	PST4	OF section A	5		1.00	
Medium		OF section B	4	9*	1.00	2.00*
		LP	12	12	1.00	1.00
L4	PST2	OF section A	5		1.00	
Medium		OF section B	4	9*	1.00	2.00*
		LP	9	9	.75	.75
L5	PST6	OF section A	5		1.00	
High		OF section B	4	9*	1.00	2.00*
		LP	10	10	.83	.83
L6	PST5	OF section A	5		1.00	
High		OF section B	4	9*	1.00	2.00*
		LP	9	9	.75	.75
Max. score		OF section A	5		1.00	
to be taken		OF section B	4	9*	1.00	2.00*
		LP	12	12	1.00	1.00
Mean scores		OF section A	4.67		.93	
of PSTs		OF section B	3.80	8.50*	.96	1.89*
		LP	8.83	8.83	.74	.74

PST-pre-service science teachers, SS-standard scores, OF-observation form, LP-lesson plan
*The level of implementation of the lesson plan is section B, it is added to the section A of the observation form, and the final total observation score is obtained.

In Table 3, pre-service science teachers are ranked from low to high by their PCK levels. When the "observation standard scores (SS)" were compared, it was found that five pre-service science teachers, except for PST3, reached the maximum score in orientation knowledge (SS_{max}=2.00). PST3 had a level below the mean orientation score (M=1.89) with their score of 1.35. Examining the standard scores obtained from the lesson plan, it was found that their lesson plan scores varied amongst each other. Except for two of them (PST3 and PST1), the other pre-service science teachers reached a score above the mean lesson plan score (M=.74). A pre-service teacher (PST4) achieved the maximum lesson plan score. It was understood that except one (PST3), the rest of them reflected the lesson plan exactly on their micro-teaching. Besides, their PCK levels (low, medium, high) and lesson plan and observation scores were not directly related. It is noteworthy that the lesson plan scores of the pre-service science teachers (except PST4) were lower than the observation scores. When we investigated the reason for this phenomenon, we saw that they had some difficulties in preparing the lesson plan. "Failure to directly reach the SSI in the textbook, to access to target references, to include SSI in the curriculum sufficiently, to use topic-specific strategies in proper order" were among these difficulties. Examining the "lesson plans," the pre-service science teachers' statements regarding the goals and objectives of the SSIs were as follows.

"To raise conscious producers and consumers, the following issues are mentioned: Biological control, definition of pesticides, their benefits and harms, alternatives instead of using pesticides. Thus, the student is informed." (PST3)

"The students are informed about the importance of the issue of technology and its place in daily life." (PST1)

"To correct students' misconception about cleaning-materials by asking questions to them. For a negative problem in daily life, they are asked to solve by defining this problem. They are introduced to cleaning-materials. The scientific process and their inquiry skills develop." (PST4)

"To raise awareness of what the chemical industries, their products, economic contributions to Turkey are. I let students solve the problem via an example scenario and make an argumentation on the effects of the chemical industries." (PST6)

When the lesson plan report examples were examined, it was found that the pre-service science teachers stated their SSI-teaching goals under various sub-themes. These sub-themes were "*associating with daily life, explaining scientific information correctly, developing scientific process skills, accessing information through research inquiry and discussion* and *establishing the science-*

technology-society-environment relationship." They also emphasized the SSI dimensions of "economic, scientific, controversial, environment" among the teaching goals. According to their lesson plan, although there was a relationship between the science orientations and the components of PCK's "assessment, curriculum, student understanding," it was determined that "teaching strategies" and science orientations mostly interacted. It was found that all of their plans presented their teaching goals with the presentation orientation. It was also found that the pre-service teachers with low PCK levels preferred the presentation orientations, while those with medium and high levels preferred additional orientations (argumentation, inquiry, problem-based, etc.). Departing from this, we determined that the pre-service teachers on low PCK levels specified more traditional orientations, while those with medium and high levels stated orientations based more on the constructivist theory. To elaborate these lesson plan findings, Table 4 shows the types of science teaching orientations in practice used by the pre-service teachers in their SSI-teaching.

Table 4. Findings related to science orientation types used by PST (observation form)

Preferred science teaching orientations	PST3	PST1	PST2	PST4	PST6	PST5	f
Presentation	X	X	X	X	X	X	6
Question-answer	X	X	X	X	X	X	6
Research-inquiry		X				X	2
Argumentation		X		X	X		3
Technology-supported	X	X	X	X	X	X	6
Other orientations							
Material design			X				1
Experimentation				X			1
Activity-supported						X	1

It was seen that all pre-service science teachers stated their goals of SSI-teaching with the orientation types of "presentation, technology-supported and question-answer." It was observed that the "argumentation" orientation followed these orientations. It was also noteworthy that new orientations (designing materials, experimentation, applying activities) were observed in addition to the already determined. So, it was concluded that they used new orientations due to the flexible practice of their lesson plan. To elaborate the observation and lesson plan data, the findings of the focus group discussion performed with six pre-service teachers after the micro-teaching practice are given below.

Table 5. Findings of micro-teaching focus group discussion related to science orientations

Theme (T)	Sub-theme	Category	Subcategory	Code	f
Science teaching orientation	Goal and objective	General goal-objective	Providing issue functionality	Using information in daily life	4
				Giving information facilitating daily life	2
				Providing operational information	2
				Association with daily life	2
			Emphasizing importance for the student	Involving student in the process	3
				Turning information into behavior	2
				Reducing issue to student' level	1
				Attract student' interest/attention	1
				Raising awareness about the issue	1
				Reinforcing topic via case studies	1
				Developing various skills	1
		Issue-specific goal-objective	Base stations	Use of base stations	1
				Benefits-harms of base stations	1
			Energy resources (ER)	Elimination of environmental problems	1
				Use of renewable energy sources	1
				The importance of renewable ER	1
			Chemical industry (CI)	Contribution of CI to economy	1
				Institutions contributing to the CI	1
			Acid-bases as cleaning material (CM)	Precautions for use of CM	1
			Space technology	Examples of space technologies	2

and space pollution	Causes of space pollution	1
	Effects of space pollution	1
	The use of space technologies	1
	Definition of space technology	1
Pesticides	Effects of pesticide use	1
	Pesticide types, harms, precaution	1
	Raising awareness about pesticide	1

As seen in Table 5, two categories related to science orientations (general and topic-specific goal-objective) were reached. It was found that the pre-service science teachers stated "general goals" related to daily life that "emphasize importance of the issue for student learning and ensure its functionality." They also stated "specific goals-objectives related to each SSI outcomes and content". When the data obtained from different data sources were compared, it was found that the "importance" and "functionality" contexts were determined commonly in the findings of the experimental design and micro-teaching. In the micro-teaching focus group discussion analyses, additional sub-themes were reached. These were "orientation types and ways to set goals." It was determined that the pre-service science teachers stated different references (curriculum, scientific report, papers, needs, internet, myself, book) as "ways to set goals." Moreover, they preferred the "argumentation, case study, question-answer and technology-supported" orientations as the "orientation type." Some direct quotations of the focus group discussion data describing these findings are given below.

"Due to the nature of the topic, to emphasize the importance of renewable energy resources to students." (PST5)

"It is one of our goals to improve various skills like discussion, etc." (PST6)

"While setting my goals, I set out by looking at the books and curriculum outcomes." (PST2)

"I used the question-answer technique while expressing goals in the introduction course." (PST3)

"My topic (base stations) was not included in the MNE textbook. I set my outcomes and goals from papers and scientific reports. I reduced them to students' understanding level." (PST1)

As a result of the micro-teaching practices, we should highlight that the pre-service science teachers did not have a single traditional orientation. They adopted multiple student-centered orientations, and they performed teaching based on these orientations. The findings from different data collection tools showed similarity to each other in that the pre-service teachers reflected their "technology-supported, argumentation-based and question-answer" orientations on SSI-teaching in action and on their own expression in the theoretical sense. For example, it was observed that the pre-service science teachers (PST1, PST4, and PST6) used the "argumentation-based" orientation in their practices in the real classroom environment. They also stated verbally in the card-sorting activity that the "*argumentation-based*" orientation reflected their teaching. Therefore, we may infer that the pre-service science teachers on different PCK levels reflected the change in science teaching orientations on their teaching after argumentation-based teaching.

Additionally, the pre-service science teachers were asked to make a self-assessment in terms of the effect of teaching practices on development of science orientations. The NVivo-12 analysis model of the data was as Figure 1.

In the self-assessment model, it was understood that the pre-service science teachers stated that their science teaching orientations showed positive development in various sub-themes. Examples of direct quotations from the participants' self-assessment views were as follows.

"The knowledge of why a topic should be taught is a factor in planning career. The things we can use in daily life are important. I understood how I could attract students' attention." (PST4)

"It helped me determine the appropriate method in this regard." (PST2)

"It guided me to prepare the lesson plan." (PST5)

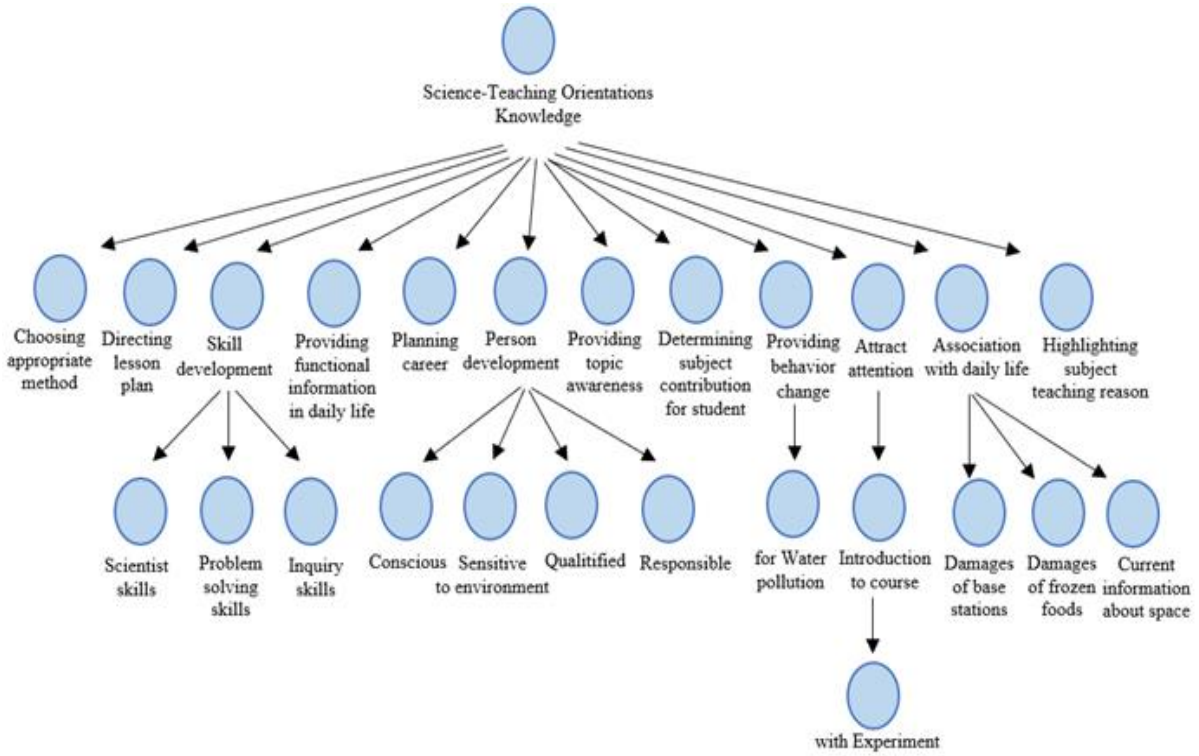

Figure 1. Self-assessment on development of science teaching orientation knowledge

DISCUSSION

In this study, we developed various SSI-specific data collection tools (card sorting activity, lesson plan, observation, and interview forms) to determine and explain pre-service science teachers' teaching orientations in theoretical sense and in action. We also prepared argumentation-based teaching modules compatible with the nature of SSIs and PCK. So, we recommend these different tools and teaching modules to identify topic-specific science teaching goals-objectives, teaching experiences and needs for lifelong professional development of pre-service teachers in argumentation-based learning environments.

In the research's experimental design, it was remarkable that the "*inquiry, argumentation-based, technology-supported*" orientations were most preferred, and the preference of the "*STEM, project-based*" orientations increased substantially in the posttest. We think the reason for this result arose from realization of argumentation-based 'mobile and QR code technology' applied in SSI-teaching with an interdisciplinary approach. Views with a more alternative and constructivist approach were also achieved following the teaching process. Based on these results, it was understood that argumentation-based teaching practices had a positive effect on the change of SSI-specific science orientations. In this context, there are research results in the literature that various practices (*teacher training and vocational development programs, method lessons, peer discussions, etc.)* contribute to development of science orientations (Aydeniz & Gürçay, 2018; Campbell et al., 2013; Faikhamta et al., 2009; Sahingoz & Cobern, 2020).

In the research's case study design, it was observed that the pre-service science teachers with different PCK levels used the "*argumentation-based and technology-supported*" orientations, which they stated in the card sorting activity. We would like to draw attention to the finding that they reflected their orientations on their teaching in the real classroom. So, it was concluded that argumentation-based teaching was effective in the science teaching orientations in action. It is possible to reach research

results which are contrary to these results. For example, it was observed that teachers who preferred the inquiry-based orientation in the card sorting activity taught via the teacher-centered orientations in practice (Alkış Küçükaydın, 2017; Monet, 2006). In the literature, the relativity of orientation knowledge specific to the "variables of experience, time, material, issue type" was emphasized due to differences between the ideal and actual orientations (Akın & Uzuntiryaki-Kondakci, 2018; Şahingöz & Cobern, 2018). In this context, because of the similarity of these variables, we may understand that the preferred and observed science teaching orientations were consistent with each other in our study.

Another remarkable result was that the pre-service science teachers performed teaching based on multiple student-centered orientations. They associated themselves with more than one constructivist SSI-teaching orientation. These orientations had the common characteristics of "*research-inquiry, scientific discussion, setting problem, generating solutions*." In fact, the student-centered orientations were mostly explained by constructivist learning concepts in science teaching (Adibelli Şahin et al., 2016). In the literature, a thesis study (Özcan, 2013) where pre-service teachers used different student-centered orientations in teaching, the nature of science was similar to the result of this study. Moreover, a study indicated that pre-service teachers gain more reform-based orientations after reflective teaching (Demirdöğen & Uzuntiryaki-Kondakçı, 2016). Such a finding was also reported as that prospective teachers had various orientations at the same time (Güven, et al. 2019; Yılmaz Ergül & Taşar, 2020). Similarly, it was determined that mathematics teachers used different representation methods, and their pedagogical content knowledge was not limited to certain orientations (Gökkurt Özdemir & Soylu, 2017).

In our study, it was found that the pre-service science teachers obtained a lower score from the lesson plans in comparison to the observation scores. So, we concluded that they reached higher scores in their observation process due to the flexible practice of their lesson plan. According to the lesson plans, it was determined that they stated the teaching objectives under the sub-headings of "*daily life, scientific process skills, discussion* and *science-technology-society-environment*" in a more reform-based approach (Luft & Roehrig, 2007; Roberts, 2007). It was noteworthy that SSI-specific goals and dimensions (*economic, controversial, environment*) took place among the SSI-teaching objectives which they planned. In a similar study (Lee & Witz, 2009), it was pointed out that science teachers deal with SSIs with their "environmental and social" dimensions. It was also seen that a pre-service teacher on the medium level (PST4) received full points from the observation and lesson plan in our study. In this context, we may infer that there was no direct relationship between the PCK levels and science teaching orientation scores. Unlike this result, it is possible to reach a study that determined a relationship between the PCK levels and reform-based science orientations of teachers (Park et al., 2011).

Considering the micro-teaching practices, the pre-service science teachers frequently emphasized science teaching orientations in accordance with the "*argumentation-based and problem-based"* teaching methods. Thus, we were able to demonstrate that their science teaching orientation mostly interacted with the teaching strategy knowledge. In the literature, there are conclusions that science teaching orientations and beliefs often interact with knowledge of teaching strategies (Demirdöğen, 2016; Suh & Park, 2017). According to the micro-teaching focus group discussion, it was determined that the pre-service teachers stated issue-specific goals. In terms of the effect of argumentation-based teaching, they assessed that their orientation knowledge showed a positive development in various sub-themes.

Conclusions, Limitations and Pedagogical Implications

In our study, we developed argumentation-based teaching modules and multiple-measurement tools in addition to the card sorting activity including innovative teaching practices in SSIs to determine the change of science orientations. Our main findings pointed out that the pre-service science teachers' SSI-specific science orientations improved during argumentation-based teaching. The findings also highlighted that this development was on both a theoretical and practical level. At the same time, each

of them had more than one reform-based SSI-teaching type. Our other remarkable conclusion was that the pre-service science teachers' reform-based goals and purposes of their teaching included various SSI dimensions. It should also be noted that their orientations were more compatible with "knowledge of teaching strategies" in comparison to other PCK components. In summary, we undoubtedly see an opportunity of this research for contributing to the literature in terms of determination of development in science orientations concretely through various evaluation tools and teaching modules prepared in the context of SSI-specific PCK.

Considering the specific results of our research, despite SSI-specific teaching practices, STEM and project-based orientations were found among the orientations that a few students were not sure in reflecting their teaching goals. Thus, activities where STEM and project-based orientations are more actively reflected in SSI-teaching may be developed and implemented. To assess these orientations predictively, additional data collection tools such as "CoRe, PaP-eRs, diary and mind maps" may be used. Additionally, the "social, ethical and political" dimensions of SSIs, which were not addressed by the pre-service teachers, may be introduced more with teaching scenarios. In our research, the pre-service teachers performed micro-teaching for SSI regarding different learning contexts, which are mostly included in the primary and secondary school science curriculum. New studies may be repeated for "global and regional SSIs" comparatively. This comparative study may be also carried out for a sample of different countries. So, it will be possible to discuss science orientations internationally in terms of education practically. It was also noteworthy that there was no relationship between the PCK levels and science teaching orientations of the pre-service teachers in our research. Departing from this, we recommend that the reasons for this phenomenon may be investigated through action research in an in-depth sense. Besides, we suggest that comparative studies examining the effects of positive or negative factors (*different learning domains of SSIs, self-efficacy and pedagogical reasoning, etc.)* on the orientations of pre-service teachers may be carried out.

This study had a few limitations. The first limitation was that the change in the SSI-specific science teaching orientations was examined through a single group. This limitation may be eliminated by performing similar studies with a control group. Another limitation was that the SSI-specific orientations were examined at the beginning of the course. In new studies, this process may be extended to all micro-teaching processes, and the orientation knowledge may be examined in a holistic approach with different PCK components.

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DEVELOPING NUMBER SENSE IN STUDENTS WITH MATHEMATICS LEARNING DISABILITY RISK

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Abstract

Learning or doing mathematics involves approximate quantification. The purpose of this research was to improve approximate number system acuity in primary school students with low achievement in mathematics. A quasi-experimental, pre-test, post-test design with a control group was utilized. Mathematics Achievement Test (MAT), Arithmetic Performance Test (APT), Number Line Estimation Test (NLE), and Raven Standard Progressive Matrices Test (RSPMT) have been conducted to identify the study groups. Initially, 302 students were surveyed with these tests. A total of 26 students scoring the lowest (bottom 25%) in all these tests, except RSPMT, have been included in the study. Students were randomly assigned to the experimental (13 students) and control groups (13 students). Experimental group played with Tablet-PC games designed to develop approximate number system, one of the components of number sense, in their free times in school. Control group, did not have any of these games but played nonmathematical games. Experimental group played with three games designed to develop number sense for two hours a week for a total of 6 hours. Analysis showed there was an increase in both of the estimation precision and mathematics achievement of the experimental group. The games played during the experimental process not only helped in teaching the spatial representation of magnitude but they also led to an improved mathematics achievement. The approximate number system sensitivity of experimental group continued to develop in retention period as measured by the 0-100 number line test. Despite an indication that number line estimation tasks have an impact on number sense and mathematics achievement, none of these results provided any evidence on being reflected on timed arithmetic performance. Activities targeting exact number system may be required for arithmetic performance. This hypothesis can be tested in future studies.

Keywords: Approximate number system, mathematics achievement, low achievers, number games, number sense

INTRODUCTION

At the initial stages, learning or doing mathematics can be considered to be a quantification process. Quantities could be either discrete like 3 marbles, or continuous like length. While we enumerate the discrete quantities through subitizing and counting, we quantify the continuous quantities via measurement. In addition, we estimate and calculate the amount of both types of quantities. Consider the following situations to exemplify these actions in real life. Why is it that an infant who is unable to count but still try to reach to the plate with more cookies in it, or for a hungry lion to attack a buffalo herd with fewer buffalos rather than more buffalos in it, or similarly, for a monkey to reach to bananas that have been hung closer to it within the same cage. The first thing that strikes the mind is basic mathematical skills. More specifically, this is being expressed as something closely related to some kind of number perception or the ability to perceive quantity, which is commonly called as the number sense (Dehaene, 2001). It has been claimed that number sense is inherent in humans and some animal species and that it can be improved with experience (Feigenson, Dehaene & Spelke, 2004; Lipton & Spelke, 2003; Xue & Spelke, 2000). So, coming naturally –through genetic transfer- and developing with experience, how is number sense defined?

What is number sense?

Number sense has been defined in a number of different ways by psychologists and math education researchers. Dehaene (2001) defines it as the ability to rapidly comprehend quantities, determine their approximate size and perform fluent operations with them. Reys, Reys, McIntosh, Emanuelsson, Johansson & Yang (1999), on the other hand, defined number sense as the ability to have a general conception of numbers and operations; being able to make flexible mathematical assessments and the ability and tendency to use this conception to develop useful and effective strategies to manage quantitative circumstances. Similarly, number sense is defined as the ability to comprehend the meanings of numbers, to develop multiple relations between numbers, to know related quantities and to operate with numbers (National Council of Teachers of Mathematics [NCTM], 1989). Even though each one of these definitions provide different perspectives regarding number sense, the basic characteristics of number sense, in general, cover using different numeric representations, knowing relative and absolute sizes of numbers, selecting and using reference points, separating and re-arranging numbers, grasping the associated effects of the operations on numbers and making flexible and correct mental calculations and estimations (Reys & Yang, 1998).

Components of number sense

Based on studies conducted on babies, adults and animals, it could be safe to claim that animal creatures' (including human) cognition has a different core systems for the representation of numbers and that the number component, or the core systems of number found in it consists of two sub-systems called approximate number system (ANS) and exact number system (ENS) (Feigenson et al., 2004; Spelke & Kinzler, 2007). It is also claimed that in addition to the one found in animals, humans have an additional sub-system, which is used to make a connection with quantity and its representations with symbols (Rousselle & Noel, 2007). Thanks to this system one can learn advanced mathematics (Butterworth, 2005). With that in mind, the current study is addressing the basic components of the core number system, which is deemed to be inherent in humans.

With regards to these components, while exact number system (ENS) is emphasizing the importance of expressing exact values of numbers (mostly quantities smaller than 5), approximate number system (ANS) is more about determining the approximate values of quantities (Izard, Pica, Spelke & Dehaene, 2008; Olkun, Altun, Göçer Şahin, & Akkurt-Denizli, 2015a). Access to Symbol System (ATS), on the other hand, is the function of accessing the magnitude through symbols or symbols through magnitudes (Rousselle & Noel, 2007).

Some researchers' claim that individual differences observed in school mathematics achievement is due to the sensitivity of ANS (Mazzocco, Feigenson & Halberda, 2011; Hellgren, Halberda, Forsman, Aden & Libertus, 2013). They further claimed that the most probable reason behind dyscalculia is the deficiency in ANS sensitivity (Mazzocco et al., 2011; Libertus, Feigenson & Halberda, 2011). Some other researchers however believe that dyscalculia is due to the deficiency of ENS (Landerl, Bevan & Butterworth, 2004). In contrast to these hypotheses, it is also claimed that dyscalculia is not caused by ANS and or ENS but it is rather caused by the inability to establish a connection between quantity and its symbolic representation, or in other words, by the deficiency of accessing size through symbols or accessing symbols through size (Rousselle & Noel, 2007; Girelli, Lucangeli & Butterworth, 2000).

The relation between the components of number sense and mathematics achievement

A number of studies have been conducted to reveal the relation between the three sub-systems (ENS, ANS, ATS) of number sense components and mathematics achievement (Izard et al., 2008, Siegler & Booth; 2005; Starr, Libertus & Brannon, 2013). One or more of the three systems of number sense are believed to be the reason behind the failure of individuals in mathematics, or in other words, the difficulties they face when learning mathematics. There are a number of counter-findings related to the impact of the performance of these three sub-systems on mathematics achievement. While some advocate a strong relation between approximate number system's (ANS) sensitivity and mathematics achievement (Starr et al., 2013; Wilson & Dehaene, 2007; Halberda, Mazzacco & Feigenson, 2008; Libertus et al., 2011; Olkun, Sarı & Smith, 2019; Sarı & Olkun, 2018; Olkun, Mutlu & Sarı, 2017),

some others believe it is actually the exact number system (ENS) sensitivity which determines mathematics achievement (Landerl, Bevan & Butterworth, 2004; Butterworth & Laurillard, 2010). There are also others who believe in a connection between high performances in access to symbol system (ATS) and mathematics achievement (Rousselle & Noel, 2007; Rubinsten & Henik, 2005). Hence, core deficit, containing all or some of ANS, ENS and ATS could be the reason behind mathematics achievement or mathematics failure of individuals (Butterworth, 2010; Olkun et al., 2015).

Starr et al. (2013) sees ANS sensitivity as an important predictor of mathematics achievement and quantitative knowledge. Furthermore, ANS sensitivity is seen as the basis for future mathematics achievement. Symbolic arithmetic is claimed to have been constructed on more primitive, approximate quantitative representations. There are also some evidences that show spatial skills are equally important for visualising a number or a quantity, or shortly, for visual representation (Olkun & Sarı, 2016). Similarly, Wilson & Dehaene (2007) deem ANS as the basic system of quantitative knowledge and arithmetic ability and believe any disorder in ANS will lead to disorders in both symbolic and non-symbolic quantitative operations. Therefore, children with ANS disorders can experience difficulties in deciding which digit is greater in a two-digit number, making predictions on a visual number line, and making calculations etc. (Wilson & Dehaene, 2007).

Developing the components of number sense

The ever-growing importance of mathematical skills in reaching academic and professional success in the modern world is a fact. When teaching mathematics, the highly complicated processes of the domain-specific cognitive development must be taken into consideration. Almost every child is unique in developing numerical skills. In particular, the fact that individuals with difficulties in learning mathematics lag two-years behind their peers (Shalev, 2004) led researchers to provide additional learning opportunities that aim to support them to catch with their peers by increasing their potential to learn in regular classes.

Early detection of dyscalculic students and the effectiveness of the education provided to such students are deemed to be an opportunity to lead them out of failure (Olkun, 2012). Because brain plasticity is at a very high level during early ages (Zamarian, Ischebeck, & Delazer, 2009). In other words, brain is more flexible during the younger years in terms of learning, renewing and improving abilities, hence intervention programs are being developed for younger children (See Whyte & Bull, 2008; Griffin, Case & Siegler, 1994; Käser, Baschera, Kohn, Kucian, Richtmann, Grond, Gross, & von-Aster, 2013; Wilson, Revkin, Cohen, Cohen, & Dehaene, 2006).

Dyscalculics are experiencing problems with such quantitative competencies as counting, magnitude comparison, arithmetic, number words, spatial representations of numeric quantities (Kucian & von-Aster, 2015). Previous studies paid particular importance to developing basic quantitative skills such as writing the numbers, comparing quantities, ordering numbers in terms of their sizes. In this sense, the fact that traditional interventions are not fully effective on students with a poor number sense, led researchers and educators towards different educational intervention techniques (Shalev, Manor & Gross-Tsur, 2005). More recently however, attention has been given to such basic skills as guessing the position of a given number on a number line. This is because these skills form the basis of number sense and is the building blocks for complicated skills, hence becoming a predictor for future mathematics achievement (Whyte & Bull, 2008).

A review of literature indicates that priority is given to intervention programs supporting approximate number system (ANS) and exact number system (ENS) within the core deficit hypothesis for students with dyscalculia. Development of ANS is prioritized more due to the theory claiming younger children with mathematical difficulty have insufficient estimation skills (Siegler & Booth, 2004; Booth & Siegler, 2006; Whyte & Bull, 2008; Kucian et al., 2011), as the mental number line estimation accuracy of children are believed to be associated with other basic quantitative/arithmetic competencies and mathematics achievement. Experiences related to the development of children's

knowledge on quantity are said to be effective on their future learning of arithmetic and other mathematical skills (Laski & Siegler, 2014; Moeller, Fischer, Nuerk & Cress, 2015; Olkun et al., 2015a; Siegler & Ramani, 2009). Therefore, researchers have developed simple board games and computer games, assisting ANS, and applied to pre-school children and primary school students with a poor number sense. Previous works held on developing the number sense are summarized in Table 1 in the Appendix.

Activities related to developing number sense are based on two different approaches (Table 1). One of these approaches is simple board games. Aiming to develop number sense, the board games have been designed on the basis of the household game Chutes and Ladders (Figure 1). Chutes and Ladders is a game that consists of numbers starting from zero and increasing consecutively until 100.

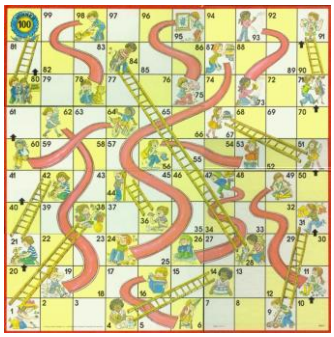

Figure 1. Chutes and Ladders

Figure 2. Number board

As seen on Figure 2, authors of these games have placed the board games in a square like hundred table. They claim that since the numbers are placed in order and in equal intervals, such board games are supposedly helping linear lines or imaginary number lines to be perceived physically (Siegler & Booth, 2004; Siegler & Ramani, 2008). As reported by Siegler and Booth (2004), board games provide various clues regarding the order and size of numbers. When a child moves the token in the game, the greater number the token reaches (a) the distance travelled by the token, (b) the number of each moves by child, (c) the amount of numbers heard and spoken by the child and (d) the time passed while moving are increasing proportionally. However, contrary to the number line, number 1 in these board games is visually closer to number 11 when compared to the distance between number 10 and number 11, therefore it may not be possible to establish a direct number-size relation. The distance travelled and the time passed might be related to the size of the numbers but the distance between the static numbers or relative locations of numbers, as in 1 and 11, do not seem to be conveying the relative sizes of numbers.

Previous studies confirm that consecutive board games help to develop a child's perception of numbers, even if they do not provide him/her through a real linear approach. These studies have also proven that it is possible to train and develop spatial representation of quantities both in typically developing children and in those with a developmental dyscalculia (Siegler & Ramani, 2008; Siegler & Ramani, 2009; Ramani & Siegler, 2008; Wythe & Bull, 2008). In addition to developing the accuracy of mental number line, simple consecutive board games are also observed to assist other quantitative abilities such as counting skills, naming numbers and comparing numbers which are not taught directly in these games (Ramani & Siegler, 2008; Laski & Siegler, 2014). However, their effect on mathematics achievement in a broader sense is unclear.

The second approach in studies held to develop number sense is the use of digital technology in cognitive training. An attempt has been made by researchers to use technology-assisted education to develop number sense by taking into consideration the positive effects of board games on the quantitative development and mathematics achievement of children (See Fischer et al., 2011; Fischer et al., 2015; Kucian et al., 2011; Käser et al., 2013; Kiili et al., 2015; Link et al., 2013; Link et al., 2014; Wilson et al., 2006). Moreover, researchers utilized digital technologies, particularly due to the

possibility of designing in accordance with every child's skill and the opportunity to provide intense education within a stimulant environment (Kullik, 2004). Furthermore, the use of technology in education is yielding significant results in both behavioural and neural terms and this created new paths for researchers (Moeller et al., 2015). For instance; providing technologic assistance in learning environments can help to create learning environments that conform to children's cognitive or performance profiles. Technology can create motivation and enhance positive identity perception by helping each student to gain a sense of achievement (Käser et al., 2013).

In summary, findings related to both board games and technology-based games developed to improve number sense indicate that an education program related to the spatial representations of numbers not only enhances the ability to correctly position numbers on an imaginary number line but it also develops other quantitative competencies (comparison of size, arithmetic operations etc.). It has been further shown that a well-designed mathematics learning game, even in a short period of time, can lead to significant leaps forward in mathematical competency and such leaps can be transferred into other fields of mathematics (Kiili et al., 2015).

In conclusion, the findings of previous studies are indicating that the design of unique learning environments aiming to develop number sense through educational interventions are promising. Even though the educational interventions provide researchers with an idea about the development of number sense, a number of limitations in these studies are making it difficult to generalize these studies to a wider scale. For example, it has been reported that in many studies aiming to develop number sense, retention is not measured (Käser et al., 2013; Wythe & Bull, 2008; Wilson et al., 2006). Most of the studies are conducted on a very small sample group (N≤10) (Käser et al., 2013; Kiili et al., 2015; Wythe & Bull, 2008; Wilson et al., 2006), and the target mass of most games are preschool children. Programs designed for preschool children are mostly concentrating on constructing basic quantitative skills. However, programs designed for primary school children need to be targeting a wider skill range (counting, arithmetic, estimation, spatial perception etc.) (Käser et al., 2013). It has been particularly observed that the training programs are not tested with regards to their reflections on arithmetic achievement and mathematics achievement.

The purpose of this current study is to investigate the effects of technology-assisted educational games, designed to develop number sense of fourth graders, on developing the number sense of students and the effects on their mathematics achievement and arithmetic performances. Ethical permission has been granted by NHBV University Ethical Committee with its 2nd meeting on February 5, 2018.

METHODS

Research Design

This study has been designed as a quasi-experimental design with a pre-test—post-test control group (Büyüköztürk, 2014). Quasi-experimental models are preferred when the controls required by real-experimental models cannot be met or are insufficient (Karasar, 2012, p.99). In this design, participants are tried to be matched from self-forming groups (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2009, p.206). In this sense, this current study has used quasi-experimental design, as there was no way of randomly assigning the participants into experimental and control groups. Despite being a strong research model, the pre-test—post-test control design does at the same time contain some weaknesses such as the risk of sensitivity mitigation of subjects as measurement tools are administered twice to the groups. Therefore, it is suggested to perform a retention test after a while completing the experimental intervention (Heppner, Kivlighan & Wampold, 1999). In this sense, three weeks after the end of the trail, a retention test has been conducted to see whether the impact of the program is still on.

Study Group

The study group consists of 4th graders selected from two different public primary schools located in mid socio-economic areas in Nevşehir province. Group matching method has been employed for determining the study group of the research. This method works by defining groups that are equal and/or close in terms of the averages of relevant variables (cited in Büyüköztürk, 2014 from Eckhardt & Ermann, 2014, p. 22). In order to conduct such a group matching, 4th grade students from different primary schools have been administered "Mathematics Achievement Test", "Arithmetic Performance Test", "Number Line Test" and Raven SPM test. In each school, students scoring the lowest 25% from all these tests, excluding the Raven SPMT, have been included in the study. Students performing in the bottom %15 in Raven SPMT were also excluded from the study. The mean and standard deviations of the scores obtained by the groups through the measuring tools applied as pre-test are shown in Table 2.

Table 2. Descriptive statistics of the pre-tests

Placement Test	Groups	N	Mean	Std.Dev.
Mathematics Achievement Test	Experimental	13	6.00	1.78
	Control	13	5.54	2.40
Arithmetic Performance Test	Experimental	13	66.00	11.40
	Control	13	65.15	12.63
Number Line Test, NLE-10	Experimental	13	26.61	9.48
	Control	13	34.21	18.43
Number Line Test, NLE-100	Experimental	13	432.71	142.21
	Control	13	439.11	103.17

Data Collection Tools

During the data collection phase, participants included in the experimental and control groups have been administered to mathematics achievement test, arithmetic performance test and number line test as pre-test, post-test and retention tests. Furthermore, RAVEN Standard Progressive Matrices test has been conducted to see whether the students in study group have at least certain intellectual level.

Mathematics achievement test (MAT) has been developed by Fidan (2013) for primary school 4th graders based on the number domain of the Turkish Mathematics Curriculum (Ministry of National Education, 2015). It contains such subtopics as counting numbers, number patterns, arithmetic operations and fractions among others. The KR-20 reliability coefficient of the test was calculated as .96, while the reliability coefficient of the current test has been calculated as .91. The duration of the test is one class hour. This test has been used in this study both to determine the sample groups, and to measure the effect of the specifically designed games on the mathematics achievement of the students.

Arithmetic performance test (APT), has been developed by De Vos (1992) and adopted into Turkish by Olkun, Can and Yeşilpınar (2013) and it consists of arithmetic operations (addition, subtraction, multiplication and division). It has a total of 200 questions, with 40 questions in each column. First column contains addition, 2nd column subtraction, 3rd column multiplication, 4th column division, and 5th column mixed operations. Olkun, Can and Yeşilpınar (2013), found the KR-20 reliability coefficient as .95 under time constraint. KR-20 coefficient has been calculated as .94 in this study. Each column is distributed separately to the students during the testing and the recommended duration for each column is 1 minute. This test is also used for determining the sample groups, to measure the effect of the specifically designed games on the arithmetic performances of the students.

Number Line Estimation Test (NLE) includes the task of estimating the position of a given number on a number line. Developed by Olkun and Sarı (2016), the content has been expanded as part of this study. Prepared as a computer-based program, "Number Line Estimation Test" is using number lines between the ranges of 0-10 and 0-100. Students performed two exercises, one for both ranges, before starting the actual test.

Raven Standard Progressive Matrices (Raven SPM) Test is measuring analytic thinking, problem solving, sequential thinking and the speed of abstraction and mental activity. In addition to general aptitude, the test is evaluating visual-spatial perception, judgement, mental flexibility, abstract thinking and analytic thinking, or fluid intelligence in other words (quoted by Başbay, 2008 from Kiriş & Karakaş, 2004). Raven SPM test is believed to measure analytic, regular and correct thinking ability, mental skill and activity speed independent from academic achievement or verbal ability (cited by Başbay, 2008 from Karakaş, 2004). Raven SPM test consists of 5 sets (A, B, C, D, E) and there are 12 questions in each set. A figure with a missing part is given in each set and students are asked to use one of the 5 options to complete the figure. The suggested duration for the test is 50 minutes. The test-retest reliability coefficient of Raven SPMT changes on the basis of time interval, sample size and age groups and the current test-retest reliability has been observed to be within the range of .55 and .93 (Khalek 1988; cited by Kurt, Bekçi & Karakaş, 2004). The purpose of having Raven SPM test in this study is to exclude the bottom 15% with the worst performance from the distribution of the scores to be obtained in this test. The reason for excluding this slice of students is that these students are most likely below-average mental capacity (Raven, Raven & Court, 2000).

Learning-Teaching Process

The experimental group played with three different games oriented to develop number sense in children. The games have been developed by the researchers based on similar traditional games. The names of the games are Adventures with Numbers: Archery, Adventures with Numbers: Treasure, and Adventures with Numbers: Slingshot. These games are meant to develop approximate number system (ANS) in children, as it is important for mathematical cognition. These games have been developed to ensure a development in spatial representation of numbers. They are being played on number lines with ranges of 0-10 and 0-100.

Feedback has been received from the colleagues to see whether the games reflect the aspects of ANS, and also to see if there are any limitations or deficiencies in the games. Feedback has been provided by field experts, through e-mail or face-to-face interviews. Experts from the fields of mathematics education and computer-education technologies have been consulted to receive their opinions about the conformity of the designed games. Details of these games are given below:

Adventures with Numbers: Archery

The scenario is based on shooting arrows. By touching and pushing it to the sides, the direction of the arrow changes. A target board appears where the direction meets the number line. When the child thinks the direction is pointing the correct position of the number, the arrow is shot to mark the target number on the number line (See, Figure 3 and 4).

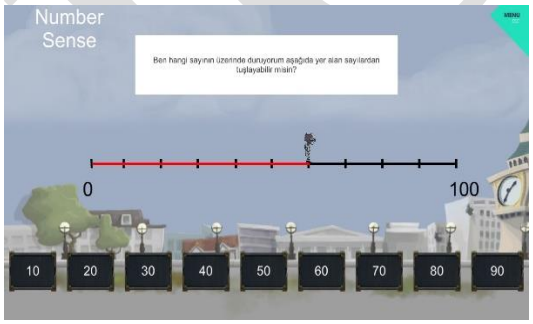

Figure 3. Practice with archery

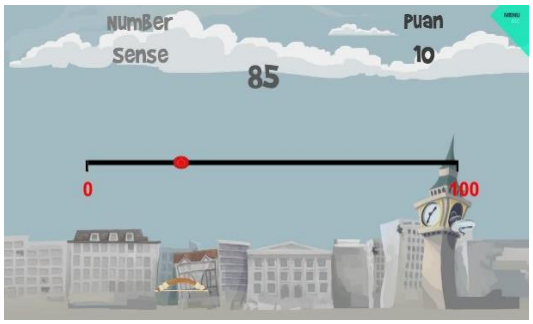

Figure 4. Actual game with archery

Adventures with Numbers: Slingshot

The scenario is shooting rubbles with a slingshot. The player is supposed to shoot the rubble on a target of his choice on the number line. After identifying the possible location of the number asked on

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the screen the slingshot is pulled and released and a red flag appears on the hit target (See, Figure 5 and 6).

Figure 5. Practice with slingshot

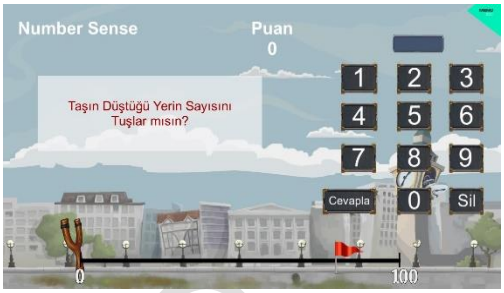

Figure 6. Actual game with slingshot

Adventures with Numbers: Treasure

The scenario is based on getting the gold placed inside the treasure chest. The game involves the child estimating the approximate value of the treasure chest's location on the number line to earn the gold inside it. The treasure chest hangs on the number line and the child estimates the approximate position of the chest to get the gold (See, Figure 7 and 8).

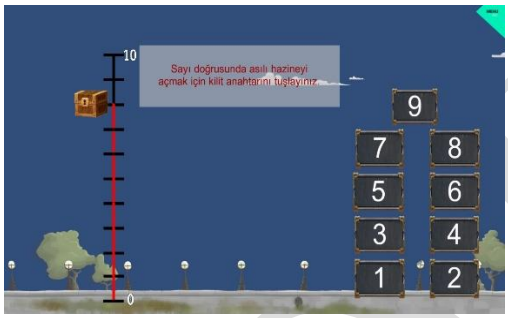

Figure 7. Practice with treasure

Figure 8. Actual game with treasure

All the above explained games have been played by the subjects on a tablet-PC in a dedicated classroom. A tablet-PC has been distributed to groups of two students and the three games were played by the students for two hours a week and a total of 6 hours. Post-tests have been conducted following the completion of the six-hour practise with games. Then a three-week break was given before conducting a retention test to observe retention. Meanwhile the control group students continued with their normal education in their classroom.

Data Analysis

Before deciding on which analysis technique is to be used, data have been reviewed to see if they meet normality assumptions such as Skewness and Kurtosis. Data of independent variables indicate that Skewness and Kurtosis values are lower than the accepted threshold of 1.96 (Can, 2014). It has been decided that data were distributed normally and parametric statistical analysis methods could be used.

In order to interpret the scores obtained from the "Mathematics Achievement Test" "Arithmetic Performance Test" and "Number Line Estimation Test" during the pre-test, post-test and retention test stages of the experimental design of the study, an independent sample test, independent t-test has been conducted (Büyüköztürk, 2010; Can, 2014). The total absolute error (TAE) scores were calculated for the NLE-10 and NLE-100 tests by using the formula "Estimations – to be estimated number)/scale" as suggested by Siegler and Booth (2004).

RESULTS

Pre-test scores of the experimental and control groups have been tested through an independent samples t-test analysis to see if their scores are similar in terms of number sense (NLE-10 and NLE-100), mathematics achievement, and arithmetic performance. The results of the analysis are given in Table 3.

Table 3. Comparisons of pre-test scores of experimental and control groups

Test	Groups	N	Mean	Std.Dev.	t	p*
NLE-10 Pre-test	Experimental	13	26.61	9.48	1.322	.203
	Control	13	34.21	18.43		
NLE-100 Pre-test	Experimental	13	432.71	142.21	.131	.897
	Control	13	439.11	103.17		
MAT Pre-test	Experimental	13	6.00	1.78	.557	.583
	Control	13	5.54	2.40		
APT Pre-test	Experimental	13	66.00	11.40	.179	.859
	Control	13	65.15	12.63		

*p<.05

Results indicated that the experimental and control groups involved in the study did not differ significantly in their number line estimations as measured by their total absolute errors in 0-10 interval number line [$t_{(24)}$=1.322, p>.05], and in 0-100 interval number line [$t_{(24)}$=.131, p>.05]. They were also not significantly different from each other in mathematics achievement scores [$t_{(24)}$=.557, p>.05], and arithmetic performance scores [$t_{(24)}$=.179, p>.05]. In other words, it could be said that prior to the experimental intervention, the achievement levels of groups were very close to each other.

We conducted independent samples t-test analysis to see if there are any differences between post-tests of the experimental and control groups number sense measurements where the experimental group played games designed to develop number sense while the control group had no such experience. The results are given in Table 4.

Table 4. Comparisons of experimental and control groups' number senses

Test	Groups	N	Mean	Std.Dev.	t	p
NLE-10 post test	Experimental	13	8.08	3.34	2.637	.014*
	Control	13	21.76	18.41		
NLE-100 post test	Experimental	13	183.03	46.37	3.124	.005**
	Control	13	272.80	92.67		

*p<.05; **p<.01

As seen in Table 4, it has been observed that there were significant differences between estimation scores as measured by total absolute errors both in 0-10 interval number line [$t_{(24)}$=2.637, p<.05] and in 0-100 interval number line [$t_{(24)}$=3.124, p<.01]. This observed difference between averages of the groups is in favour of the experimental group. In other words, it can be said that Tablet-PC applications used by the experimental group to develop number sense led to an improvement for the number line estimation skills of students in the experimental group. It can also be said that through the games the number line estimation skills of the experimental group students become more accurate when compared to control group students.

We conducted independent samples t-test analysis, to see if there were any differences between the mathematics achievement and arithmetic performances of experimental and control groups after the intervention. As presented in Table 5, a significant difference has been observed between the experimental and control groups mathematics achievement scores [$t_{(24)}$=3.098, p<.005]. This observed difference is in favour of the experimental group. In other words, Tablet-PC applications used by the

experimental group to develop number sense led to an improvement in mathematics achievements of the students.

Table 5. Comparisons of experimental and control groups' mathematics achievement and arithmetic performances on post-tests

Test	Groups	N	Mean	Std.Dev.	t	p
MAT Post-test	Experiment	13	13.00	2.04	3.098	.005*
	Control	13	9.00	4.18		
APT Post-test	Experiment	13	80.92	14.71	.663	.514
	Control	13	76.76	17.14		

*p<.01

A comparison of arithmetic performances of the groups involved in the study (Table 5) has not indicated any significant difference between the post-test scores of experimental and control groups [$t_{(24)}$=.663, p>.05]. In other words, the games designed to develop number sense did not have any additional effect on the arithmetic performances of the students in the experimental group. In fact, both experimental and control groups' scores improved nearly equally. Arithmetic performance is more about Exact Number System (ENS). This study however, has only targeted approximate number system (ANS). So, this is an expected result.

Retention tests

Looking at the results of the retention test score averages (Table 6), held three weeks after the completion of the experimental intervention, there were significant differences among total absolute errors in number line estimations of both in 0-10 interval number line [$t_{(24)}$=2.274, p<.04] and in 0-100 interval number line [$t_{(24)}$=2.867, p<.012]. These observed differences are in favour of the experimental group.

Table 6. Comparisons of number line estimations of experimental and control groups

Test	Groups	N	Mean	Std.Dev.	t	p
NLE-10 Retention	Experimental	13	8.06	3.46	2.274	.040*
	Control	13	16.34	12.66		
NLE-100 Retention	Experimental	13	164.67	34.54	2.867	.012*
	Control	13	242.04	90.96		

*p<.05

Table 7 indicates a significant difference between the experimental and control groups in terms of mathematics achievement retention test held three weeks after the experiment [$t_{(24)}$=2.274, p<.05] but no such difference has been observed again between the groups in terms of arithmetic performance [$t_{(24)}$=1.287, p>.05]. The observed difference in mathematics achievement in favour of experimental group in post-test has continued in the retention test. Similarly, there was no difference between the experimental and control groups in terms of arithmetic performance in the post-tests and the same applies to the retention test.

Table 7. Comparisons of mathematics achievement and arithmetic performance of experimental and control groups

Test	Groups	N	Mean	Std.Dev.	t	p
MAT Retention	Experiment	13	12.77	1.96	2.774	.012*
	Control	13	9.54	3.71		
APT Retention	Experiment	13	81.85	12.18	1.287	.210
	Control	13	73.92	18.55		

*p<.05

DISCUSSION and CONCLUSIONS

Educational interventions that conform to new approaches targeting individuals with number sense insufficiency or mathematics difficulty are still on a developmental stage. Early detection of individuals with number sense insufficiency or mathematics difficulty and developing suitable intervention programs for them is important for the development of mathematical skills of these individuals. Previous studies on number sense or mathematics difficulties in primary school do provide us with some ideas, however the effect of developing different components (approximate number system, exact number system, access to symbol system) of "number sense" on mathematics achievement has not been fully studied. Such studies are only being brought recently to the field of mathematics education. Studies held in Turkey, for instance, are mostly on identifying individuals with a lack of number sense and revealing the relation between number sense and mathematics achievement (Olkun, 2012; Olkun et al., 2015a; Olkun & Akkurt-Denizli, 2015b; Yaman, 2014). There is only one study conducted in Turkey with the purpose of developing number sense through educational-experimental intervention (See Olkun & Özdem, 2015c). It targets subitizing and arithmetic facts components of the exact number system.

The current research is investigating the number sense development of fourth graders with low mathematics achievement through technology-assisted games. It also aimed at investigating the effect of number sense games on mathematics achievement and arithmetic performance. Furthermore, retention tests have been conducted to obtain findings related to the reflections of the games on number sense development, mathematics achievement, and arithmetic performance.

The education activities held in the experimental group through tablet PC games led to a significant improvement in the number line estimation skills of students with low achievement in mathematics and a decrease in total absolute errors in their number line estimations. This finding is an indication that it is possible to train and develop the spatial representation of numbers. The greater improvement in the number sense of the experimental group students compared to control group students conform to the findings in literature. Spatial accuracy of number line estimations has been observed to develop in education activities aiming to develop quantity representation both in dyscalculic and in normal developing children (Siegler & Ramani, 2009; Whyte & Bull, 2008; Wilson, Revkin, Cohen, Cohen & Dehaene, 2006; Käser, Baschera, Kohn, Kucian, Richtmann, Grond, Gross & von-Aster, 2013; Kucian, Grond, Rotzer, Henzi, Schönmann, Plangger, Gälli, Martin & von Aster, 2011; Fischer, Moeller, Bientzle, Cress & Nuerk, 2011).

Further to teaching spatial representation of numerical magnitudes, the games played during the experiment also contributed to a development in mathematics achievement. A significant increase has been observed in the numeric performances of experimental group students with lower mathematics achievement. This significant finding is an indication that it is possible to increase mathematics achievement of a child by developing approximate number system, which is an important dimension of inherent number sense. Previous studies have also provided evidence regarding the existence of the relation between approximate number system sensitivity and mathematics achievement (Kucian et al., 2011; Kucian et al., 2013; Griffin et al., 1994; Link et al., 2013).

Kucian et al., (2011) reported that education programs provided for developing the quantity representation in dyscalculic children have a positive effect on the mathematical achievement of these children. Ramani and Siegler (2008) on the other hand, concluded that playing with simple linear board games not only develop spatial accuracy of mental number line but it also has a positive impact on other quantitative tests such as counting skills, naming numbers and number comparison, which cannot be taught directly during the linear board games. It has been reported that a well-designed mathematics learning game, even in a short period of time, can lead to significant leaps forward in mathematical competency and such leaps can be transferred into other fields of mathematics (Kiili et al., 2015). The findings of the current study provided additional evidence to the improvability of mathematics achievement through number sense training.

Another significant finding of the current study is the fact that tablet-PC games designed in accordance with the approximate number system did not yield a meaningful difference between the arithmetic performances of experimental group students. Despite an increase in the arithmetic performances within the groups, no significant difference has been observed among the experimental and control groups. There are evidences in the literature indicating that the approximate number system and exact number systems of individuals with counting and calculation difficulties are not working properly (Landerl, Bevan & Butterworth, 2004). There is an ongoing debate about arithmetic operations, in the sense that whether they are performed with exact number system or approximate number system. But there are evidences that both systems are being used (Cohen & Dehaene, 2000). For instance, students who internalized the rules of numbers and are operating with any two numbers, provide a single answer as it should be (such as 6+5=11) while students with difficulties in calculation can provide multiple answers (such as 6+5=10 or 12). This is an indication that along with exact number system, approximate number system is also involved. Over time, it is possible to give the correct answer off by heart as a result of internalizing.

Findings related to retention indicate that the success achieved in post-test total absolute errors in number line (0-10 and 0-100) estimations has continued in retention test. Specifically, total absolute error of experimental group students receded from 183.03 to 164.67 in the post-test. That means students in the experimental group improved their approximate number system relatively permanently. Something similar has also been observed in mathematics achievement test retention scores. The difference between the experimental and control group students, as obtained in the post-test, has been observed in the retention test too. In terms of arithmetic performances, no differences were observed in the post-test and in retention test between the experimental and control group students. Despite indicating that quantity representation activities have an impact on number sense and mathematics achievement, no evidence has been produced on any impact on arithmetic performance.

ANS sensitivity is deemed to be the predictor behind future mathematics achievement and symbolic arithmetic is deemed to be constructed on more primitive quantitative representations (Starr, Libertus & Brannon, 2013). Although we did not find any evidence of arithmetic improvement in this study, Wilson, Revkin, Cohen, Cohen & Dehaene, (2006) reported a significant increase in the basic number sense performances of children, and the ratio of correct answers in subtraction exercises had a reported average increase of 23%. There was no improvement observed throughout the study with regards to the performances in addition exercises and in base-ten conception exercises. In previous studies Olkun, Mutlu and Sarı (2017) found that the number line estimation skills of students within the 0-100 interval account for 5% of the variance in arithmetic performance. In the same study, Weber fraction and NLE 10 (small numbers) contributed more to arithmetic performance as measured by Arithmetic Performance Test (APT) than mathematics achievement as measured by MAT. On the other hand, NLE 100 (large numbers) contributed more to mathematics achievement than arithmetic performance (Olkun et al., 2017).

Suggestions

In summary, estimation acuity, a component of number sense, is related to the future mathematics achievement (Berch, 2005) but may not be that directly related to arithmetic performance, which depends mostly on exact number system. With regards to arithmetic performance, activities targeting exact number system may be necessary. This hypothesis can be tested in future studies.

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Appendices **

Table 1. A summary of the actions taken to improve components of number sense

Program name	Researchers	Age group	Education duration	Content	Research Limitations
Paper-pen and board games					
Number Board Games	Siegler & Ramani, 2009	4-5	3 weeks and 15-20 minutes a day	Approximate Number System (ANS) and Exact Number System	Retention not tested

				(ENS)	
Number Board Games	Whyte & Bull, 2008	3-4	4 sessions and 25 minutes in each session	ANS	Retention not tested and there is no control group
Number Board Games	Siegler & Ramani, 2008	4-5	2 weeks and 15 minutes	ANS	There is no control group, retention not tested
Number Board Games	Ramani & Siegler, 2008	4-5	2 weeks and 15-20 minutes	ANS	There is no control group
Number Board Games	Laski & Siegler, 2014	6	3 weeks and two class hours a week 2 days and 1 hour a day	ANS	Retention not tested and there is no control group, sampling group not sufficient
Disorganized Point Counting Game	Authors, 2015	8-9		ENS	Retention not tested
Technology assisted educational games					
Number Race	Wilson, Revkin, Cohen, Cohen & Dehaene, 2006	7-9	5 weeks and half an hour a day	ANS and ENS	Studied a small-sized group (n=9), retention not tested and there is no control group.
Calcularis	Käser, Baschera, Kohn, Kucian, Richtmann, Grond, Gross & von-Aster, 2013	8-11	6-12 weeks and 20 minutes a day	ANS and ENS	Retention not tested, dyscalculic students not identified through a standard test and there is no control group.
Rescue Calcularis	Kucian, Grond, Rotzer, Henzi, Schönmann, Plangger, Gälli, Martin, & von Aster, 2011	8-10	5 weeks and 15 minutes a day	ANS and ENS	Groups have different intellectual levels, retention not tested in control group, sample group is limited
Digital Dance mat Training	Fischer, Moeller, Bientzle, Cress & Nuerk, 2011	5-6	3 weeks and 15 minutes a day	ANS	Tool used in education is not common,
Kinect training	Link, Moeller, Huber, Fischer & Nuerk, 2013	7	3 class hours	ANS	Mechanism occupies a lot of space, there is a need for a longer term activity
Digital Dance mat Training	Link, Schwarz, Huber, Fischer, Nuerk, Cress & Moeller, 2014	8	-	ANS	-
Full-body Movement	Fischer, Moeller, Huber, Cress & Nuerk, 2015	7-8	15 minutes	ANS	Lack of time, trial and control groups unevenly distributed, sample group size is small
Semideus	Kiili, Devlin, Perttula, Tuomi & Lindstedt, 2015	12-13	2 months and 40 minutes a week	ANS	Retention not tested, Sample size is small, group equality lacking, duration not sufficient

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THE EFFECTS OF EXTRINSIC AND INTRINSIC FACTORS ON TEACHERS' JOB SATISFACTION IN TALIS 2018

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Abstract

Investigating whether the effects of extrinsic and intrinsic factors on teachers' dissatisfaction with the teaching profession show variation between countries is crucial, especially given the significant impact on quality of instruction, which is also associated with student performance. In this respect, the main aim of this study is to reveal the effects of a group of variables categorized as extrinsic and intrinsic factors and covered in OECD's 2018 Teaching and Learning International Survey (TALIS). These factors include teacher-student relations, perceived value of teachers in their society, the participation of stakeholders in school decisions, teacher cooperation, teacher salary satisfaction, teacher gender, socioeconomic status (SES) composition of the class, teacher workload, and this study examines TALIS results from Finland, Italy, and Turkey. Structural equation modelling (SEM) were carried out to reveal relationships between extrinsic factors and teacher satisfaction with the profession, to investigate the effects of extrinsic and intrinsic factors on the dimensions of teachers' satisfaction, and to reveal relationships among the dimensions of teacher satisfaction. In addition, the probability of having dissatisfied teachers with their jobs for each country were estimated by using two consecutive multiple logistic regressions. The results indicated that teachers' satisfaction with the environment had a positive effect on satisfaction with the profession, which is highest in Finland compared to Turkey and Italy. In addition, when a group of variables are controlled for, teachers' dissatisfaction with the profession was highest in Finland among the three countries and lowest in Turkey.

Keywords: Teachers' job dissatisfaction, TALIS 2018, structural equation modelling (SEM)

INTRODUCTION

Unquestionably, one of the determinants of the quality of instruction is teacher quality (Hanushek & Rivkin, 2010). Some basic conditions are expected to be provided for the teacher, who is regarded as the main component for improving the quality of instruction. As well as teacher training, teacher job satisfaction has been noted as one of the conditions that improve the quality of instruction (Iwu, Ezeuduji, Iwu, Ikebuaku & Tengeh, 2018). Therefore, revealing the factors ensuring teacher job satisfaction should be considered first in efforts to improve the quality of instruction.

Investigating the factors that affect teacher job satisfaction will enable us to reveal the reasons that hinder increasing quality of instruction. In addition, studies show that there is a significant relationship between teacher attrition and dissatisfaction with the teaching profession (Johnson, Kraft & Papay, 2012). Teacher retention seems to be the other crucial and problematic issue that should be considered. For example, in the United States, the need for qualified science and math teachers is 2.5 times higher than the retired teachers; in Norway, 4.6% of teachers left their profession during a period of one year (Mostafa & Pal, 2018). Moreover, the teacher attrition rate is increasing in some countries, including Australia, China, and England (Mostafa & Pal, 2018). Therefore, teacher job satisfaction/dissatisfaction is an important issue that should be emphasized as it affects retention. Job satisfaction, which is very important for continuing the profession, contributes not only to the motivation and development of teachers but also to the learning and development of students (Perie, Baker & Whitener, 1997). This is because the instruction that the teacher provides is affected by the teacher's job satisfaction.

Since job satisfaction is a sophisticated concept consisting of a series of factors related to a job (Ouyang & Paprock, 2006), all these factors should be considered in situations that affect teacher job satisfaction. In the literature, some studies categorize factors that affect teacher job satisfaction into three clusters – community factors, school factors, and teacher characteristics (Ouyang & Paprock, 2006) – others examine factors related to teacher job satisfaction by dividing them into two main categories: extrinsic and intrinsic factors (Gkolia, Belias, & Koustelios, 2014). Extrinsic (job satisfaction with the work environment) and intrinsic (job satisfaction with the profession) factors are related with teacher job dissatisfaction in several studies (Hauber & Bruininks, 1986; Hirschfeld, 2000). Extrinsic factors are defined as the external benefits provided by the organization, and intrinsic factors are controlled by many forces affecting the professional's internal satisfaction (Randolph & Johnson, 2005). While the extrinsic category includes some tangible factors such as school safety, salary, workload, teachers' status in society, school resources, and perceived support from administrators, the intrinsic category includes working with students, teacher control over the class, classroom activities, and students' characteristics (Madero, 2019; Mostafa & Pal, 2018).

When extrinsic factors are examined, teacher cooperation, salary, participation of stakeholders in the school decisions, and perception of value given by society are remarkable. Although the effect of salary on teacher satisfaction seems to have reduced over time (Klassen & Anderson, 2009), it has always maintained its effect on continuing work (Khazaei et al., 2016). Another factor, teacher cooperation and collegiality, are emphasized since it is considered to be a component of communities of practice and professional learning communities (Bolam & McMahon, 2004). Teacher cooperation has also been significant predictor of job satisfaction (Durksen et al., 2017). Similarly, among extrinsic factors, teacher-student relationships have an impact on job satisfaction, and this relationship is important to keep experienced teachers in the profession (Veldman, van Tartwijk, Brekelmans, & Wubbels, 2013). In addition, stakeholder participation is a significant factor. Stakeholder participation in school-based management is a means by which schools as organizations develop themselves through expanded productivity and efficiency (Botha, 2007). In this way, teachers' organizational commitment is expected to be high. The next extrinsic factor is the value of teachers in their society. Workload, the last extrinsic factor, is found to be a significant predictor of anxiety and depression (Ferguson, Frost & Hall, 2012), which are also strongly related with dissatisfaction. On the other hand, when intrinsic factors are examined, we see gender and class socioeconomic composition as significant. Although the relationship of gender with job satisfaction is generally discussed with a focus on career planning, there are studies on the effect of gender on job satisfaction (e.g., Menon & Athanasoula-Reppa, 2011). Since the socioeconomic level of students in the classroom affects job dissatisfaction in terms of the varieties of problems encountered, it is also taken into consideration.

In the last decade, many studies have been carried out to reveal the factors that have potential to affect teacher job satisfaction (e.g., Madero, 2019; Malinen & Savolainen, 2016; Okeke & Mtyuda, 2017; Sahito & Vaisanen, 2020). However, few of them focused on the comparison of job satisfaction by considering intrinsic and extrinsic factors across countries based on an international large-scale assessment. The TALIS 2018, which was carried out by OECD (The Organisation for Economic Co-operation and Development), provides us with useful dimensions related to teacher job satisfaction, including extrinsic factors such as teacher cooperation in schools, student and teacher relations in schools, participation of stakeholders in school decisions, teachers' perceived value in their society, and teacher workload and intrinsic variables, including teacher gender and the socioeconomic composition of classes (Ainley & Carstens, 2018).

In this study, we have investigated the direct effects of the extrinsic and intrinsic factors included in the TALIS 2018 on teacher satisfaction across Turkey, Finland, and Italy. In addition, the variation in teacher dissatisfaction has been examined by controlling for these factors across the three countries. The reasons for variation are also discussed by scrutinizing the educational systems and cultural differences in these three countries. The outstanding performance of students in Finland on the PISA (Programme for International Student Assessment) and the low performance of students in Italy and

Turkey on both the PISA and TIMSS (Trends in International Mathematics and Science Study) lead us to compare these three countries with regard to teacher job satisfaction.

Research Aims

This study has three aims. In the first phase of the study, the direct effects of extrinsic factors on lower secondary teachers' satisfaction with the profession are investigated and compared across Turkey, Finland, and Italy. The second aim of the study is to investigate whether dissatisfaction of lower secondary teachers show variation across three countries when the extrinsic (teacher cooperation, teacher-student relations, the participation of stakeholders in school decisions, teachers' perceived value in their society, teacher salary satisfaction) and intrinsic (teacher gender, class SES composition, teacher workload) factors included in the TALIS 2018 are controlled for. In addition, the probability of teacher job dissatisfaction is also interpreted regarding extrinsic and intrinsic factors, respectively. The last aim of this study is to investigate the effects of extrinsic and intrinsic factors on the dimensions of teacher job satisfaction, which were defined in the TALIS 2018 as teacher satisfaction with the work environment, with the profession, and with classroom control. In addition, the effects of these dimensions of teacher job satisfaction on each other are also examined and compared across Turkey, Finland, and Italy.

METHODS

Firstly, the sample of the study and the rationale behind the variable selection were described based on the related literature. In the first phase of the study, while dissatisfaction of teachers with their profession was determined as the dependent (response or predicted) variable of this study, independent variables (explanatory or predictor) were defined as teacher cooperation, teacher-student relations, participation of stakeholders in school decisions, teachers' perceived value in their society, teacher salary satisfaction, teacher gender, class SES compositions, and teacher workload. In the second phase of study, teachers' satisfaction with the work environment and teachers' satisfaction with classroom control were considered as dependent variables in addition to teacher satisfaction with their profession.

TALIS 2018 Data and Sampling

The third cycle of the TALIS (2018), which includes more than a hundred thousand teachers from 48 countries at the lower secondary level, deals with some of the important dimensions such as teachers' professional practices, instructional practices, feedback and development, education and initial preparation, self-efficacy, and job satisfaction (Ainley & Carstens, 2018). A stratified two-stage probability sampling design was used: in the first stage, schools in each country were randomly selected, and in the second stage the list of in-scope teachers was randomly selected. In-scope teachers were defined as the teachers who provide instruction at the lower secondary level for the International Standard Classification of Education (ISCED 2). Totally 10.415 (Turkey = 3952; Finland = 2851; Italy = 3612) teachers participated this study from three countries. The missing values did not exceed 2.2% for each recoded categorical response and explanatory variable. Therefore, the missing values were replaced with the mode for each variable (Tabachnick & Fidell, 2007).

Target Dimensions and Factors in TALIS 2018

In the TALIS 2018, numerous questionnaire items were presented related to teachers' attitudes, perceptions, and practices. These items allow for scale scores for latent constructs which are simply derived from the combination of the responses to the related items. In the TALIS 2018, these scale scores for latent constructs were produced by confirmatory factor analysis (CFA) latent modelling within the framework. The process which covers the scale score calculation includes the following steps: (1) Descriptive and internal consistency analysis, (2) CFA, (3) measurement invariance testing, (4) final score modelling, and (5) construction of the scale scores (OECD, 2019a). Scale scores were also presented in the TALIS 2018 database. For the aim of this study, when we examined the direct effects of extrinsic and intrinsic variables on teacher job satisfaction and investigated the relationships among job satisfaction dimensions, the scale scores were used directly. On the other hand, during the

investigation of the variation on teacher dissatisfaction across countries, scale scores were converted to the two-level categorical variables.

The dimensions of satisfaction with the profession, satisfaction with classroom control and satisfaction with the work environment were used as dependent variables in the analyses. The dimension of satisfaction with the profession comprises four items in the TALIS 2018 teacher questionnaire (OECD, 2019a):

> The advantages of being a teacher clearly outweigh the disadvantages (1), If I could decide again, I would still choose to work as a teacher (2), I regret that I decided to become a teacher (reversed scored) (3), and I wonder whether it would have been better to choose another profession (reversed scored) (4).

The dimension of satisfaction with the work environment includes items such as "I would like to change to another school if that were possible (reversed scored) (1), I enjoy working at this school (2), I would recommend this school as a good place to work (3), and All in all, I am satisfied with my job (4)." For the dimension of teachers' satisfaction with classroom control, teachers were asked to point out degree of control in the following areas: "Determining the course content, Selecting teaching methods, assessing students' learning, disciplining students, and determining the amount of homework to be assigned." The response options were strongly agree (4), agree (3), disagree (2), and strongly disagree (1) (OECD, 2019a). In this study, whereas the scale scores of three dimensions were taken directly for structural equation modelling (SEM), a two-level categorical variable was produced for the dimension of teacher satisfaction with the profession by setting a cut-off point, below which teachers are labelled as dissatisfied with their profession, and above the cut-off point the teachers are labelled as satisfied with their profession. In this way, this categorical variable could be used in logistic regression.

Teacher-student relations (Teach-stu), participation of stakeholders in school decisions (participation), teachers' perceived value in their society (value), and teacher cooperation are the dimensions which were used as dependent variables. Teacher-student relations (Teach-stu relations) includes four items, such as "Teachers and students usually get on well with each other (1), Most teachers believe that the students' well-being is important (2), Most teachers are interested in what students have to say (3), If a student needs extra assistance, the school provides it (4)" (OECD, 2019a). The factor of participation of stakeholders in school decisions comprises five items as follows (OECD, 2019a):

> This school provides staff with opportunities to actively participate in school decisions (1), This school provides parents or guardians with opportunities to actively participate in school decisions (2), This school provides students with opportunities to actively participate in school decisions (3), This school has a culture of shared responsibility for school issues (4), There is a collaborative school culture which is characterized by mutual support (5).

The dimension of teachers' perceived value in their society includes items such as: "Teachers' views are valued by policymakers in this country/region (1), Teachers can influence educational policy in this country/region (2), and Teachers are valued by the media in this country/region (3)" (OECD, 2019a). The response choices presented for these items range from *strongly agree* (4) to *strongly disagree* (1). The factor of teacher cooperation comprises eight items such as (OECD, 2019a):

> Exchange or develop teaching materials with colleagues (1), Discuss the learning development of specific students (2), Work with other teachers in this school to ensure common standards in evaluations for assessing student progress (3), Attend team conferences (4), Teach jointly as a team in the same class (5), Provide feedback to other teachers about their practice (6), Engage in joint activities across different classes and age groups (e.g. projects) (7), Participate in collaborative professional learning (8).

The response options were presented as "never (1), once a year or less (2), 2–4 times a year (3), 5–10 times a year (4), 1–3 times a month (5), and once a week or more (6)" (OECD, 2019a). The scale scores for these dimensions were taken for the SEM. In addition, for the logistic regression, two-level categorical variables were obtained by using the determined cut-off point on the scale scores.

In addition, salary satisfaction, class SES composition, and teacher workload were also used as explanatory variables for the logistic regression analyses. Although the amount of teacher wages was not asked directly, teachers' satisfaction with their salaries were presented as an item to indicate whether they were satisfied with the salary that they received for the teaching profession. The response categories presented range from strongly agree (4) to strongly disagree (1). We combined response options (1) strongly disagree and (2) disagree to indicate the (1) dissatisfaction with salary and (3) agree and (4) strongly agree under the label satisfaction with salary (0) (OECD, 2019a). SES composition of the class is the other variable that was derived from a single item. Percentage of students coming from socioeconomically disadvantaged homes asked to teachers. Teachers who indicated that the percentage of students from socioeconomically disadvantaged homes is more than 10% of the students in the classroom were labelled as teachers who have low-SES students in their classes (1). On the other hand, teachers who indicated that none of the students or less than 10% students in their classes were coming socioeconomically disadvantaged homes were labelled as teachers who do not have low SES students in their classes (0). The teacher workload variable was calculated by whether the teaching hours of teachers exceeds 67% of their total time in school (Modero, 2019).

The omega coefficients and stratified Cronbach's alpha for the three countries, which indicate satisfactory reliabilities for the dimensions, are presented in Table 1 (OECD, 2019a).

Table 1. Omega coefficients and stratified cronbach's alpha for the *dimensions*

Dimensions/Factors	Omega Coefficients		
	Turkey	Finland	Italy
Satisfaction with the profession	.86	.91	.91
Satisfaction with work environment	.86	.83	.84
Satisfaction with classroom control	.90	.87	.90
Teacher-student relations	.88	.80	.84
Participation of stakeholders in school decisions	.90	.80	.77
Teachers' perceived value in their society	.78	.83	.72
	Stratified Cronbach's Alpha		
Teacher cooperation	.87	.80	.79

Data Analysis

The two dada analysis methods performed in the study were structural equation modelling (SEM) and multiple logistic regression. SEM was carried out using LISREL 8.7, and logistic regressions were conducted using SPSS 26. In the first step, multiple regression analyses were carried out using LISREL for each country to produce path diagrams which explicitly show the relationships of extrinsic factors with teacher satisfaction with the profession. In the second step, two consecutive multiple logistic regression analyses were conducted to infer whether the odds of teacher dissatisfaction across countries varies by controlling for some of the extrinsic and intrinsic variables and to investigate whether the presence of the extrinsic and intrinsic factors have an effect on teacher dissatisfaction in Turkey, Italy, and Finland. In the third step, a structural model was conducted to test the relationship between extrinsic factors, teacher satisfaction with the profession, teachers' satisfaction with the work environment, and teacher satisfaction with classroom control.

In the first step, the teacher-student relations (Teach-stu), participation of stakeholders in school decisions (Participation), teachers' perceived value in society (Value), teacher cooperation (Cooperation), and teacher workload (Workload) were used as the predictor variables, and teacher satisfaction with the profession (Satisfaction) was used as the predicted variable. The multiple

regression analysis conducted to reveal the relationships between extrinsic factors and teacher satisfaction can be expresses with the following equation:

$$Satisfaction = \beta_0 + + \beta_1 Teach\text{-}stu_t + \beta_2 Participation_s + \beta_3 Value_t + \beta_4\ Cooperation + \beta_8 Workload$$

Multiple logistic regression, which was conducted in the second step, allows us to understand the impact of a set of predictors on the categorical explanatory variable (Pallant, 2011). It was run to understand which variables affect the teacher dissatisfaction with the profession. We can also interpret the probability of teacher dissatisfaction with the profession based on a group of predictors and various effects of the variables separately among the set of predictors on teacher dissatisfaction with the profession.

To investigate these aims, multiple logistic regression was run twice to infer whether the probability of teacher dissatisfaction changes across the countries by controlling for a group of explanatory variables, such as teacher cooperation, teacher-student relations, participation of stakeholders in school decisions, perception of teachers' value in the society, teacher salary satisfaction, teacher gender, class socioeconomic composition, and teacher workload. Based on this aim, we can express the equation as:

$$\Pr(Dissatisfaction_t = 1) =$$

$$\frac{(\beta_0 + \beta_1 T_t + \beta_2 F_t + \beta_3\ Cooperation_t + \beta_4 Teach\text{-}stu_t + \beta_5 Participation_s + \beta_6 Value_t + \beta_7 Salary_t + \beta_8 Gender_t + \beta_9 SES_c + \beta_{10} Workload_t)}{1 + exp\ (\beta_0 + \beta_1 M_t + \beta_2 M_t + \beta_3 Cooperation_t + \beta_4 Teach\text{-}stu_t + \beta_5 Participation_s + \beta_6 Value_t + \beta_7 Salary_t + \beta_8 Gender_t + \beta_9 SES_t + \beta_{10} Workload_t)}$$

The second multiple logistic regression was run to infer the presence of effects of teacher cooperations, teacher-student relations, participation of stakeholders in school decisions, perceptions of teachers' value in the society, teacher gender, class socioeconomic composition, and teacher workload on teachers' odds of being dissatisfied in Turkey, Finland, and Italy. We ran logistic regression for each country using the equation below:

$$\Pr(Dissatisfaction_t = 1) =$$

$$\frac{exp\ (\beta_0 + \beta_1\ Cooperation_t + \beta_2 Teach\text{-}stu_t + \beta_3 Participation_s + \beta_4 Value_t + \beta_5 Salary_t + \beta_6 Gender_t + \beta_7 SES_c + \beta_8 Workload_t)}{1 + exp\ (\beta_0 + \beta_1 Cooperation_t + \beta_2 Teach\text{-}stu_t + \beta_3 Participation_s + \beta_4 Value_t + \beta_5 Salary_t + \beta_6 Gender_t + \beta_7 SES_t + \beta_8 Workload_t)}$$

In the equations, the presence of teacher dissatisfaction, which is the binary indicator, was expressed as $Dissatisfaction_t$; teacher countries such as Turkey and Finland were expressed as T_t and F_t, respectively; $Cooperation_t$ represented collaborative actions employed by teachers; Teach-stud is student-teacher relations; participation of stakeholders in school decisions was expressed as Participations; $Value_t$ is the perceived value given to the teachers by the society; $Salary_t$ represented teacher salary satisfaction; $Gender_t$ is the teacher gender; perceived class SES composition was expressed by SES_c ; and teacher workload was represented by $Workload_t$.

Logistic regression is very sensitive to multicollinearity, which deals with the intercorrelations among the explanatory (predictor) variables and correlations between predicted variable and predictor variables. Pallant (2011) states that the independent variables should not be correlated to each other (tolerance value is determined to be less than .10) and there should be a robust correlation between independent variables and the dependent variable. The correlation matrix of the independent variables was checked, and none of the correlation coefficients exceeded the critical value of .10. In addition, before running the analyses, the distribution of the cases regarding the variables that were included in the analyses was carefully checked in case of the presence of outliers.

In the final step, a hypothetical model was constructed to investigate the relationships between extrinsic factors and the dimensions of teacher satisfaction, such as satisfaction with the profession, satisfaction with the work environment, and satisfaction with classroom control. The relationships among the dimensions of satisfaction were also revealed in the hypothetical model, which is presented in Figure 1.

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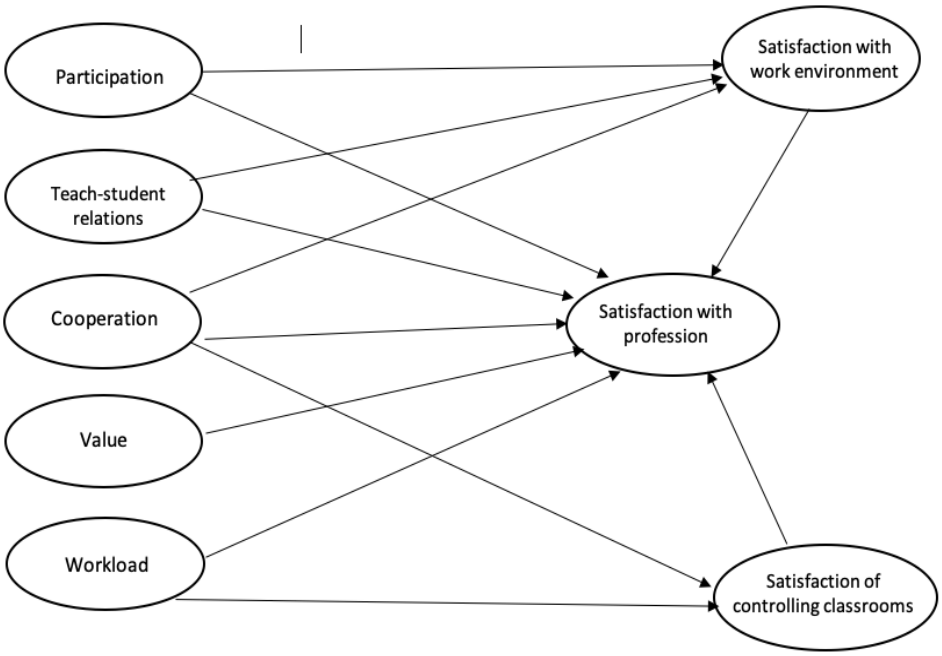
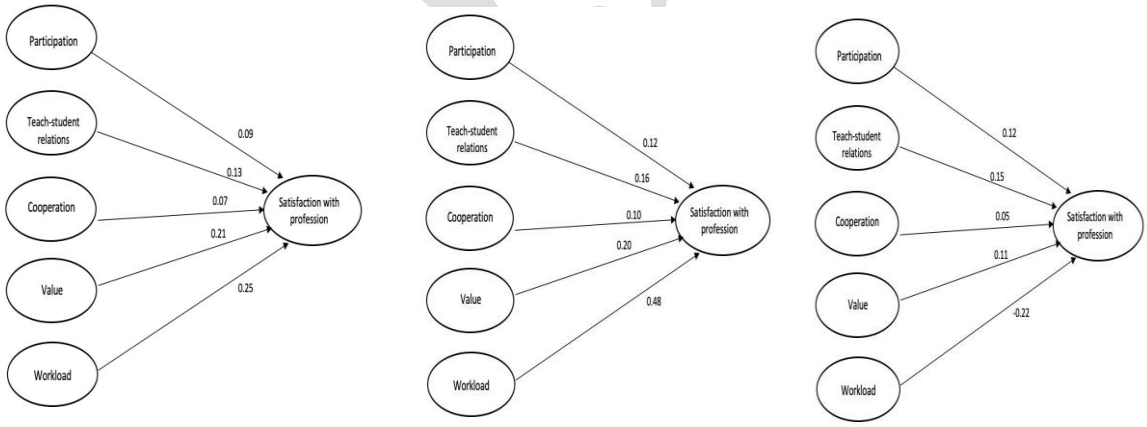


Figure 1. Hypothetical model

RESULTS

Firstly, multiple regression analyses were carried out by producing path diagrams though LISREL to compare the relationships between extrinsic factors such as teacher-student relations (Teach-stu), participation of stakeholders in school decisions (Participation), teachers' perceived value in society (Value), teacher cooperation (Cooperation), and teacher workload (Workload) with teacher satisfaction with the profession.



Turkey Finland Italy

Figure 2. Path diagrams of multiple regression analyses for Turkey, Finland, and Italy

The analysis showed that teachers' perception of value (Value), teacher-student relations (Teach-stu), participation of stakeholders in school decisions (Participation), and teacher cooperation (Cooperation) had positive effects oh teacher satisfaction with the profession for all three countries. However, the effects of teacher workload on satisfaction with the profession show some variation among countries. Whereas teacher workload had positive effects on satisfaction with the profession

for Turkey and Finland, the effect of teacher workload on satisfaction with the profession was found to be negative for Italy.

In the second step, the results of the analysis are presented using the related descriptive statistics. The sample includes 10 415 teachers for the aims of the study (Turkey=3952, Finland=2851, and Italy=3612). The percentage of teachers with respect to gender, SES compositions of their classrooms, and workload are presented in Table 2.

Table 2. Teacher gender, classroom SES composition, and workload (%)

	Turkey N = 3952	**Finland N = 2851**	**Italy N = 3612**	**Total N = 10415**
Gender				
Female	57.8	69.6	78.8	68
Male	42.2	30.4	22.2	32
Classroom SES Composition				
No low SES students	50.6	71.6	77.8	65.8
Having Low SES students	49.4	28.4	22.2	34.2
Workload of teachers				
Not overloaded	27.6	59.1	71.0	51.2
Overloaded	72.4	40.9	29.0	48.8

Table 3 presents teacher dissatisfaction in each country. In all three countries, approximately half of teachers reported dissatisfaction with the teaching profession. The percentages of teachers who were dissatisfied were 53.3%, 56.6%, and 53.2% in Turkey, Finland, and Italy, respectively.

Table 3. Teacher dissatisfaction with the teaching profession (%)

Dissatisfaction with the teaching profession	**Turkey N = 3952**	**Finland N =2851**	**Italy N = 3612**	**Total N = 10415**
Yes	53.3	56.6	53.2	51.6
No	46.7	43.4	46.8	48.4

The results of the first logistic regression analyses indicated that teacher dissatisfaction displays variations across the countries after controlling for teacher cooperation, teacher-student relations, and participation of stakeholders in school decisions, teachers' perceptions of value in society, teacher salary satisfaction, gender, perceptions of classroom socioeconomic composition, teacher workload (First logistic regression controlling for a group of variables).

Table 4. The odds ratios of dissatisfaction with the profession with regard to countries and teachers

	Estimated odds ratios (First logistic regression controlling for a group of variables)			**Estimated odds ratios (Second logistic regression)**		
	Model 1	**Model 2**	**Model 3**	**Turkey**	**Finland**	**Italy**
Turkey	.73* (.06)	.50* (.06)		-	-	-
Italy		.67* (.05)	1.35* (.06)	-	-	-
Finland	1.47* (.05)		1.99* (.05)	-	-	-
Cooperation	1.42* (.04)	1.42* (.04)	1.42* (.04)	.62* (.07)	.70* (.08)	.78* (.06)
Teach-student relations	2.13* (.04)	2.13* (.04)	2.13* (.04)	.46* (.08)	.52* (.08)	.42* (.07)
Participation	1.25* (.04)	1.25* (.04)	1.25* (.04)	.76* (.07)	.78* (.08)	.86 (.06)
Value	1.32* (.04)	1.32* (.04)	1.32* (.04)	.66* (.07)	.71* (.08)	.89 (.07)
Salary	.48* (.05)	.48* (.05)	.48* (.05)	2.60* (.08)	1.87* (.08)	1.72* (.09)

Gender	1.34*	1.34*	1.34*	.66*	.75*	.86
	(.05)	(.05)	(.05)	(.07)	(.09)	(.08)
SES	.86*	.86*	.86*	1.30*	1.06	1.02
	(.05)	(.05)	(.05)	(.07)	(.09)	(.08)
Workload	1.15*	1.15*	1.15*	.84*	.77*	.98
	(.04)	(.04)	(.04)	(.08)	(.08)	(.08)
Intercept	-	-	-	1.22*	2.71*	1.45*
				(.10)	(.13)	(.12)

*p<.05. Standard errors shown in parenthesis.

The first adjusted ratio (model 1) that can be used for comparing Turkey to Italy regarding teacher dissatisfaction with the profession was .73 (95% CI from .66 to .82). This value indicates that the probability of a teacher being dissatisfied with the profession is 27% lower in Turkey than in Italy when the selected variables are controlled for. In addition, model 1 revealed that the probability of being dissatisfied with the profession is 47% greater for a teacher in Finland than other countries after controlling for the determined variables (95% CI from 1.32 to 1.64). The odds ratios of model 1 were significant at .05. In model 2, the odds ratios obtained can also be used to compare teachers in Turkey with those in Finland and teachers in Italy with those in Finland. The adjusted odd ratio for teachers who are dissatisfied with the profession comparing Turkey with Finland was computed as .50 (95% CI from .44 to .55). The ratio shows that a teacher in Finland has a two times greater probability of being dissatisfied with the profession compared to an average teacher in Turkey with the same values for controlled variables. In addition, model 2 shows that an average teacher in Italy has 33% lower odds of being dissatisfied with the profession than a corresponding teacher in Finland when controlling for the determined variables. The odds ratios in model 2 were significant at .05. Model 3 was used to compare teachers in Italy with those in Turkey and teachers in Finland with those in Turkey regarding teacher dissatisfaction with the profession. The adjusted estimated odds were computed to be 1.35 (95% CI from 1.21 to 1.50), which means that in Italy a teacher has 35% greater odds of being dissatisfied than teachers in Turkey who have the same values for the controlled variables. In addition, the estimated odds ratio was computed as 1.99 for teacher dissatisfaction when comparing Finland to Turkey (95% CI from 1.78 to 2.22). This result shows that a teacher in Finland has a nearly two times higher probability of being dissatisfied than a Turkish teacher when controlling for the group of variables. This ratio (1.99) also confirms the results obtained from model 2.

The variables in the model and the corresponding estimated odds ratios are presented with the results of the second logistic regression in Table 4 (second logistic regression). In Turkey, the odds ratio of .62 means that teachers who are in an environment where cooperation takes place have a 38% lower probability of being dissatisfied with the teaching profession (95% CI from .54 to .72, significant at .5%). The odds ratios for this variable are .70 and .78 for Finland and Italy, respectively. In addition, in Italy, the odds ratio (OR=.42) indicates that when the teacher and student relations are good in a school, teachers have a 58% lower probability of being dissatisfied with the profession than a teacher who is working in a school where teacher-student relations are poor (95% CI from .37 to .49, significant at .5%). For this variable, the odds ratios are very close in the three countries (OR=.46 for Turkey, OR=.52 for Finland). Moreover, in Turkey, teachers who perceived that they are valued by their society have a 34% (OR=.66) lower probability of being dissatisfied with their profession (95% CI from .58 to .76, significant at .5%). Similarly, the probability is nearly the same for teachers in Finland (29%). However, the odds ratio was found to be highest and not significant for Italy (OR=.86). The highest variation among the odds ratios was retained using the variable of salary satisfaction. In Turkey, teachers who reported that they were not satisfied with the salary they receive for the teaching profession have more than 2.5 times (OR=2.60) the probability of being dissatisfied with the profession compared to the teachers who told that they satisfied with their salary (95% CI from 2.22 to 3.04, significant at .5%). The odds ratios found for this variable were 1.87 and 1.72 for Finland and Italy, respectively. This means that teachers who were not satisfied with their salaries have a 87% and 72% higher probability of being dissatisfied with the profession in Finland and Italy, respectively (for Finland: 95% CI from 1.60 to 2.20; for Italy: 95% CI from 1.44 to 2.04, significant at

.5%). Moreover, female teachers in Turkey and Finland have a 34% and 25% (OR=.66) lower probability of being dissatisfied with the profession than male teachers, respectively.

In the final step, a structural model was built for the three countries separately to compare the test of the hypothetical model in which teacher-student relations, participation of stakeholders in school decisions, teacher cooperation, teachers' perception of value given in society, and teacher workload have effects on teacher satisfaction with the profession; participation of stakeholders in school decisions, teacher-student relations, and teacher cooperation have effects on teacher satisfaction with the work environment; and teacher cooperation and workload have effects on teacher satisfaction with classroom control: the hypothetical model also proposed relations among the dimensions of teacher satisfaction, which implied the effects of teacher satisfaction with the work environment and satisfaction with classroom control.

GFI (Goodness-of-fit Index), AGFI (adjusted goodness-of-fit index), SRMR (standardized root mean squared residual) and RMSEA (root mean square error of approximation) were used to check the goodness of fit the SEM models for each country. Whereas values greater than .90 indicate good fit for GFI and AGFI, values that are smaller than .10 were acceptable fit indexes for RMSEA and SRMR (Steiger, 1990). For Turkey's model, he fit indexes were found to be .99, .95, .06, and .03 for GFI, AGFI, RMSEA, and SRMR, respectively. In addition, for Finland's model, the fit indexes were calculated as .99, .94, .10, and .03 for GFI, AGFI, RMSEA, and SRMR, respectively. Finally, for Italy's model, the fit indexes were found to be 1.00, .97, .08, and .03 for GFI, AGFI, RMSEA, and SRMR, respectively.

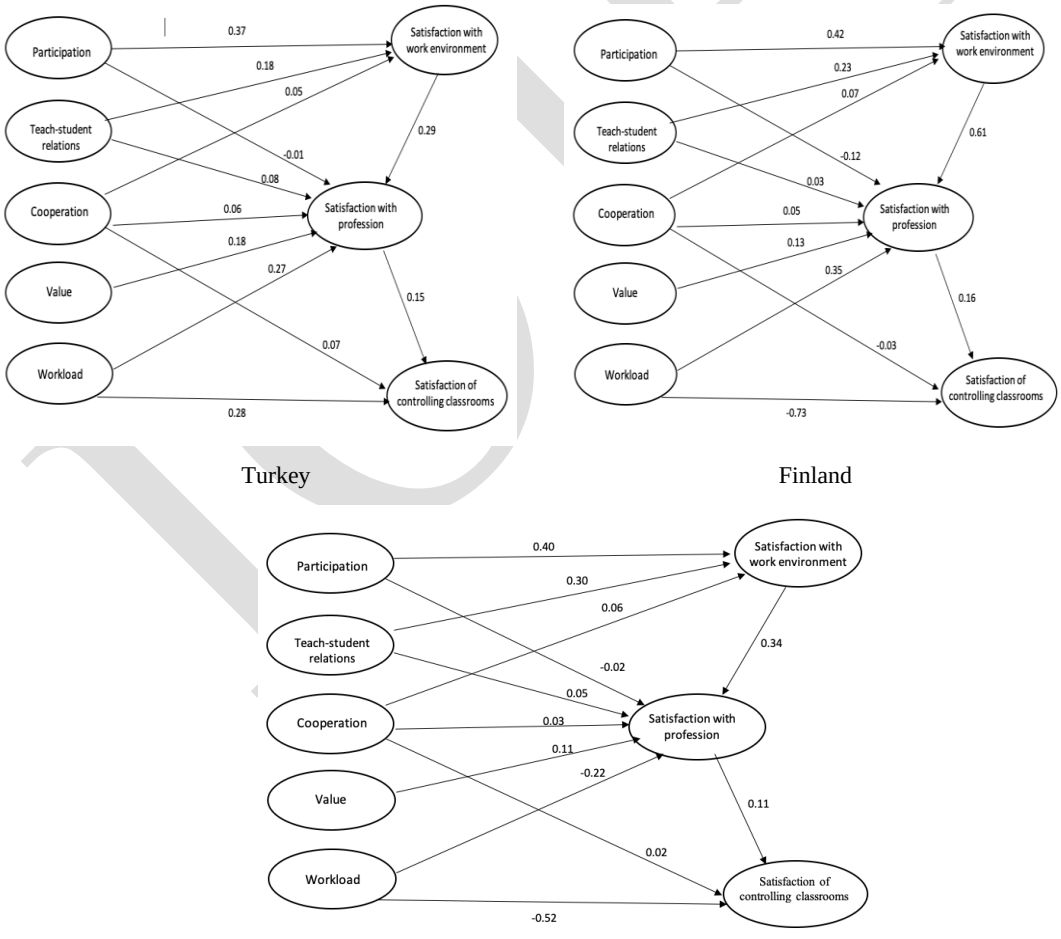


Figure 3. Structural models for Turkey, Finland, and Italy

The analyses revealed that teachers' satisfaction for the work environment had a positive effect on teachers' satisfaction with the profession and teachers' job satisfaction with the profession had a positive effect on teachers' satisfaction of controlling classrooms for Turkey, Finland, and Italy. However, the effect of teacher satisfaction with the environment on teacher satisfaction with the profession is greater in Finland than both Turkey and Italy. In addition, whereas there is a positive correlation between teachers' workload and teachers' satisfaction with the profession for Turkey and Finland, the correlation was found to be negative between teacher workload and teacher satisfaction with the profession in Italy. Moreover, while there was a high negative correlation between teacher workload and teacher satisfaction with classroom control in Finland and Italy, a positive correlation was found between these dimensions in Turkey.

DISCUSSION and CONCLUSIONS

The positive impact of teachers' job satisfaction on schools and students has been expressed by especially exposing the positive association of teachers' job satisfaction with the teacher performance (Renzulli, Macpherson Parrott & Beattie, 2011). In addition, the importance of job satisfaction has not only been investigated for its positive impact on teachers' performance but also explored for having the potential to reveal the robust implications on teachers' attitudes, retention, burnout, confidence, and students' academic achievement (Klassen et al., 2009; Renzulli, Macpherson Parrott & Beattie, 2011). Therefore, it is essential that knowing the explicit and implicit elements related with social and school factors and teachers' characteristics could lead us to reach better school and educational system. Without teachers' involvement, commitment, and motivation to the teaching profession, it is impossible to constitute robust and stable school and education systems.

Using the TALIS 2018 database, we carried out this study to investigate intrinsic and extrinsic factors related to school, society, teacher attributes, and students' characteristics across the three countries. Teacher salary satisfaction (teacher factor), working in a school in which teacher cooperation actions is encouraged (school factor), being in a school where teacher-student relations are good (school factor), being in a school in which decisions were taken with the participation of all stakeholders (school factor), societal value of teachers (social factor), and teacher workload (school factor) were defined as the extrinsic elements, and teacher gender (teacher factor) and the composition of classrooms regarding the socio-economic level of students (student factor) were defined as the intrinsic elements related to teacher satisfaction with the profession. As indicated in the literature, the dominant factors that have the potential to contribute the teachers' job satisfaction/dissatisfaction were also included in TALIS 2018 and carefully selected for this study with the alignment of intrinsic and extrinsic factors. In the first phase of the study, the effects of extrinsic factors on teachers' satisfaction with the profession were revealed for three countries (Turkey, Finland, and Italy) using multiple regression analyses to reach a decision to include the variables in the analyses that were conducted in the second and last phase of the study. In the second phase of the study, instead of making interpretations about the degree of teacher job satisfaction or dissatisfaction, we preferred to make inferences based on the presence or absence of teacher job dissatisfaction. That is why the multiple logistic regression was used for the analysis process. Finally, a SEM was built to review the effects of intrinsic and extrinsic factors on teacher job satisfaction.

First, we focused on relationships between extrinsic variables and teacher satisfaction with the profession to decide whether it is worthwhile to include these variables in the logistic regressions and the SEM. Whereas the relationships show some variations among the three countries, the relationships were found to be significant. For example, whereas the correlations between teachers' perceived value in their societies and teacher satisfaction with the profession are nearly the same in Turkey and Finland, the correlation is low between variables in Italy when compared to Turkey and Finland.

Secondly, we have focused on whether there was a variation between countries when the teachers have the same values on controlled variables, which are defined in the literature as dominant elements under extrinsic and intrinsic factors. The results revealed that teachers in Finland have the highest

likelihood of being dissatisfied among the three countries. In Italy, teachers have a greater probability of being dissatisfied with the teaching profession than teachers in Turkey but a lower probability than teachers in Finland.

Although there are not any studies focusing specifically on comparing variations among European countries by controlling for related variables with job satisfaction, Rasku and Kinnunen (2003) investigated differences in well-being outcomes which involved teacher job satisfaction among ten European countries, including Finland and Italy. They revealed somewhat contrary results with our study, namely that Finish teachers reported higher scores on job satisfaction than European teachers. In addition, based on the mean scores of the countries on the index variable of 'teaching satisfaction with the profession' revealed in TALIS 2018, the average score in Finland and Italy are nearly the same, whereas the average score in Turkey is lower than these two countries, which indicates that teachers in Turkey had the lowest job satisfaction level when compared with Finland and Italy. However, in our study, after controlling for the related variables, teachers in Finland had the highest probability of being dissatisfied, while teachers in Turkey have the lowest. These results indicate that the variables which are determined to be covariates have the potential to be a driving force for variations on teacher job satisfaction among the three countries. In addition, Madero (2019) carried out a study to investigate the variations among Mexico, Chile, and Brazil in secondary teacher job dissatisfaction based on the TALIS 2013. In our study, although the teachers' level and the selected explanatory variables show some differences, Madero (2019) also found variations among Brazil, Chile, and Mexico by controlling for a different set of variables.

As it is found to be connected to many outcomes, positive school climate has also been connected to teacher job satisfaction and teacher retention (Collie et al., 2012; Ingersoll, 2001). Some of the dimensions constituting school climate were designated as cooperation among teachers, teacher-student relations, and decision making in schools (Johnson et al., 2007; Malinen & Savolainen, 2016; OECD, 2019a). In this study, the variables were selected to capture the effects of the dimensions which compose the school climate on teacher dissatisfaction with the teaching profession. One of the prime sources of teacher job satisfaction was defined as teacher cooperation (Nyamubi, 2017; Susmitha & Reddy, 2017). Effective cooperation among colleagues was recommended to improve job satisfaction (Khazaei et al., 2016). In addition, it is claimed that teacher-student relations have a robust association with teacher job dissatisfaction (Veldman, van Tartwijk, Brekelmans, & Wubbels, 2013). Moreover, although some of the contrary results were reported (Taylor & Tashakkori, 2010), participation of stakeholders in the decision-making process were found to positively affect job satisfaction (Kim & Yang, 2016). So, in our study, the importance of teacher cooperation, positive teacher-student relations, and participation of stakeholders in the decision-making process were proven to prevent teacher dissatisfaction with the profession in all three countries. For example, in Turkey, a teacher's odds of being dissatisfied decreases by 38% when the teacher cooperation in the schools is encouraged. In addition, in Italy, when teacher-student relations are good in a school, a teacher working in this school has 58% lower odds of being dissatisfied with the profession of teaching.

Similarly to the other professions, improvement of recruitment and retention of qualified persons for the teaching profession depends on the value given to the teaching profession in the society, which is also associated with teacher satisfaction the profession. In addition, in the literature, one of the main factors affecting job satisfaction was defined as social respect (Khazaei et al., 2016; Sahito & Vaisanen, 2020). In this study, although in the case of Italy no relation between teacher perception of value and job satisfaction was found, in Turkey and Finland, the presence of teachers who believe that they are valued by the society decreases the odds of being dissatisfied with the teaching profession, specifically at 34% and 29%, respectively. Therefore, increasing the status and respect of teachers seems to be the key factor to improve teacher job satisfaction.

Although teacher wages and satisfaction with the salary they receive is known as one of the extrinsic factors affecting teacher job satisfaction (Khazaei et al., 2016; Sultana et all., 2017), there has been no

study that includes variables related to teacher wages or their satisfaction with the salary they receive, since previous cycles of the TALIS did not include a related item. In a similar vein with the related literature, in the case of all three countries in the study, teacher salary satisfaction seemed to be a more important extrinsic factor than the other factors included in this study. Especially in Turkey, the likelihood teachers of being dissatisfied with the teaching profession is the highest among the three countries when teachers are dissatisfied with the salary they receive. As the PISA 2018 results are examined, there is an agreement with this study in this matter. It was revealed that among the three countries, the starting salary of teachers at the lower secondary level is highest in Finland and lowest in Turkey. In addition, the salary of teachers at the top of the scale is very close in Finland and Italy; however, the salary of teachers at the top of the scale in Turkey is nearly 25% lower when compared to these two countries (OECD, 2019b). Therefore, we can conclude that one of the dominant controlled variables that leads teachers in Turkey be the least dissatisfied teachers among the three countries is undoubtedly the percentage of teachers who are dissatisfied with their salary. Moreover, in this study, whereas student socioeconomic status was found not to be associated with teacher dissatisfaction with the profession in the case of Finland and Italy, the classrooms where the proportion of low socioeconomic status students is high have higher odds of teachers being dissatisfied with the profession in Turkey. The PISA results expressed the impact of student socioeconomic status (SES) on student performance in Turkey as one of the highest among the countries (OECD, 2016a). In addition, it was found that (Ramirez & Viteri, 2016) students from more socio-economically advantaged contexts are taught by teachers who are satisfied with their salaries.

One of the surprising results of this study is about teacher workload. In the literature, although many studies have asserted that teacher work overload is one of the extrinsic factors related with teacher dissatisfaction (Geiger & Pivovarova, 2018; Sahito & Vaisanen, 2020), some studies did not find any association between teachers who experience a high workload and teacher dissatisfaction with the profession (Madero,2019). In this study, the condition of over workload for teachers is associated with teacher dissatisfaction in Turkey and Finland but not associated in Italy. Surprisingly, in both Turkey and Finland, the condition of teacher overload decreases the odds of teachers being dissatisfied with teaching profession. However, for Turkey, statistics indicate close to a non-significant association. For Finland, the teachers who are in a condition of work overload may represent their dedication to the teaching profession, which in turn is a driving force of job satisfaction.

The only personal characteristic of teachers included in this study is teacher gender. Although some of studies have indicated higher job satisfaction levels among female teachers by referencing teacher wages, working conditions, and organizational climate (Şahin & Sak, 2016), some studies have found no differences between female and male teachers regarding job satisfaction (Yayla et al., 2018). In this study, although no association was found in the in the case of Italy, female teachers tend to have lower odds of being in a situation of dissatisfaction with the profession in Turkey and Finland. The reason for this result can be explained by the desirable nature of the teaching profession among women in most European countries (Tašner et al., 2017).

Another important result in terms of the study is that relations with different dimensions are also important in satisfaction. The dimensions of teacher satisfaction implied the effects of teacher satisfaction with the work environment and teacher satisfaction with classroom control. Numerous studies on the relationship between work environment or climate and job satisfaction reveal the effects of these variables on teacher job satisfaction (Baughman, 1996). Teacher satisfaction with the work environment had a positive effect on teacher satisfaction with the profession, and teacher satisfaction with the profession had a positive effect on teacher satisfaction with classroom control for Turkey, Finland, and Italy. Many studies conducted in different countries on work environment and job satisfaction reveal similar effects on teacher job satisfaction (Dorozynska, 2016; Mehmeti & Telaku, 2020). However, one important point here is that satisfaction with the working environment in Finland is approximately two-fold that of Turkey and Italy. The most interesting point is that when the variances between schools of countries are evaluated, this rate is the lowest in Finland. This means

that although school environments in Finland are the closest to each other, they have a greater impact on teachers' satisfaction than in Turkey and Italy. However, in Turkey and Italy, the variance between schools is higher, but the level of teacher satisfaction with the work environment is effected by halfway Finland. This situation implies that teachers may be dissatisfied with other factors that have priority in the work environment.

It could be suggested that the dimensions which constitute the school climate, such as cooperation among teachers, teacher-student relations, and inclusion of stakeholders in decision making should be encouraged by the administration boards of schools and educational systems. In addition, satisfaction with the salary retains its importance on teacher satisfaction with the profession, which in turn affects the value given by society to the teaching profession, should be considered by policy makers. It should be never forgotten that the socioeconomic levels of students remain associated with teacher job satisfaction as well as with student performances. The findings of this study, which is based on a large-scale assessment conducted by OECD, have the potential to drive research about the association between teacher job satisfaction and attrition and retention in the teaching profession. Longitudinal studies should be employed at the regional level to obtain useful findings about teacher job satisfaction which enables policymakers to create a climate where teacher job satisfaction can be improved.

Limitations

There are some limitations of the present study which should be acknowledged. First, the TALIS data was obtained using self-reporting scales. The respondents/teachers may be inclined to respond favorably to authority by anticipating the correct answers that should be given. Second, the continuous variable is converted to a categorical variable, it causes information loss. However, SEM has been applied to minimize this limitation.

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INVESTIGATION OF METACOGNITION AWARENESS LEVELS AND PROBLEM SOLVING SKILLS OF MIDDLE SCHOOL STUDENTS

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Abstract

The aim of this study was to analyze middle school students' metacognition awareness levels and problem solving skills. The research was carried out with a total of 1595 middle school students studying in the 5th, 6th, 7th, and 8th grades in a middle school in a city of the Central Anatolia Region. The metacognitive awareness scale (MAS) form B for children developed by Karakelle and Saraç (2007) and the problem solving inventory (PSI) for middle school level students developed by Serin and Saygılı (2010) were used as instruments. The research was developed in accordance with the survey model, which is one of the quantitative research methods. The SPSS program was used for analysis. Descriptive statistics, normality tests, correlation analysis, independent samples t test, and one-way variance analysis were run. For this study, the Cronbach Alpha value of the metacognitive awareness scale (MAS) for middle school students was found to be .84 and the problem-solving inventory (PSI) for children at the middle school level was found to be .65. Metacognition levels of females were higher than the males. Females and males were at the same level in the problem solving inventory. In the study, it was concluded that the metacognition awareness levels and problem solving skills were significantly different at different grade levels.

Keywords: Metacognition, middle school, problem solving skills.

INTRODUCTION

Thinking with knowledge is using related concepts but knowledge is not enough for thinking. Some educational institutions generally place that transfer of knowledge to students piece by piece, they do not encourage individuals to think and image adequately. The way to close this shortcoming is to include more mathematical thinking and more precisely problem solving activities. Students can develop different thinking skills through their experiences with problem solving. The skills gained with problem solving skills should be perceived in solving other problems, remembering a first solution, and being aware of all the mental activities. This process in problem solving steps reveals the importance of the concept of metacognition and its relationship.

The National Council of Teachers of Mathematics (NCTM) stated that the problem solving process should be extended to the entire mathematics education and the process should be shaped by teachers (NCTM, 1991). Metacognition skills begin to manifest in the preschool period and continue to develop throughout the learner's life. Metacognitive abilities further develop and differentiate with richness of life as an individual matures. However, the effect of teaching on the acquisition of metacognitive skills is more than maturation (Gage and Berliner, 1988; cited in Subaşı, 1999). In this process, the teacher should present problems that will give students' different expressions, considering their cognitive development. However, students' negative past experiences, or beliefs can negatively affect this process. Such negative thoughts can also negatively affect success.

Problem Solving

Mathematics is a special and general language that has a unique alphabet, contains symbols and shapes, uses letters for known and unknown expressions, and includes unique words and phrases (Umay, 2002). This language not only teaches its formulas but also provides skills, such as going

beyond rules and exploring connections. Mathematical problems, on the other hand, help the individual to get into this thinking process. Unlike exercises that require repetition in a certain order, problems enable students to reach a result by thinking, researching, and discussing. Mathematical problems provide skills such as understanding connections within a problem, revealing operations to resolve the connections, making decisions, and implementing the process. NCTM expresses the main rationale for studying mathematics as problem solving (NCTM, 1977). Similarly, the NCTM stated that the problem-solving process should be extended to the entire teaching of mathematics and the process should be shaped by teachers (NCTM, 1991).

The most common problem types in the literature are unusual (non-routine) and ordinary (routine) problem types. An unusual problem type is defined as a predictable, well-studied approach or no-path problems for unusual problem solutions. In contrast, ordinary problems are those that one can solve by learning familiar methods that were previously familiar to them and follow step by step (Woodward, Beckmann, Driscoll, and Franke, 2012). Ordinary problems' solutions can be realized with four operations. The problem can be solved by following a well-known example that does not create innovation, which is step by step is an ordinary problem. One will not have the opportunity to use their own judgment or creative abilities (Polya, 2017). Solutions of extraordinary problems require higher levels of skills, such as seeing relationships, classifying, and organizing data beyond the four processing skills (Souviney, 1989). Mathematical problem solving is the process of eliminating a problem by using the necessary knowledge and passing the steps to reach an existing goal that mathematics must have in an abstract structure (Altun, 1995).

The process of solving the problem is not different from the scientific process. The ways to access information are experiences, knowledge of another person (consensus), knowledge of an expert person (authority), logic, and science (Büyüköztürk, Çakmak, Akgün, and Demirel, 2016). While solving a problem in the scientific method, one uses the problem solving process as support. It is a process, which includes the following steps in the scientific method: identifying a problem or problems, describing it, collecting data, analyzing it, and interpreting the reached conclusion (Fraenkel and Wallen, 2006).

Problem solving steps were defined by Polya (1944, p.5) as follows:

> "First, we need to understand the problem, and see clearly what the problem wants. As a second step, we need to see how the various elements are connected to each other, how the unknown is connected to the data to create an idea of the solution and ultimately create a solution plan. Third, we implement our plan. Fourth, we go back to the completed solution, review, and discuss the solution." (p. 5).

Whatever the problem is, it is necessary to decide on the solution and develop a strategy. Metacognition, on the other hand, has been stated as the main component of the problem solving process in many studies. Problem solving is an important element of learner's mental behavior (Schoenfeld, 1985).

Metacognition

According to Flawell (1985), who was the first to use the concept of metacognition, said metacognition is that the student is aware of the repetitive cognitive steps progressing in a certain order and time. Depending on the studies on the subject, different definitions have emerged over time. In some definitions, metacognition is considered as "high-level cognition" according to cognition within the hierarchical order of consciousness (Schunk and Pajares, 2001). Selçuk (2000) expressed it as the knowledge and awareness of individuals about their cognitive process. There are definitions that address behavior and reaction in the face of certain situations and problems as a process of changing them (Huitt, 1997). When considered within the boundaries of modeling, it is explained as a mesh divided into the three parts of metacognitive control, metacognitive monitoring, and metacognitive knowledge (Dunlosky and Metcalfe, 2009). Metacognitive information is stored declarative information that allows us to overcome an existing problem situation (Flawell, 1979).

When considered in the solution process of a mathematics problem, it can be expressed as remembering and using previous ideas and experiences required for problem solving. Stored declarative information helps us understand the problem. Metacognitive monitoring provides information about students' own cognitive status (Schwartz and Perfect, 2002). The condition of the appropriateness of the ideas obtained for the solution of a problem or the right solution strategy shows a cognitive monitoring status. However, metacognitive control expresses existing information with conscious or unconscious choices while activity is going on (Dunlosky and Metcalfe, 2009). The metacognitive control stage corresponds to looking back after solving a mathematical problem and reviewing the solution steps repeatedly. It provides consolidation of knowledge and the development of problem solving ability.

Problem Solving and Metacognition

Knowing the basic concepts and the rules for their use and knowing the steps to solve the problem in mathematics also brings methods that ensure achieving the correct result. While solving a problem, it may be necessary to use strategies such as organizing the data, deliberately estimating and checking, animation, logical reasoning, pattern finding, metacognitive monitoring, and drawing (Posamentier and Krulick, 2016). In addition to these skills, another required skill is metacognition (Victor, 2004). Students use metacognitive strategies in planning the problem, choosing for complex situations, associating these choices with previous knowledge, adapting new information to other situations, and monitoring how efficient the process is (Clark, 1998).

There are studies in the literature that suggest that there is a relationship between metacognitive knowledge and problem solving skills (Hollingworth and McLoughlin, 2001). There is a significant relationship between problem solving achievement and metacognition skills. Teaching skills increases student's achievement in problem solving. Thus, these skills organize the mental processes of students more actively and effectively (Schoenfeld, 1985). Karakelle (2012) stated that metacognition awareness levels and problem solving perceptions were interrelated structures. According to Aşık and Erktin (2019), there was a statistically low relationship between students' metacognition knowledge and problem solving skills.

The aim of this study was to analyze middle school students' metacognition awareness levels and problem solving skills in terms of different variables. The research problems were:

1. Is there a significant mean difference between metacognition awareness levels and problem solving skills in terms of gender?
2. Is there a significant relationship between metacognition awareness levels and problem solving skills?
3. Is there a significant mean difference in the level of metacognition awareness and problem-solving skills in terms of grade levels?

METHOD

Research Model

Surveys aiming to determine the expectations, behaviors, attitudes, opinions, beliefs, and characteristics of individuals on certain topics. These studies are called survey studies (Gürbüz and Şahin, 2017). The most ideal method of collecting information about different middle school student groups and their characteristics is survey models (Robson, 2017). Explaining the results and patterns in the survey models leads us to descriptive interpretation. In accordance with the data obtained, it was aimed to examine the metacognition awareness levels and problem solving skills of middle school students from various aspects. Research and publication ethics were followed in the article.

Sample of the Study

Non-probabilistic techniques that are not possible are easier to apply to study but their power to represent the research population is weak. Especially if the characteristics (demographic characteristics, attitudes, and experiences, etc.) of the elements that make up the research population

are similar or homogeneous in the research population, the use of non-probabilistic techniques is often not a problem (Gürbüz and Şahin, 2017). In this study, the sampling was chosen by convenient sampling. The sample of the study was 779 female (48.8%) and 816 male (51.2%) students studying in a public middle school in Kocasinan, Kayseri. The distribution of students by gender is given in Table 1. The sample shows a balanced distribution in terms of gender.

Table 1. Gender distribution of the sample

Gender	f	%
Male	816	51.2
Female	779	48.8
Total	1595	100

Instruments

Metacognitive awareness scale (MAS) for children

The metacognitive awareness scale (MAS) form B for children was developed by Karakelle and Saraç (2007). The Cronbach Alpha value was found to be .64 by Karakelle and Saraç (2007). The scale includes 18 items with 5-point-Likert-type questions. The answer options are "1 - I Never Behave Like This, 2 - I Rarely Behave Like This, 3 - I Behave Like This Every Time, 4 - I Behave Like This Frequently, 5 - I Always Behave Like This". In this study, the reliability coefficient value for the metacognition awareness scale was found to be .84 as given in Table 2. According to Özdamar (2018), a Cronbach Alpha reliability coefficient of the scale between .90 < a <1.00 is highly reliable, .60 < a < .90 is reliable, .40 < a < .60 is low reliable, and .00 < a < .40 is not reliable. It is in the reliable range of metacognition awareness scale for children.

Problem solving inventory for elementary school children (PSI)

Problem solving skills were used for the problem solving inventory (PSI) for primary school children, which was developed by Serin, Serin, and Saygılı (2010). The Cronbach Alpha reliability coefficient was found as .80 by Serin, Serin, and Saygılı (2010). The scale consists of 24 items with 5-point-Likert type options. Answer options are “1 – Never, 2 – Rarely, 3 – Sometimes, 4 – Often, and 5 - Always”. As given in the problem solving inventory reliability analysis in Table 2, the problem solving reliability statistics value is .65 for the problem solving inventory. According to Özdamar (2018), a Cronbach Alpha reliability coefficient of the scale between .90 < a <1.00 is highly reliable, .60 < a < .90 is reliable, .40 < a < .60 is low reliable, and .00 < a < .40 is not reliable. The problem solving inventory for children in primary school is in the low-reliable range.

Table 2. Problem solving inventory and metacognition awareness scale reliability analysis

Scale	Cronbach Alpha	Total item number
Problem solving	.65	24
Metacognition	.84	18

Data Analysis

The analysis of the data collected from the metacognitive awareness scale (MAS) and problem solving inventory (PSI) for children was done with SPSS 25. In this context, descriptive statistics, normality tests, Levene test, correlation analysis, independent samples t-test, and one-way analysis of variance (ANOVA) were performed. The probability value for the analysis is determined as .05 level (95% confidence level) and .01 (99% confidence level).

Research Ethics

The ethical considerations of the data collection tools used in this research was carried out by the Social and Humanities Ethics Committee of Erciyes University in their meeting on 25 February 2020 and permission was given in the ethical committee review report number 62 on 28 April 2020. Research permission was obtained from the National Education Directorate of Kayseri with permission number 94025929-605.02-E.8819332.

RESULTS

In this section, the answers to the research questions, the analyses of the data collected from the metacognitive awareness scale (MAS) and the problem solving inventory (PSI), and the findings obtained from these analyses are included.

Central tendency measurements were used to define a single value that best expresses the distribution. The most common way is to calculate the means (Robson, 2017). In Table 3, descriptive statistics for the middle school students are given with central tendency of the MAS and problem solving inventory. When the descriptive statistics given in Table 3 are examined, the mean, median, and mode values related to problem solving and metacognition values are close to each other.

Table 3. Descriptive statistics of the scales

Scale	n	M	Median	Mode	Skewness	Kurtosis
Problem solving	1595	71.552	71	68	.192	.726
Metacognition	1595	69.156	71	72	-.531	.058

The normal distribution is the theoretical distribution of the scores seen after calculating the mean and standard deviation (Tabachnick and Fidell, 2013). Another way to test normal distribution is to look at the skewness and kurtosis coefficients. Since the descriptive statistics are between +1.5 and -1.5 in Table 3, problem solving inventory and metacognition awareness scale shows normal distribution (Tabachnick and Fidell, 2013). In samples with a normal distribution, the Levene homogeneity of the variances results are shown in Table 4.

Table 4. Homogeneity of variances Levene variance equation

Scale	F	df	p
Problem solving	.466	1593	.495
Metacognition	4.285	1593	.039

The homogeneity of the variance test is the first assumption of the independent samples t test. The Levene test result of problem solving is [$F_{(1593)}$ = .466, p=.49>.05] and the Levene test result of the metacognition awareness level is [$F_{(1593)}$=4.285, p=.039>.01]. Homogeneity of variances was satisfied.

Investigation of Metacognition Awareness Levels and Problem Solving Skills by Gender

After providing the homogeneity of variances assumption, it was examined whether there was a statistically significant mean difference between metacognition awareness levels and problem solving skills of female and male students attending middle school. Table 5 shows the independent sample t-test results regarding the gender variable.

Table 5. Independent sample t test results regarding gender

Scale	Gender	n	M	SD	t	p
Problem Solving	Female	816	71.693	9.267	.633	.527
	Male	779	71.404	8.971		
Metacognition	Female	816	68.550	10.770	2.23	.020
	Male	779	69.792	10.500		

Independent samples t-test results are given in Table 5 at the significance level of .05 for whether there is a significant mean difference in the problem solving skills and the metacognition awareness scores between female and male middle school students for problem solving skills [$t_{(1595)}$=.633, p=.527] and for metacognition awareness [$t_{(1595)}$=2.23, p=.020]. Since problem solving skills [$t_{(1595)}$=.633, p=.527>.05], there is no statistically significant mean difference between the means of male and female students attending middle school. As the metacognition awareness level is [$t_{(1595)}$=2.23, p=.02<.05], there is a statistically significant mean difference between the scores of males and females attending middle school. The metacognition awareness levels showed a significant mean difference in favor of male students (M=68.550) compared to female students (M=69.792).

Examining the Relationship between Metacognition Awareness Levels and Problem Solving Skills

Correlation analysis, which means relationship, is an analysis method that confirms the relationship between two or more variables in studies (Taşpınar, 2017). Correlation analysis was conducted to examine the relationship between the problem solving skills and metacognition awareness means of students attending middle school. Since the data showed normal distribution, Pearson correlation analysis was performed. Problem solving skills and metacognition awareness levels are significant at a .05 level (r =.287, p =.000>.05) and is given in Table 6. Students' metacognition awareness levels have a positive and significant relationship in problem solving skills.

Table 6. Pearson correlations between metacognition and problem solving

Scale		Metacognition
Problem solving	Pearson Correlation	.287
	p	.000
	n	1595

Investigation of Metacognition Awareness Levels and Problem Solving Skills According to Grade Levels

Problem solving skills and metacognition awareness levels were examined at the grade levels. ANOVA was applied for more than two groups. This method of analysis can also be used to compare the means between independent samples, as well as to compare the means of three different periods for a sample that is not considered interdependent (Çimen, 2015). It was investigated whether there is a statistically significant mean difference between the problem solving skills and metacognition awareness levels of the students attending middle school at varying grade levels. Table 7 shows the normality test results of the grade levels.

Table 7. Normality test results of grade levels

Grade Level	n	Skewness	Kurtosis
5	250	.154	.307
6	492	.110	.220
7	356	.129	.258
8	497	.110	.219

The Levene Test was performed to test whether the homogeneity of the variance of the groups is one of the conditions of one-way analysis of variance for independent samples. The homogeneity test results of problem solving skills and metacognition awareness total scores are given in Table 8.

Table 8. Homogeneity of variances

Scale	Levene Statistics	df1	df2	p
Problem Solving	1.299	3	1591	.273
Metacognition	1.447	3	1591	.227

According to the Levene Test, there is no statistically significant difference between the variances of the groups since the problem solving skill group's significance is p=.2273>.05 and the metacognitive awareness level's significance is p=.222>.05. Therefore, the variances of the groups can be considered equal. Descriptive statistics of the problem solving and metacognition scales with respect to grade levels are given in Table 9.

Table 9. Descriptive statistics of scales with respect to grade levels

Scale	Grade Level	n	M	SD	Std. Error	Minimum	Maximum
Problem Solving	5	261	69.0843	8.13779	.50372	41	91
	6	523	71.7228	8.80339	.38495	46	108
	7	339	72.4985	8.90893	.48387	41	99
	8	346	72.5694	9.23899	.49669	42	104
	Total	1469	71.6324	8.89714	.23213	41	108
Metacognition	5	261	71.8621	10.00366	.61921	41	90
	6	523	69.5296	10.33188	.45178	21	90
	7	339	69.7640	10.21270	.55468	39	90
	8	346	66.8613	10.73169	.57694	34	90
	Total	1469	69.3696	10.45922	.27289	21	90

According to the mean differences between the grade levels in Table 10, the metacognitive awareness levels of the students attending middle school between grade levels, has a statistically significant mean difference in grade levels [$F_{(3,1591)}$=13.174, p=.000<.05]. Similarly, the total points of problem solving skills of the students attending middle school are between the grade levels, there is a statistically significant mean difference in grade levels [$F_{(3,1591)}$=7.777, p=.00<.05]. There is a significant mean difference between at least two of the four grade levels.

Table 10. Differences between groups

Scale		Sum of Squares	df	Mean of Squares	F	p
Metacognition	Between groups	4386.027	3	1462.009	13.174	.00
	Within groups	176558.788	1591	110.973		
	Total	180944.815	1594			
Problem Solving	Between groups	1917.156	3	639.052	7.777	.00
	Within groups	130737.222	1591	82.173		
	Total	132654.379	1594			

*p<.05

Multiple comparison tests were carried out to understand which grade levels of students attending middle school are different. If homogeneity of variances is satisfied (Equal Variances Assumed), the most used Post-Hoc test is the Tukey test (Kalaycı, 2014). Tukey test results for the differences between the mean of grade levels are given in Table 11.

Table 11. Differences between grade levels

Scale	(I) Grade Level	(J) Grade Level	Mean Differences	Standard Error	p
Problem Solving	5	6	-2.52117	0.81820	.011*
		7	-2.15025	0.86926	.064
		8	-4.92184	0.81681	.000*
	6	7	-0.37092	0.73299	.958
		8	-2.40067	0.66996	.002*
	7	8	-2.77160	0.73144	.001*
Metacognition	5	6	-2.67793	0.70407	.000*
		7	-3.32807	0.74801	.000*
		8	-2.93804	0.70287	.000*
	6	7	-0.65013	0.63075	.731
		8	-0.26010	0.57650	.969
	7	8	0.39003	0.62941	.926

*p<.05

When the mean difference between grade levels means is examined in Table 9, there is a significant mean difference in terms of problem solving skills among students studying at the sixth grade level among students studying in the sixth and eighth grades. There is no significant mean difference between students studying in the fifth grade and seventh grade since p=.064>.05 in terms of problem solving skills. There is no significant mean difference in terms of problem solving skills between students studying in the sixth grade and the seventh grade since p=.958>.05. There is a significant mean difference in terms of problem solving skills between students studying in the sixth grade and

the eighth grade since p=.002<.05. There is a significant mean difference in problem solving skills between students studying in the seventh grade and in the eighth grade since p=.001<.05.

There is a significant mean difference in terms of metacognitive awareness levels between the students studying at the fifth grade level and in the sixth, seventh, and eighth grades as p=.00<.05. There is no significant mean difference in terms of metacognition awareness levels between the students studying at the sixth grade level and the metacognition awareness level of those in the seventh grade is p=.731>.05. There is no significant mean difference in terms of metacognition awareness levels between the students who study at the sixth grade level and in the eighth grade because p=.996 >.05. There is no significant mean difference between the metacognition awareness level of the students studying in the seventh grade level and in the eighth grade as p=.926>.05.

DISCUSSION and CONCLUSIONS

In this study, the level of metacognition awareness levels, problem-solving skills of middle school students, mean difference between female and male, the relationship between metacognition awareness level and problem solving skills, and mean difference between grade levels were examined.

According to the findings of the study, the problem solving skills of the students do not show a significant mean difference in terms of the gender of the students. In another study on the problem solving skills of teachers, there was no statistically significant mean difference in terms of problem solving skills of males and females (Demir and Baloğlu, 2020; Demirtaş and Dönmez, 2008). Problem solving skills of middle school teachers did not show a significant mean difference according to gender (İnan, 2015). Problems in the problem solving inventory are well-designed and non-routine problems. These problems were designed for gender bias so that both female and male students solve the problems in the problem solving inventory with similar abilities. These problems are from the daily life of both female and male students. The mean of metacognition awareness levels showed a significant mean difference according to gender. It is in favor of female student's metacognition awareness levels. Similar findings were obtained in studies on metacognitive awareness level and gender (Evran and Yurdabakan, 2013). In a study conducted with metacognition awareness levels of middle school students, female metacognitive awareness levels were higher than male students (Öztürk and Kurtuluş, 2017). There are studies showing that metacognition awareness levels did not differ by gender (Balcı, 2007). The level of metacognition awareness in primary school students is an important variable in terms of gender (Topçu and Tüzün, 2009). The reasons why metacognition awareness levels are in favor of female students are stated to be that females are better than males in strategies such as planning, organizing, and evaluating (Bağçeci, Döş, and Sarıca, 2011). Female students are more concentrated due to developmental changes than male students are in middle grades. Female students use their metacognition abilities since they are more organized and planned than the male students in middle grades.

Students' metacognition awareness levels have a positive and significant relationship in problem solving skills. Similarly, in research conducted with middle school students, the finding that there was a positive and significant relationship between the student's mathematical metacognition awareness and problem solving skill levels paralleled this finding (Kaplan, Duran, and Baş, 2016). In a study conducted with university students, individuals were clearly associated with the metacognitive actions used in solving problems in their daily lives, their self-perception of problem solving powers, and their metacognitive awareness levels (Karakelle, 2012). Effective problem solving abilities need the metacognition abilities of planning, organizing, and estimating. Metacognition awareness abilities are like the steps of problem solving and students use these abilities while defining variables in a problem and deciding which strategy they will use.

The problem solving skills and metacognition awareness levels of the students differed according to the grade levels for some of them. Problem solving skills differed at each grade level, while metacognition awareness levels differed in the lower grades. While metacognition awareness levels

are expected to create a situation in favor of upper grades, this difference occurred in the lower grades. In another study conducted at the 6th, 7th, and 8th grade levels of middle school, there was a significant relationship between grade levels and metacognition awareness levels. As the grade levels increased, metacognition awareness levels increased (Temur, Kargın, Bayar, and Bayar, 2010).

Activities that will enable middle school students to be aware of and improve their metacognition levels should be included (Alan and Özsoy, 2019). It should be ensured that students can easily express what they know or do not know, their plans while solving a problem, and realize the inconsistencies or uncertainties within this plan. Environments in which students can evaluate themselves should be created, and the learning processes in different disciplines should be realized similarly to the student. The teacher should provide environments where students can express their thoughts comfortably, give feedback to the students about the awareness of metacognition levels, collect data, and guide them.

The study has same limitations. First limitation is that this study is a survey study. Metacognition abilities should be analyzed longitudinally and over years. Researchers only try to define the actual statements of the middle school students. Then, the surveys were administered in a big school to control the environmental factor. However, this was a limitation, future studies should be designed in a variety of schools for analyzing environmental factors.

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OPINIONS OF PRIMARY SCHOOL TEACHERS ON THE HISTORY SUBJECTS IN THE 4TH GRADE SOCIAL STUDIES CURRICULUM

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Abstract

The purpose of this study is to determine the opinions of primary school teachers regarding the history subjects found in the primary school 4th grade coursework in scope of the year 2018 Social Studies Course Curriculum. The study utilized survey technique in a qualitative research paradigm. Data were gathered through interviews and document analysis technique. The study group for the study comprised of 20 teachers working in Ankara and İzmir who participated in the study on voluntary basis. The descriptive analysis method was used for analysis of the data, and data presentation was based on frequencies and percentages. Results showed that 1) the history subjects in the Social Studies curriculum are insufficient in relevance to purposes of the course and in regard of achievement of gains, 2) the subjects fail to endear history courses to the student and 3) the time allotted for history subjects in the curriculum is insufficient. It was concluded that the methods and techniques recommended for history teaching are insufficient, that teachers face significant difficulties in teaching history subjects, that the subjects are not qualified to create an awareness of history in students, and that while the history subjects defined under curriculum gains are congruent with the values, qualifications and basic abilities defined in the curriculum, the coherence between the subjects and targeted gains should be improved. In regard of improvement of history lessons the teachers recommend use of visuals, organization of research and study trips to historic locations, objectification of abstract contents to render them more compatible for the level of children, to include less gains and more activities, and to provide teachers with seminars regarding history teaching and teaching methods.

Keywords: Primary school history teaching, social studies teaching, primary school curriculum, teacher opinions

INTRODUCTION

Children meet planned and scheduled history teaching at primary school level for the first time. The children begin to perceive the feeling and idea of a history standing behind all the rules, attitudes and behaviors of their family, the people they live among and their physical and social near circle for the first time in this period of their lives. The images of pharaohs, sultans, emperors and empresses and the history charts looking down on them from the walls of the corridors and classrooms of their schools, the adages, poems and songs they hear, the fairy tales and stories they listen to, the films and animations they watch, the monuments and historic buildings adorning the playgrounds, parks and streets they play in and the stories told about these awaken feelings, ideas and impressions on history in children, just like they do in adults. Resembling a blank slate, as John Locke (1632-1704) puts it, memories of children form their first impressions of history through activities in their daily lives and the images they experience through these activities. This allows children to develop a feeling of history through the medium of their social and physical environment.

On the other hand, another determining factor affecting history education is the intellectual and cognitive development level of children. There is a direct relation between the intellectual and cognitive development levels of children and their manner and level of interpretation and understanding of their world and the objects and events therein. Therefore, curriculums prepared for education of children must be congruent with intellectual and cognitive development of children as well as their interests and abilities. However, the speed and impact of scientific and technologic developments also have a dizzying impact on intellectual and cognitive development of children and develop their interests and abilities to a similar extent. Accordingly, children experience a more effective, faster and more comprehensive transformation in their cognition and comprehension of their society and their world in comparison to adults. Chief among the reasons of this state of affairs is the fact that the children have not yet achieved a level of activity in regard of prejudices and presumptions

bearing the load of history leading to subjective interpretations in their conception of history. Therefore, the view of each generation regarding society, world and life tangibly and appreciably differentiates from the past, leading to changes and transformations in their cognition of history and their social abilities. All these factors makes it essential to review and reorganise the structure, the content and the teaching methods of the Social Studies courses aiming to prepare the children for social life, as well as the history subjects like those in scope of this coursework.

In the last twenty-five years the speed of developments in information and communication technologies and the changes caused by these developments on the education and learning approaches have necessitated both review of classical learning theories of the past and reorganisation of curriculums in accord with learning capacities of new generations and their personal and social requirements. All these factors necessitate frequent review of education programs and course contents of Turkish schools in various phases of education from preschool to doctorate degree level. Reorganisations conducted in this direction have been subject to many studies and reviews including assessments from stakeholders in their fields regarding their positive and negative aspects. While history education in secondary level education in Turkey has been subject to many and varied studies (Aktekin & Ceylan, 2012; Turan, 2015; Arseven, Dervişoğlu & Uludağ, 2015; Berberoğlu & Berberoğlu, 2015; Şimşek, 2016; Kaya & Perihan, 2017; Belenli & Avaroğulları, 2017; Özdemir, 2017; Şimşek & Alaslan, 2017; Turan, 2018; Yıldırım, 2018; Turan, 2015, Turan, 2018; Akbaba, 2019) it is seen that the primary school stage in history education is generally a neglected field.

Due to the fact that primary school level Social Studies courses more heavily focus on citizenship knowledge and social abilities, the history education in scope of this curriculum is pushed into a very limited frame. The goals and targets defined for the Social Studies courses and the gains ascribed to these have also determined the limits of subjects discussed in history lessons. This circumstance leads studies and research on the Social Studies courses to focus on the general outlines of the course and the citizenship knowledge sections in particular, thus leading to neglect of aspects like structure, content, problems, etc. of history teaching at primary school level. Nevertheless, just recommending some theoretical and practical examples from the literature would be insufficient to ensure an effective history education by providing history curriculums, textbooks and education methods which will instil an awareness of history up to the goals and targets of primary school history courses constituting the first stage of history education and the need of the age of the students. There is a need to re-evaluate history education on all aspects, also referring to experiences and assessments of the students and the teachers. Such a re-evaluation has become essential to ensure a history education fulfilling to the extent of problems, expectations, demands, interests and abilities of students and teachers as two stakeholders receiving and providing education in scope of the curriculum. The children cannot be expected to form healthy individual and social frames of reference, viewpoints, and problem-solving and life skills for their future lives while also insisting on a social and historic understanding disregarding modern conditions and values of the world and the society they live in. The teachers' experiences and observations regarding teaching of curriculum content and the problems faced by the students and by the teachers themselves provide important contributions to development of history education. However, a history teaching approach determined by specialists and academicians unaware of classroom practices in history education and disregarding the expectations of students, the problems faced by teachers during teaching practice, and their observations and experiences on learning styles of the students, cannot provide a history education suitable for the requirements of the age.

Due to all these reasons, in this study it is deemed necessary to refer to opinions of teachers regarding teaching of history subjects in the 2018 Social Studies Curriculum currently implemented in Turkish primary schools with an education period of four years.

Purpose and Scope of the Study

The purpose of this study is to determine the opinions of primary school teachers regarding history subjects taught in scope of the 2018 Primary School Social Studies Curriculum which is currently in force. While there are previous studies reflecting opinions of teacher on various aspects of the new

curriculum in force (Er & Bayındır, 2015; Çatak, 2015; Ersoy, 2016; Kısa & Gazel, 2016; Avcı, İbret & Avcı, 2017; Aydemir, 2017; Dolmaz & Kılıç, 2017; Avcı & Faiz, 2018; Görmez, 2018) no study regarding history subjects was found in the literature. The only study regarding history education in scope of Social Studies course (Ulusoy, Erkuş, 2015) is in regard of the previous curriculum, and no study discussing the new curriculum implemented as of 2018 was found in the literature. This study aims to fill this gap. This study aims to determine the deficiencies in primary school history education and problems experienced in its practice in order to help develop better qualified curriculums and to light the way for further studies on primary school history education.

Study Questions

In scope of the study purpose, primary school teachers were asked to answer the following questions regarding efficacy of the history subjects found in scope of the 4th Grade Social Studies Curriculum: What are the opinions of primary school teachers on history subjects in 4th Grade Social Studies Curriculum regarding;

1- Suitability of the history subjects to purposes of the Social Studies course;

2- The level of achievement of the stated gains;

3- Whether the contents of history subjects in curriculum are able to endear history subjects to children at primary school level;

4- Whether the time allotted for the curriculum gains is sufficient;

5- Suitability of the methods and techniques recommended in the curriculum;

6- Problems experienced in teaching of these subjects;

7- Efficacy of these subjects in instilling an awareness of history in the students;

8- Level of correlation between the values, qualifications and basic abilities defined under the curriculum and the history subjects defined under the curriculum gains; and

9- What are their recommendations for effective history teaching at primary school level?

METHOD

The study is conducted based on the case study approach, a qualitative research method. “Case study method is used to determine the conditions of an event or fact faced in real life (Yıldırım and Şimşek, 2008). Case study is a method frequently employed for deep examination of multiple events, environments, programs, social groups or other interlinked systems” (Büyüköztürk, Çakmak, Akgün, Karadeniz, Demirel, 2008: 257). Again, as pointed out by Yıldırım and Şimşek (2008), qualitative research methods allows one to view the facts from individual viewpoints and to illustrate the social structure and processes creating these viewpoints (Örücü and Şimşek, 2011: 176). This study aims to have primary school teachers evaluate the condition of the history subjects in scope of the Social Studies course.

Study Group

The study group in this study is comprised of 20 primary school teachers working in city centres of İzmir and Ankara. According to Yıldırım and Şimşek (2008) maximum diversity can be achieved with relatively small sample groups and maximising the level at which the individual diversity of stakeholders in the subject problem is reflected by the gathered data.

13 of the teachers participating in the study are women, while 7 are men. The graduate degrees of the teachers comprise 11 from Primary Class Teaching programs, 2 from Biology programs, 1 from a Teaching Academy, 1 from a Education Institute, 1 from a Turkish Language program, 1 from a Public Administration program, 1 from a Physics program, and 2 from Teaching Major Departments. In addition, professional experience of the teachers range from 1 to 10 years for 2 teachers, 11 to 20

years for 4 teachers, 21 to 30 years for 8 teachers and 30+ years for 6 teachers. 5 of the teachers hold master's degrees, while 2 hold doctorate degrees. Master's degrees of the teachers comprise 2 in Education Management, 2 in Curriculum and Instruction, 1 in Public Administration and 1 in Oceanography, while the Doctorate degrees of the teachers comprise Science Teaching program and Curriculum and Instruction. Among the 20 teachers 5 have participated in more than 10 on-the-job training programs, 10 have participated in more than 5 and 3 have participated in less than 5, while 2 have not participated in any on-the-job training. All teachers work at public primary schools in city centre counties of İzmir and Ankara. Classes taught by the participating teachers comprise of 20-25 students for 3 teachers, 26-30 students for 6 teachers, 31-35 students for 9 teachers, and 35-40 students for 2 teachers. In the period when the study was conducted 5 of the teachers were teaching 1st grade, 1 was teaching 2nd grade, 6 were teaching 3rd grade and 8 were teaching 4th grade.

Data Collection

"Structured interview form", a qualitative data collection method, was employed in the study. A structured interview form comprised of open-ended questions intended to assess the opinions of primary school teachers regarding history subjects in scope of the Social Studies Curriculum. First a comprehensive literature screening was conducted in the field and 6 general themes were determined to prepare the teacher interview form, and a semi-structured interview form of 10 items with sub-questions was generated as a data collection tool. The draft interview form was created also by referring to opinions of three specialists in the field. Then, after a pilot run including interviews with four teachers the interview form was brought to its final form and made ready for use. This pilot run was conducted with 4 teachers who are not included in the study group. The interview form shaped after this pilot run is comprised of two sections, including information on demographic characteristics of the participants in the 1st section, while the 2nd Section includes questions aimed to determine opinions of teachers regarding teaching of history subjects in scope of the primary school 4th grade Social Studies Curriculum. Teacher interview forms were conveyed on the basis of voluntary participation for data collection. The feedback obtained from the returned forms constitutes the primary data source for the study.

Data Analysis

The collected data is analysed by descriptive analysis method. In descriptive analysis approach the gathered data is processed by being classified under predetermined themes or categories. In order to reflect the viewpoints of interviewed people in a salient manner, the gathered data are described in a clear and systematic fashion and results are sought by examining the causal relations between these by explaining and interpreting these descriptions (Yıldırım and Şimşek, 2008: 224). Themes are determined in light of conceptual frameworks, interview questions and sub-questions based on field literature. The data collected with the forms were first carefully read and analysed, and the main ideas emerging from each question were summarised. Repeated expressions were tabulated by noting the participants and frequency of the repeated expressions, and the most emphasised ideas were determined as the main categories of data analysis. Gains, content, learning-teaching processes and measurement-evaluation elements of the "Social Studies Curriculum" as well as the recommendations of the teachers were taken into consideration in this scope and were summarised and interpreted under these main themes. In presentation of the findings names of the teachers were anonymised by using code numbers. For example, Ö.1 refers to teacher coded with the number 1. Open-ended questions were used to ensure "credibility" of the study, thus aiming to obtain data focused on depth. In addition, the study structure was submitted to review of specialists, referring to opinions of people specialised in qualitative study methods in regard of analysis and interpretation of the interview forms. Detailed description approach was chosen to ensure transmissibility of the study.

FINDINGS

The findings of the study are examined under nine headings, comprised of the opinions of the teachers regarding "1- Suitability of the history subjects to purposes of the Social Studies course; 2- The level

of achievement of the stated gains; 3- Whether the contents of history subjects in curriculum are able to endear history subjects to children at primary school level; 4- Whether the time allotted for the curriculum gains is sufficient; 5- Suitability of the methods and techniques recommended in the curriculum; 6- Problems experienced in teaching of these subjects; 7- Efficacy of these subjects in instilling an awareness of history in the students; 8- The relationships among the values, qualifications and basic abilities defined under the curriculum and the history subjects defined under the curriculum gains; and 9- What are their recommendations for effective history teaching at primary school level?" In conclusion of evaluation and interpretation of the data collected from interviews conducted with participating class teachers regarding the history subjects in the primary school 4th grade Social Studies Curriculum in accord with the themes determined in scope of descriptive analysis process, the following findings were derived:

Opinions of the Participants regarding Suitability of the History Subjects to Purposes of the Social Studies Course

The teachers were asked "What are your opinions regarding suitability of the history subjects in Social Studies Curriculum to the purposes of the Social Studies course?" Answers given by the teachers are shown on the Table 1.

Table 1. Opinions of the participants regarding suitability of the history subjects in social studies curriculum to purposes of the social studies course

Opinions	f	%
Suitable	3	15
Suitable, but not sufficient	6	30
Not suitable	8	40
No opinion	3	15

15% of the participants express the history subjects in the 4th Grade Social Studies Curriculum are suitable for purposes of the Social Studies course, while 40% express they are suitable but not sufficient, 30% of participants express these subjects are not suitable for the purposes, while 15% state they have no thought on this matter.

Thoughts of the teachers who opine the history subjects in the 4th Grade Social Studies Curriculum are suitable for the purposes of Social Studies course (Ö1-Ö2-Ö14) can be outlined in general as follows: two teachers pointing out positive aspects have also expressed the program also contains negative points, stating *"The subjects are suitable for the stated gains since 4th Grade curriculum covers family history, national cultural elements, children's games from past to today and heroes of national was of independence"* (Ö14). *"Short and understandable, suitable for purposes of the social studied course"* (Ö1).

Thoughts of the teachers who opine the history subjects in the 4th Grade Social Studies Curriculum are suitable for the purposes of Social Studies course but are not sufficient (Ö6-Ö9-Ö13-Ö16-Ö17-Ö19) meet at the point that *"Historic events are presented at the cognitive level in accord with the stated gains in scope of the course. History subjects fulfil the knowledge gain of the course, but cannot be fully completed in the allotted class hours and causes difficulties due to being full of details exceeding the level of the students"* (Ö6-Ö9). Other opinions include, *"The spiral and interlinked structure of the course is positive. However, the National War of Independence subjects which require rote learning should be reviewed" (Ö16). "Suitable for purposes other than having a little too much detail" (Ö13). "The subjects in the curriculum meet the stated gains up to a level on the points of conformity with one's person and environment in regard of personal characteristics, knowing one's self, recognising individual differences, understanding values of one's society and understanding Atatürk's principles. However, in the context of general purposes of Social Studies course, sufficient learning cannot be achieved on intangible elements which are not tangibly utilised in daily life, like homeland, flag and independence. On the other hand, handling of national and universal values also includes internal contradictions and discrepancies"* (Ö17).

However, another important point in the studies is the fact that the teachers who opine the history subjects in the 4th Grade Social Studies Curriculum are not suitable for the purposes of Social Studies course have expressed their thoughts in a more detailed and precise language. Thoughts of the participants who express negative opinion on the matter focus on the following points. *"History subjects are not suitable for the purposes of the curriculum and the level of the students and are insufficient and boring"* (Ö11). *"The subjects have been handled in too many particulars and too much detail for the characteristics of the target age group. The subjects remain intangible in the minds of the students. They end up quickly forgetting what they learned. Students prefer to learn by rote since the subjects remain intangible for them"* (Ö8). *"The history subjects are insufficient. The students graduate with knowledge levels way below that of general culture"* (Ö18). *"There are unnecessarily long narrations which bore the students"* (Ö3). *"The number of subjects is too high, and the content is hollow"* (Ö15). *"The national war of independence subjects which require rote learning should be reviewed. I think the purposes remain too theoretical, the knowledge transfer gets stuck at the receiving stage, failing to induce heroisation and assimilation of knowledge"* (Ö7). *"Distance education fails to teach subjects in an effective and productive manner"* (Ö16). When opinions the teachers participating in the study regarding Suitability of the History Subjects in the Socials Studies Curriculum to the Purposes of the Social Studies Course are taken as a whole, it can be said a large majority holds a negative opinion, reaching up to 70% when those who find the subject partially suitable but still insufficient were added

Opinions of the Participants regarding the Level of Achievement of the Stated Gains

The teachers were asked "What are your opinions regarding the level of achievement of the stated gains by the history subjects in the curriculum?" Answers given by the teachers are shown on the Table 2.

Table 2. Opinions of the participants regarding the level of achievement of the stated gains by the history subjects

Opinion	f	%
Subjects can achieve the gains	8	40
Subjects can partially achieve the gains	3	15
Subjects cannot achieve the gains	8	40
No opinion	1	05

While 40% of the teachers participating in the study express that the history subjects in the 4th Grade Social Studies Curriculum has the capability to achieve the stated gains, %40 opines these subjects are insufficient and 10% stated they find the subjects only partially suitable.

The teachers who think the history subjects in the curriculum can achieve the stated gains (Ö1-Ö2-Ö3-Ö6-Ö9-Ö10-Ö12-Ö16) have confined themselves to state their positive opinion with few words, without going into detail; *"Stated gains can be achieved"* (Ö1). *"I think they achieve the stated gains"* (Ö12). *"I find the relationship between the gains and the content to be generally positive"* (Ö16). *"At achievable level"* (Ö10).

The teachers who think the history subjects in the curriculum can partially achieve the stated gains (Ö5-Ö11-Ö13) have also not provided any details regarding their judgement of partial achievement, stating, *"partially achieve"* (Ö5), *"Intermediate"* (Ö11) and *"Some are suitable, some are not"* (Ö13).

The teachers who posit that the history subjects in the curriculum are insufficient to achieve the stated gains (Ö4-Ö8-Ö14-Ö15-Ö17-Ö18-Ö19-Ö20) express their views as follows. *"The subjects have been handled in too many particulars and too much detail for the characteristics of the target age group. The subjects remain intangible in the minds of the students. They end up quickly forgetting what they learned"* (Ö8). *"Learning cannot take place because the time allotted for the classes is too short and the subjects are too many in number"* (Ö4). *"Subjects on Atatürk's principles remain too intangible in regard learning principles since they are not handled with more tangible, modern comparisons from daily life. Again, subject on personal rights and responsibilities do not correspond to what students*

face in real life and thus cause contradictions. Stated gains regarding the National War of Independence and Founding of the Republic are handled in a very tangible manner, but the contradictions particularly between gains regarding republic and the practices the students face in daily life cause these subjects to become insufficient in achieving the general purposes of Social Studies teaching" (Ö17). *"History subjects should be structured from near-to-far in a manner helping the children to recognize and understand their own time"* (Ö15). *"Since primary school students are at the concrete operations stage history subjects remain too intangible for them. They have difficulties in understanding these subjects. Unless visual materials are added to the course, the knowledge cannot take root in their minds"* (Ö19). *"Subjects are sufficient for the stated gains. But we are unable to support the subjects with extracurricular activities"* (Ö14). *"Interest and learning lessen as the subjects lessen"* (Ö18).

Opinions of teachers participating in the study who think the history subjects in the 4th Grade Social Studies Curriculum are insufficient to achieve the stated gains based on their own experiences and observations carry great importance regarding history teaching in primary schools.

Opinions of the Participants regarding Whether the Contents of History Subjects in Curriculum are Able to Endear History Subjects to Children at Primary School Level

When asked whether the contents of history subjects in the 4th Grade Social Studies Curriculum are able to endear history subject to children at primary school level, the answers provided the results shown in the Table 3.

Table 3. Opinions of the participants regarding whether the contents of history subjects in curriculum are able to endear history subjects to children at primary school level

Opinion	F	%
The subjects endears history	5	25
Should be improved	3	15
No opinion	1	05
The subjects do not endear history	11	55

When asked whether the contents of history subjects in the 4th Grade Social Studies Curriculum are able to endear history subject to children at primary school level: 25% of the participants expressed they do, 15% expressed they should be improved, 5% stated they have no thought on this matter, and 55% of the participants expressed the subjects do not endear history to the children.

The teachers who state the history subjects in the 4th Grade Social Studies Curriculum do not endear the field of history to primary school level children (Ö3-Ö4-Ö6-Ö7-Ö8-Ö9--Ö17-Ö18-Ö19-Ö20) express their thought as follows:

The teachers who state the history subjects in the 4th Grade Social Studies Curriculum cannot endear the science of history to the primary school level children (Ö3-Ö4-Ö6-Ö7-Ö8-Ö9--Ö17-Ö18-Ö19-Ö20) express their thoughts as follows: *"Endearing history to children, especially children on primary school level is a very important matter, and the textbooks used in education must support this. The subjects need restructuring to make them more tangible"* (Ö6-Ö9). *"The books scatter the narration too wide in handling the subjects and the teaching program containing too many activities for too little time decreases efficiency and leads to omissions"* (Ö4). *"In order to endear history to children the lessons should include short, clear and understandable activities suitable for the level of children"* (Ö3). *"The contents remain too intangible, leading the students to drift away from the subject and fail to assimilate learning sufficiently"* (Ö7). *"The subjects fail to endear history because they fail to encompass national cultural values, the cultural environment of our geography in regard of material and spiritual culture, solely taking a narrow nationalist and religious view as its reference"* (Ö17). *"In order endear history to children at this level story books on the subjects should be read, especially in the case of the National War of Independence. I have been reading the series 'Anadolu'ya Can Verenler' ('Those Who Raise Anatolia') and I find it very beneficial. I find that 'complete the map' activities also ease learning and provide many benefits. The contents remain intangible, leading*

children to rote learning, preventing them from internalising and learning to love the subject" Ö19. It is also pointed out that history *"Must be seen and visited to solidify"* the love for the subject (Ö11). As it is seen, teachers ascribe the failure to endear the history courses at primary school level to many reasons.

25% of the teachers states that the curriculum is suitable to endear history subject to the students and that they find the curriculum positive in this regard (Ö10-Ö12-Ö13-Ö14-Ö16), while those who expand on their viewpoint express their thoughts as follows: Some have ascribed their opinion to the basis of *"Through analysis of recent history* (Ö10), *the positive structure of the curriculum in regard of time, chronology, changes and continuity"* (Ö16), while some have emphasised, *"Students love the subjects as long as they don't go into too much detail"* (Ö13).

Teachers who stated the curriculum manages to partially endear the subject to students, but must be improved, recommend *"the curriculum should be supported with short, clear and understandable activities suitable for the level of the students"* (Ö8), *"the curriculum should be taught in the order of near-to-far history"* (Ö15), *"trips and visualisations should be utilised to make subjects tangible"* (Ö11) and *"details unsuitable for the age group should not be taught"* (Ö8).

Opinions of the Participants regarding Whether the Time Allotted for the Curriculum Gains is Sufficient

The teachers were asked "Do you think the class hours (time) allotted for teaching of history subjects to achieve the stated curriculum gains for history subjects under the 4th Grade Social Studies Curriculum are sufficient?" Answers of the teachers are as shown in the Table 4.

Table 4. Opinions of the participants regarding whether the time allotted for the curriculum gains is sufficient

Opinion	f	%
Sufficient	9	45
Insufficient	11	55

55% of the teachers participating in study find the allotted class hours (time) insufficient, while 45% finds it sufficient. Those who find it insufficient (Ö1-Ö3-Ö4-Ö7-Ö13-Ö14-Ö15-Ö16-Ö17-Ö18-Ö19) explain their reasons as follows: *"I believe the Time is Not Sufficient. The students struggle with the intensive 4th Grade Social Studies Curriculum following the Third Grade Life Studies content. Therefore I believe the allotted time is not sufficient"* (Ö7). *"Being only on single class level along with the large number of units sufficient time is not left for oral history activity and reflective thinking approach in a three class hour time period"* (Ö16). *"Lesson contents should be enriched in regard of basic life skills, providing more content which will contribute to communication, relationships, social and personal development as well as improvement in fields related to social problems, basic rights, duties and responsibilities the student will face in daily life, and the share of universal values and gains should be increased"* (Ö17).

Excluding one teacher who stated *"Class hours are sufficient. The classes should be supported with extracurricular trips"* (Ö14), the teacher who found class hours (time) sufficient (Ö2-Ö5-Ö6-Ö8-Ö9-Ö10-Ö11-Ö12-Ö20) have contented themselves with only expressing class hours are sufficient or suitable.

Opinions of the Participants regarding Suitability of the Methods and Techniques Recommended in the Curriculum

The answers of the participating teachers to the question "What is your opinion regarding suitability of the methods and techniques recommended in the curriculum for teaching of 4th Grade Social Studies course?" were as shown in the Table 5.

Table 5. Opinions of the participants regarding suitability of the methods and techniques recommended in the curriculum

Opinion	f	%
Sufficient	8	40
Insufficient	10	50
Needs Improvement	2	10

As seen in Table 5, 40% of the teachers opine the time recommended for history subjects in the curriculum is sufficient, while 50% state it is insufficient, and 10% opine it needs improvement.

Among the teachers who find the methods and techniques recommended in the curriculum for teaching of the 4th Grade Social Studies course (Ö1-Ö2-Ö5-Ö6-Ö9-Ö10-Ö11-Ö12), only two of them explain their thoughts on the matter as, *"Practicable methods and techniques are provided. As teachers we can diversify the techniques to rescue the class from becoming monotone"* (Ö6-Ö9), while the others confine themselves to simply state it is suitable.

Teachers who find the recommended methods and techniques insufficient (Ö6-Ö9-Ö7-Ö13-Ö14-Ö15-Ö16-Ö17-Ö18-Ö19) express their thoughts on this matter as follows: *"The generally flat language used to convey the subject lead the students to treat it as a fairy tale. Alternatively, use of methods and techniques that can improve interest and focus of the students would be more beneficial"* (Ö7). Another teacher pointing out the methods and techniques are not suitable states, *"it is seen the intangible nature of the subjects negatively affects learning"* (Ö8). *"Being confined to the classroom, history teaching fails to provide efficient results even when narration and question-answer techniques or visuals like slideshows, videos and films are used. Lack of sufficient historic materials at the school is a large problem. If the class hours were sufficient the methods could be found suitable. However, due to insufficient class hours the recommended methods and techniques remain insufficient"* (Ö14). And another teacher recommends, *"More active strategies, especially in organising trips, visits and experiences, should be used to endear the subjects to the student. Rather than oral narration, research and study trips should be organised to museums, historic locations and natural sites, allowing the student to see historic and cultural elements on site"* (Ö17).

10% of the teachers participating in the study recommend, *"The methods and techniques should be further simplified,"* (Ö20) and *"they would be suitable if the class environment is made more suitable and materials are somewhat increased"* (Ö20).

Opinions of the Participants regarding Problems Experienced in Teaching of History Subjects

When asked "Do you experience problems in teaching history subjects in the 4th Grade Social Studies Curriculum?" answers of the teachers were as seen in the table below.

Table 6. Opinions of the participants regarding problems experienced in teaching of history subjects

Opinion	f	%
No I Don't	3	15
Yes I Do	18	85

15% of the teachers participating in the study state they do not experience problems in teaching of history subjects, while 85% state they experience various problems. The teachers who state they do not experience problems ascribe this state of affairs to the fact that the utilized methods and techniques being suitable for the student level (Ö6-Ö9) and that the subjects are made tangible by organizing historic and cultural locations in the local area (Ö17).

The teachers who state they experience problems in teaching the subjects (Ö1-Ö2-Ö3-Ö4-Ö5-Ö6-Ö7-Ö8-Ö10-Ö11-Ö12-Ö13-Ö14-Ö15-Ö16-Ö18-Ö20) classify the problems they face in three main headings, namely "the subjects being unsuitable for the student level, problems arising from teaching methods and techniques, and the subjects being uninteresting." Main problems arising from the subjects being unsuitable for student level are expressed as follows: *"The subjects being way above the*

student level (almost to the high school level) poses a large problem" (Ö11). History subjects being above the student level render them more intangible and over-levelled in comparison to other lesson subjects. *"I have difficulty in teaching because subjects remain intangible"* (Ö2). *"I have problems in teaching the subjects in chronological order"* (Ö8). *"Student have trouble remembering past dates"* (Ö1-Ö5-Ö12), *"students have difficulty imagining historic events and facts in their minds, which make them intangible"* (Ö13), *"students cannot remembers the dates chronologically"* (Ö8). Another problem is the fact that *"students cannot act in ease when answering questions quite a ways above their level"* (Ö3). Teachers participating in the study express the problems arising from teaching methods and techniques as follows: *"The inability to utilise the diversity of methods and techniques contemplated in the curriculum, performance of evaluation according to the content rather than the stated gains, the failure to awaken interest of the student, the student's lack of knowledge regarding their own historic values and the student's lack of inclination to learn causes problems in teaching"* (Ö7). *"Lack of sufficient visual materials lead the subjects to remain intangible"* (Ö15). *"Lack of opportunities for cross-disciplinary linear activities sadly confines the teaching to a vertical and one sided progression." "The sudden intensification of history content in the curriculum in comparison to the previous grade and the deficiencies in preliminary learning of the students lead to learning difficulties"* (Ö16). *"We cannot take the students to visit historic locations. Simple narration in classroom is not sufficient"* (Ö14). A large majority of the teachers participating in the study point out that significant difficulties are experienced in history teaching and these difficulties are faced on many levels.

Opinions of the Participants regarding Efficacy of History Subjects in Instilling an Awareness of History in the Students

The answers of the participating teachers to the question "What is your opinion regarding efficacy of 4th Grade history subjects in the 2018 Social Studies Curriculum in instilling an awareness of history in the students?" were as shown in the Table 7.

Table 7. Opinions of the participants regarding efficacy of history subjects in instilling an awareness of history in the students

Opinion	f	%
Efficient	6	30
Partially Efficient	3	15
Not Efficient	11	55

30% of the teachers participating in the study gave a positive answer regarding efficacy of 4th Grade history subjects in the 2018 Social Studies Curriculum in instilling an awareness of history in the students, while %15 think they are partially efficient, and 55% opines they are not efficient. The teachers who believe awareness of history is sufficiently formed (Ö2-Ö6-Ö8-Ö9-Ö16-Ö19) state; *"while the students meet the Social Studies course for the first time in the 4th grade, since the groundwork for these subjects are formed in the previous years they begin the 4th grade at a high level of readiness. In this case, the awareness of history awakened in the children in the previous years is further developed with the history subjects in the 4th Grade Social Studies Curriculum"* (Ö6-Ö9). Another teacher opines, *"when supported with visual materials history teaching does not pose any problem in raising an awareness of history"* (Ö8). *"Of course it contributes. However, the teacher must guide the student well and use diverse materials"* (Ö19).

Teachers who state the history framework in the curriculum is partially efficient in raising an awareness of history (Ö6-Ö12-Ö14-Ö20) express their thoughts as follows, *"a more complete awareness of history can be achieved by utilising more materials and activities."*

According to teachers participating in the study who state the history subjects in the curriculum are insufficient to raise an awareness of history (Ö1-Ö3-Ö4-Ö7-Ö10-Ö11-Ö13-Ö14-Ö15-Ö17-Ö18) the most important reason for this state of affairs is the fact that *"history lessons are monotone and uninteresting for the children." "Under the current circumstances of history lessons opportunities for*

trips, visits and experiences are limited and therefore these lessons remain limited and ineffective in raising an awareness of history" (Ö14). Another reason is stated as follows, *"since awareness of history is a field which requires high levels of abstraction it becomes difficult to fulfil"* (Ö17). Therefore, *"tangible, uncomplicated, clearer gains should be targeted, and lesson contents should be structured according to this. Subjects and content determined according to student level, and gains and teaching methods determined according to these will be more effective in development of an awareness of history"* (Ö13). To this end the subjects should be *"moved away from monotone structures and towards the interests of students"* (Ö1) in a manner more suitable and more attractive for modern needs and expectations.

Level of Correlation between the Values, Qualifications and Basic Abilities Defined under the Curriculum and the History Subjects

When asked about their opinions regarding the level of congruity and proportionality between the values, qualifications and basic abilities defined under the curriculum and the history subjects, their answers were as shown in the Table 8.

Table 8. Opinions of the participants regarding level of correlation between the values, qualifications and basic abilities defined under the curriculum and the history subjects

Opinion	F	%
Congruent	11	55
Partially Congruent	3	15
Incongruent	4	20
No Opinion	2	10

55% of the teachers participating in the study have stated history subjects are congruent and proportional with the values, qualifications and abilities determined in the curriculum, while 15% state they are partially congruent, 20% states they are incongruent, and 10% state they have no thought on the matter.

Teachers participating in the study who find the correlation between the values, qualifications and basic abilities defined under the 4th Grade Social Studies Curriculum and the history subjects defined under the stated gains as congruent and proportional (Ö1-Ö2-Ö3-Ö4-Ö6-Ö7-Ö8-Ö10-Ö12-Ö13-Ö16) have mostly simply stated they find these elements congruent and proportional, without expanding on their thoughts. Those who expand on their thoughts have expressed their opinion as follows; *"Children are able to easily learn, understand and internalise the National War of Independence"* (Ö10). *"The subjects seem sufficient for core values. Course-specific abilities are very well prepared"* (Ö16). *"I definitely believe they are correlated. I believe values must definitely have a place in the content of social studies course, and these values are closely related to history subjects. I believe values like love of flag and nation, patriotism, etc. should be taught in content of this course"* (Ö7).

Teachers participating in the study who find the correlation between the values, qualifications and basic abilities defined under the 4th Grade Social Studies Curriculum and the history subjects defined under the stated gains as partially congruent (Ö9-Ö18-20) state that *"class hours for history subjects should be increased towards this end and unnecessary details should be avoided"* (Ö19) and these subjects *"should be supported with suitable activities"* for a more congruent curriculum.

Teachers participating in the study who find the correlation between the values, qualifications and basic abilities defined under the 4th Grade Social Studies Curriculum and the history subjects defined under the stated gains as incongruent (Ö11-Ö14-Ö17-Ö19) opine, *"in order to repair this problem material cultural elements like literature, arts, culture, paintings, sculptures, etc. should be selected in accord with learning characteristics of the students. Care should be shown to ensure that spiritual cultural elements like traditions, customs and usages conform to daily life experiences, and these should be determined in a fashion comporting to realistic needs and ensuring cultivation of equal and free individuals. Traditional values which do not align with modern social life should be eliminated from the curriculums"* (Ö17).

Two teachers (Ö5-Ö15) have stated they have no thought on the correlation between the values, qualifications and basic abilities defined under the 4th Grade Social Studies Curriculum and the history subjects defined under the stated gains.

Recommendations for Effective and Efficient History Teaching at Primary School Level

Finally, the teachers participating in the study were asked what are their recommendations for achieving effective and efficient history teaching for primary school children. When tabulated the feedback from the teachers appears as follows:

Table 9. What are your recommendations for effective history teachings at primary school level?

Opinions	f
Subjects should be supported more with visuals like images, films, maps, etc.	8
Trips to Historic Locations should be organised	5
Intangible contents should be replaced with tangible and age-appropriate content	4
Teachers should be provided with seminars on history teaching	4
Teaching should be based on practical and experience learning	3
Less subjects, less stated gains, more activities	2
Enactments, dramatization and gamification	2
Basic life skills should be taken as basis for teaching	2
Social Studies classes should be formed	1
Subjects should be made into stories	1
Social Studies libraries should be formed	1
Class equipment should be increased	1
Biographies should be utilised	1
	35

Finally, the teachers were asked what are their recommendations for effective history teaching at primary school level. It is seen the answers of participating teacher show great diversity. Some of the teachers have answered very shortly, while others have provided quite detailed responses. It is remarkable that some of these opinions support each other or even overlap. It is observed that some recommendations by the teachers for increasing effectiveness of history teaching are frequently expressed by many others, while some opinions remain particularly singular.

History lessors should be taught with more visualisation: Chief among the recommendations expressed by teachers (Ö1-Ö2-Ö3-Ö8-Ö12-Ö14-Ö17-Ö19) for more effective and more efficient history teaching is the idea that more visuals should be sued in history teaching (40% - f 8). Use of visuals like images, maps, films, videos, etc. suitable for the subject and the student level emerges as the most effective solution. Teachers express the importance of visuals for history teaching as follows: *"Teachers and students should be provided with access to visuals, worksheets and activities prepared according to subjects in the curriculum and level of the students through EBA environment in order to make lessons more effective, more interesting and more fun"* (Ö8). *"History can be better presented to children using cartoons and animations"* (Ö2). History subjects in Primary 4th Grade Curriculum *"should be made more effective and more fun for the children"* (Ö1). *"Subject should be made more endearing with short and concise narration and exemplary visuals"* (Ö3). *"I make a point of reading children's books about the National War of Independence and have my class read them too. I also add small videos about them. I make sure to include map activities. I do all I can to visualise the subject"* (Ö19). *"Teaching using short and concise films would be more effective"* (Ö12). *"Visuals and video presentations should be used more"* (Ö13-Ö19).

Study trips should be organised to historic locations: Many teachers (Ö4-Ö10-Ö11-Ö12-Ö14) have strongly pointed out in various ways that access to study trips to locations of important historic events, museums and archaeological sites providing the opportunity to see, touch and feel history on site. It is emphasised that such efforts should be supported by the Ministry of National Education. *"Trips to important historic locations like Çanakkale Soldiers' Cemetery, Anıtkabir, etc. should be organised in first grade and even in preschool"* (Ö14). Especially *"Trips to museums and historic locations to learn about the history of the National War of Independence. The Ministry of National Education should undertake these excursions and make them mandatory"* (Ö10). It is opined lives of important historic

personages should be included in history textbooks. Curriculums *"should be organised to better suit learning by practice and experience. Learning by practice, experience, observation and feeling should be promoted and curriculums should be structured according to this"* (Ö11). *"Short and concise films should be made and used in lessons"* (Ö12). _"Less subjects and more practical activities should be included, and historic locations should be visited for travel and study" (Ö4).

History subjects should be structured with tangible learning suitable for student level: Another important solution recommended by the teachers (Ö6-Ö9-Ö17) making lessons less intangible, structuring subjects to include tangible elements understandable for the students, more suitable to student level. *"Rather than details exceeding the student level and boring the student, more tangible elements can be used"* (Ö6-Ö9-Ö4). "Activities suitable for student level" should be planned. *"Efforts should be made to provide less details and more lasting learning with a smaller number of gains and less content"* (Ö17). *"Since this is an intangible field, the teaching methods and strategies should be made more suitable for learning principles, using a path from tangible to intangible, simple to complex, and tools like trips, observations and enactments should be utilised more"* (Ö17). Connections should be made to historic events which promote and support basic life skills. *"Subjects on Atatürk's Principles should be supported with simpler, more understandable, tangible learning contents, and visuals related to these subjects and historic films should be prepared and presented for the students. Students should be advised to read children's books on the National War of Independence and classrooms should have libraries including such books"* (Ö17).

Teachers should be provided with trainings on history subjects and history teaching methods: Another recommendation of the teachers participating in the study (Ö7-Ö8-Ö14-Ö20) to increase efficacy of history teaching is provision of on-the-job trainings to teachers regarding history subjects and history teaching methods. *"Trainings should be provided to teachers to remedy deficiencies of teachers regarding history teaching methods and techniques"* (Ö7). *"Researchers in the field of history should give seminars to teachers at schools"* (Ö14). _"Schools should be provided with subscriptions to periodicals on history," (Ö14). *"Teachers should be provided with history teaching seminars even if only by remote learning"* (Ö8-Ö20).

"In order to help children like history lessons the subjects should be made easier to understand by storification and gamification" (Ö17). *"Teachers should be provided with drama training so each teacher can utilise drama"* (Ö2).

In order to achieve these recommendations the teachers support the idea of "increasing the number of class hours" and *"forming a Social Studies workshop like the science laboratories in each school"* (Ö15) in order to remedy structural and equipment deficiencies. Another teacher points out the approach that made them love history as a solution: *"All my life I never liked history lesson and thought I would never understand it. Because my teachers would only narrate the subject without using any materials and so what I hear would sound like a lullaby to me. There was nothing to motivate me or awaken my interest. My opinion on this matter changed when I became a teachers, because when I started to think about how I could teach Social Studies course most effectively and made efforts to that end history lessons become more enjoyable both for me and my students"* (Ö19).

DISCUSSION and CONCLUSIONS

The results indicate that history teaching provided at primary school level has many problems. While opinions of the teachers vary regarding the efficiency and efficacy of the history teaching provided in 4th grade, it is revealed that it bear many problems in general. This result is congruent with the results of a study (Er & Bayındır, 2015) which exhibits that history teaching in scope of the Social Studies course fails to provide the expected efficiency. The acquired results indicate that deficiencies found in the previous curriculum have not been repaired in the last curriculum either.

The result presenting that the history subjects in the 2018 Social Studies Curriculum are congruent and proportional with the values, qualifications and basic skill stated in the curriculum constitutes the only

item where more than half of the teachers judge the program meaningful and positive in itself. This result emerges as the only point which is effectively taken into account in relation to a previous study (Yiğittir & Kaymakçı, 2012) and which shows partial positive development at 4th grade level.

While the point that curriculums related to history teaching should be structured according to intellectual and cognitive development status of the students on all levels is a matter strongly emphasised in studies on this field (Safran & Şimşek, 2006; Dilek, 2007; Dilek & Alabaş, 2010), results of this study exhibit this recommendation was disregarded. A large majority of the teachers participating in the study opine that the subjects in 2018 Social Studies curriculum are not suitable for the purposes stated in the curriculum and must be restructured in a manner suitable for cognitive and intellectual levels of the students. The recommendation that history subjects in the curriculum should be simplified has also been a part of studies on the previous curriculum (Er & Bayındır, 2015). The notion that students have difficulty memorising the dates of historic events is congruent with the results of Pala & Şimşek (2016) study. In conclusion, this results in a very low level of achievement of gains stated in the curriculum. Another result derived from the study is the fact that number of class hours allotted for history subjects in the Social Studies course is insufficient. In addition, due to the limited time allotted for history subjects, activities cannot be performed sufficiently and even teaching of the subjects falls behind. This result supports previous studies (Er & Bayındır, 2015). Results of the study show that all problems pointed out for the previous curriculums have not been remedied in 2018 Social Studies Curriculum either. Therefore, history subjects which remain too intangible, which children have trouble imagining in their minds and difficulty in comprehending, lead children to dislike history lessons.

One of the most important findings of the study is the fact that the history subjects taught in scope of the 2018 Social Studies Curriculum is not effective and is insufficient in raising an awareness of history in the students. Teachers ascribe the main reasons for this state of affairs as the insufficient time allotment, lack of support for extracurricular and curricular activities, lack of educational equipment infrastructure for activities in history lessons and their own lack of proficiency in history teaching methods and use of technology in history teaching.

Teachers have revealed their opinion that visual materials like images, videos, animations, etc. should be intensively used for effective teaching of history subjects in Primary School 4th Grade Social Studies Curriculum. This result is congruent with results of previous studies (Akbaba, 2003; Akbaba, 2005a; Akbaba, 2005b; Akbaba, Keçe & Erdem, 2012; Alabaş, 2007) which support effectiveness of visuals in increasing effectiveness of history teaching.

Teachers recommend providing history teaching in a manner supporting learning by practice, experience, observation and feeling in order to achieve the expected efficiency in teaching of history subjects in Primary School 4th Grade Social Studies Curriculum. In this regard, a significant number of teachers have recommended, in their answers to various questions, organisation of extracurricular activities like visits to museums and historic locations and restructuring of the curriculums accordingly as the second most effective solution. These results of the study supports the results of previous studies (Ata, 2013; Ata, 2015; Kısa & Gazel; Öner, 2015; Berk, 2017; Üztemur, Dinç ve Acun, 2018) which show extracurricular activities are quite effective in history teaching at middle school level and exhibits that the same is also valid for primary school level.

Another important solution recommendation, as supported by a previous study (Berk, 2012) is the notion of using historic re-enactments and drama to increase children's interest in the course in history teaching at primary school level and that there is a need to provide teachers with training in this regard to this end. In the study teachers have also recommended determination of the subjects in the curriculum on the basis of basic life skills, creation of specially equipped Social Studies classrooms containing lesson materials (visuals, books, museum items, etc.) which facilitate and reinforce Social Studies teaching as seen in the example of science laboratories, and use of stories and biographies of important historic personages as solutions for effective history teaching at primary school level.

Recommendations

History education provided in scope of the Primary School Social Studies courses should be restructured on basis of basic life skills and student interests in accord with intellectual and cognitive development level of the students. Curriculums should be prepared with participation of all stakeholders, including comprehensive and inclusive information from current, qualitative and quantitative studies based on data obtained from teachers and students as well as academicians.

History teaching inside and outside classroom should be made more efficient and enjoyable by using all kinds of visual materials (images, maps, films, animations, etc.) and organising study and observation trips to various historic locations like museums, archaeological sites, etc. and the financing and organisation affairs necessary to achieve these practices should be resolved by the Ministry of National Education (MEB). The activities and visual materials to be used in the classes should be prepared by specialists according to various levels supporting attention and learning capacities of students and opened to access of teachers indefinitely and without charge.

Primary school teachers should be provided with on-the-job trainings regarding history subjects and history teaching methods without charge in order to keep their knowledge and skill current.
Qualitative and quantitative studies should be conducted on history teaching at schools by annually gathering feedback from students and teachers to analyse needs and to determine strong and weak aspects in order to ensure effective and efficient history teaching at schools.

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DEVELOPMENT OF THE ONLINE RESEARCH AND READING COMPREHENSION SKILLS SCALE FOR MIDDLE SCHOOL STUDENTS[1]

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Abstract

Nowadays, online research and reading comprehension skills are among the prominent concepts. It is not possible to deny the effects of the internet on students' daily and academic lives. In the study, a scale was developed to be used in order to reveal the level of internet use of middle school students in their research processes and to determine the level of online research and reading comprehension skills. In the development of the scale, the relevant literature and curriculum were examined, the findings obtained from the interviews and observations with the students were used, and the opinions of the field experts were taken. As a result of all these operations, an item pool and a draft scale form were created for the instrument. The prepared form was applied to middle school students and explanatory and confirmatory factor analyses were conducted on the obtained data. As a result of the analyses, it was seen that the scale contains 30 items and the items of the scale were collected in five factors. It is thought that the instrument developed to determine the online research and reading comprehension skills levels of students has the potential to contribute to the related literature.

Keywords: Online research, reading comprehension, internet searching, middle school students.

INTRODUCTION

Information technologies affect the field of education deeply as well as every area of life as it thought. Now, we are in an era dominated by digital tools, not pens and paper any more. With these new tools, the concept of literacy has also changed. In addition to traditional literacy, which includes the ability to read and create certain symbols, digital literacy, internet literacy, multi-layered literacy, functional literacy, and other new types of literacy have entered into our lives (Kurudayıoğlu and Tüzel, 2010).

Students who are in the middle of digital literacy, internet literacy, multi-layered literacy, functional literacy and other new types of literacy are considered to be “digital natives”. Digital natives' reading, writing and communication practices have been an important area of research for media literacy researchers and teachers for the last few years. Little information is available about students' online activities, perceptions, preferences, and skills.

Lawless and Schrader (2008) stated that the internet had become a dominant source in today's digital world. The internet-related changes have led educators, researchers, politicians and administrators to think about what it is to read and understand online information. However, little is known about students’ understanding of what they read online on the internet and the strategies and processes they use to research online. New literacy of online research and understanding has recently become known. Countries such as Australia, Canada and the United States of America aim to integrate this research into new curricula and educational standards (Leu, McVerry, O’Byrne, Kiili, Zawilinski, Everett-Cacopardo, 2011; Leu, Zawilinski, Forzani, & Timbrell, 2015).

[1] This study was carried out as a doctoral thesis prepared by Süleyman Ünlü and executed by Prof. Dr. Musa Çifci

It is suggested that the internet and other information and communication technologies (ICTs) significantly change literacy skills over time (Coiro, Knobel, Lankshear, & Leu, 2008). The increasing importance of the internet, especially as an essential tool in our everyday and working life, necessitates new ways of thinking about both new literacy skills and traditional literacy skills required for competence on the internet. As a result of these developments regarding the internet, the concept of literacy affects our ability to comprehend critical evaluation of information, synthesize texts and read online. Indeed, critical evaluation has become one of the most important skill sets that readers need today (Goldman, Lawless & Manning, 2012; Wiley, Goldman, Graesser, Sanchez, Ash, Hemmerich, 2009).

Dual-Level Theory of New Literacy

Due to the rapidly developing nature of literacy, the object we are trying to research is constantly changing and redefined. Thus, the dual-level theory of new literacy has been proposed (Leu, Kinzer, Coiro, Castek & Henry 2013). One of the principles of new literacy (Leu, Kinzer, et al., 2013) is that the internet allows new social applications with technologies such as instant messaging, social networks, blogs, wiki and e-mail (Greenhow, Robelia and Hughes, 2009; Lewis and Fabos, 2005).

The internet is seen as an important tool in the development of new literacy skills. Skills in information and communication technologies also constitute the content area of new literacy. As Coiro et al. (2008a) stated, both information and communication technologies and online environments such as the internet YouTube, blog, Facebook, Twitter and forum created environments for the use of literacy skills.

In today's world, because of the constantly changing social applications and information communication technologies, it is difficult to make a definition of a concept which is also changing continuously. Today, the concept of literacy is tried to be defined through different theories and perspectives such as literacy as a new discourse (Gee & Handford, 2013), multimodality (Kress, 2003), multi-literacy (New London Group, 1996), information and communication technologies literacy (International ICT Literacy Panel, 2002) and digital literacy (Martin, 2006) (as cited in Yamaç, 2018). Researchers, on the other hand, are trying to gather these theories and perspectives under a single roof called the dual-level new literacy (Leu et al., 2015; Leu et al., 2013). The first one is "new literacy in lowercase letters" and the second is "New Literacy in Capital Letters".

The basic principles of the New Literacy with Capital Letters Theory are as follow (Leu et al., 2013, p.1158):

- The Internet is the descriptive technology for literacy and learning in our global society.
- New literacy is needed to take full advantage of the internet and related technologies.
- New literacy is a concept that is constantly changing.
- New literacy is a multiple, multi-format and multi-modal literacy.
- The basis of new literacy is critical literacy.
- New types of strategic knowledge are required along with new literacy.
- New social practices are the basic element of new literacy.
- Teachers have an even more important function in literacy education with the change of their roles.

Leu et al. (2013) believe that these principles are useful for informing the "Theory of New Literatures" and to guide the development of new literary (lower-case) theories, many of which are emerging and developing. An example of the lowercase theory of new literacy developed is to understand online research and reading. In these online research and reading comprehension studies (Leu et al. 2013 p. 1164), 6 key elements are emphasized.

1. Online research and reading comprehension is a self-regulated process, as each reader can follow a unique method of structuring information and text.

2. There are five steps that define the process of online research and reading comprehension: (1) identification of a problem (2) reaching information to solve a problem (3) evaluation of the information, (4) synthesis and (5) reporting.

3. Online research and reading comprehension differ from offline reading, thus requiring additional skills and strategies.

4. Online content can be supportive, especially for some individuals who have difficulty in reading.

5. It cannot be said that adolescents are always skilled at online research and comprehension.

6. It can be said that collaborative online reading and writing practices increase understanding and learning skills (Leu et al., 2013, p. 1164).

Unlike the 8 principles expressed in capital letters, these 6 principles expressed in lowercase letters guide researchers in online research and reading comprehension.

We can express the new dual-level literacy theory, consisting of literacy with capital letters and literacy with lowercase letters, as follows: It would be beneficial to use this theory in order to discover new theory fields. Also, the lowercase letter literacy research can inform the capital letters literacy theory over time. Leu et al. (2013) stated that if traditional paradigms were used, we might not be able to keep up with the rapidly changing literacy environment. They also stated that we needed new epistemologies and research practices that kept pace with the rapid changes we envisioned, as new literatures are constantly changing (p. 1171). The dual-level literacy theory with lowercase and capital letters will help researchers understand online reading, read again, and understand social applications.

Online research and understanding begin with a question. The information needed to solve this question often leads the online research and understanding process (Zhang and Duke, 2008). Online readers often access information via search engines (Afflerbach, 2015). Online readers evaluate selectively in achieving results that are relevant to research questions. The ability to synthesize the information obtained as a result of the evaluation is an important aspect of online research and understanding (Deschryver & Yadav, 2015; Goldman et al., 2012). Readers choose important ideas from multiple sources and organize them to create a consistent understanding of the topic and compare similar and different aspects of these ideas (Cho & Afflerbach, 2015; Rouet, 2006; Strømsø, Bråten and Britt, 2010). Readers then integrate these ideas by creating unifying links to make consistent statements in writing (Spivey and King, 1989).

Purpose of the Study

In the current study, it is aimed to develop a scale to measure the online research and reading comprehension skills of middle school students (6^{th}, 7^{th} and 8^{th} grades). Today, there are not enough measurement tools to evaluate the online reading needs of middle school students. With this study, it is thought that some contributions will be made to the related literature. In accordance with this purpose, all steps of online research and reading are followed in the study: in the first stage, the problem is identified; in the second stage, information necessary to solve the problem is obtained; in the third stage, critical reading is performed to evaluate the data obtained; in the fourth stage, the obtained information is synthesised and in the last stage, the constructed information is shared via online tools with others.

METHOD

Participants

A total of 469 students attending eight middle schools in the central district in the city of İzmir participated in the current study. The mean age of the participating students is 12.3 (Sdev: 0.4). Of the participating students, 51.1% are males and 49% are females. Of the students, 149 (32%) are 6^{th} grade students, 163 (35%) are 7^{th} grade students and 157 (34%) are 8^{th} grade students.

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Table 1. Demographic characteristics of the sample

Participants	f	%
6th grade	149	31.8
7th grade	163	34.8
8th grade	157	33.5
Total	469	100.0

The participating students were found to be medium level internet users in general. Four students out of every ten students (43%) stated that they had been able to have access to content in the internet environment for three years while the internet history of the remaining students was found to be varying between one year and four years. The students' frequencies of daily internet use were close to each other.

Table 2. Time of the İnternet use

Frequency of internet use	f	%
1-2 hours a day	152	32.41
3-4 hours a day	169	36.03
More than 4 hours a day	148	31.56
Total	469	100.0

Measurements

The Online Research and Reading Comprehension Skills Scale (ORRCSS) was developed to determine students' level of internet literacy and it is a 30-item self-assessment scale. In the development of the scale items, first the literature on online research and reading comprehension skills was reviewed (Coiro, 2005; Coiro and Dobler, 2007; Coıro, & Putman, 2016; Coiro, & Kennedy, 2011; Gambrell et al., 1996; Greene et al., 2011; Kiili,, Coiro, & Hämäläinen, 2016; Kiili, Leu, Utriainen, Coiro, Kanniainen, Tolvanen, et.al. 2018; Leu, Forzani, Burlingame, Kulikowich, Sedransk, Coiro, et.al. 2013; Leu, McVerry, O'Byrne, Kiili, Zawilinski, Everett, Cacopardo, et.al. 2011; Leu, Zawilinski, Forzani, & Timbrell, 2014; Li, 2020; Moos and Azevedo, 2008; Putman, 2014; Zawilinski, Carter, O'Byrne, McVerry, Nierlich, & Leu, 2007).

The scale items were designed in the form of a five-point Likert scale ranging from "Never" to "Always".

The scale was developed to include five sub-scales to determine middle school students' online research and reading comprehension skills. Brief information was given about these sub-scales below:

1. Problem posing and defining (has 4 items. Sample item: "I do not waste time on irrelevant subjects while researching in the internet.")
2. Having access to online information (has 9 items. Sample item: "I can use the "Advanced Search" option in the tools menu of the opening page of Google, Bing and Yandex.")
3. Analysing online information (has 7 items. Sample item: "I pay attention to whether pictures, sounds and other visuals on the web page are in compliance with my goal.")
4. Synthesising online information (has 7 items. Sample item: "I can determine the different, similar or contradictory aspects of the bits of information on different web pages.")
5. Conveying information by using multimedia (has 3 items. Sample item: "I can attach files to communication tools such as WhatsApp, Facebook Messenger, e-mail.")

Data Analysis

In the analysis of the collected data, SPSS 21.0 and AMOS Graphics were used. First, descriptive statistics and correlation analysis were employed and then structural equation modeling (SEM) and bootstrapping were conducted. In order to test the hypotheses of the relationships among career adaptability, EI, striving for a goal, and setting life goals, the SEM approach was used. On the basis of what has been recommended by Anderson and Gerbing (1988), first, confirmatory factor analysis was used to test whether the measurement model had an acceptable fit to the data. After the measurement model was confirmed, the maximum likelihood method was used to analyze the serial structural model. Chi-square statistic (χ^2), χ^2/df ratio, CFI, RFI, GFI, TLI, SRMR, and RMSEA χ^2/df ratio < 5; SRMR and RMSEA < .08; and CFI, RFI, GFI, and TLI > .90 were used as cut-off criteria in the evaluation of the fitness of the SEM (Hu & Bentler,1999; Kline, 2015). Finally, a bootstrapping procedure with 10,000 bootstrapped samples was used to determine the significance of the mediation effects. As proposed by Hayes (2013), the presence of significant mediation (i.e. an indirect effect) was determined when the 95% bias-corrected bootstrap confidence interval (CI) did not contain 0. While testing mediation, the bootstrapping procedure is preferred more as it has some advantages over Baron and Kenny (1986) and Sobel's (1982) traditional approaches (Hayes, 2015; Preacher et al., 2007).

RESULTS

In the current study, first, attempts were made to establish the content validity. To this end, a four-stage action plan was implemented: 1. Review of the relevant literature and curricula, 2. Analysis of the documents obtained from the interviews conducted with middle school students and observation notes, 3. Development of the item pool, 4. Interviews with field experts.

In the relevant literature, research on online research and reading comprehension was reviewed. Moreover, the content of information technologies and Turkish courses were examined and the relevant objectives were determined. The skills that could be related to online research and reading comprehension were listed such as how to conduct a search on the harms of radiation emitted by phones in search engines, how to limit the search, how to select key words and how to select the best results in search engines.

In the interviews conducted with the students, the issues stated by the students in relation to online research and reading comprehension were determined and the data obtained from the observation forms were evaluated together with the students' journals. In this way, the students' opinions about online research and reading comprehension were determined and thus the items were written and added to the item pool.

In the item pool constructed, there were a total of 44 items. Then the draft scale was submitted to the review of five field experts (two teachers, three academicians) and two measurement and evaluation experts. In light of the feedback received from the experts, a total of 14 items were discarded from the pool and some changes were made on some of the remaining items.

The scale was then submitted to expert review again and it was agreed that this form of the scale could be administered to students. The data collected were analyzed in SPSS program package.

In this process, exploratory and confirmatory factor analyses were conducted. In order to evaluate the theoretical factor structure of the scale determined by the researcher and to reduce the item numbers into fewer factors, principal components factor analysis was carried out (Tabachnick and Fidell, 2001).

First, Kaiser-Meyer-Olkin sampling adequacy measurement was performed to investigate the adequacy of the data set for more analyses and the value was calculated to be 0.903. Barlett's Sphericity test was found to be significant (p <.001).

[*KMO* = .903, Barlett's Sphericity Test: App. *Chi-square* = 7458.52; *df* = 435, *sig* = .000].

Second, principle components analysis was conducted without rotating and a construct with 6 factors having eigenvalue higher than 1 was obtained. This construct explains 63.13% of the total variance. When the Scree plot was examined, it was seen that there is a high momentum fall after the fifth factor. Thus, it was decided to test the five-factor construct.
Oblique rotation method was preferred for testing the five-factor construct, since the items in the online research and reading comprehension skills scale are related to skills and include self-assessments of students. According to Tabachnick and Fidell (2001), attention should be paid to have coefficient values above .30 to adapt the scale items to the relevant factor construct. Then, to reveal the level of relationship between the factors and to determine the item-factor interaction, rotation analysis was performed both vertically and obliquely (using direct oblimin technique and 0 delta value).

In the tables below (Table 3), findings from the factor analysis are presented.

Table 3. Rotated design matrix of the online research and reading comprehension skills scale (principle components analysis)

Items	Mean	Std.Dev.	F1	F2	F3	F4	F5
1. When I encounter new information on the Internet, I know I can find better of this information.	3.11	1.49	-.034	.092	.018	.540	-.069
2. I do not waste time on irrelevant subjects while researching in the internet.	3.13	1.42	-.002	.035	-.089	.861	.018
3. I know how to research which topic in the internet.	2.58	1.41	-.131	-.053	.043	.858	-.009
4. I know how to research a topic I am researching in the internet without confusing it with other topics.	3.45	1.37	.200	-.013	.082	.560	-.003
5. I know how to use search engines (such as Google, Bing, Yandex, Yahoo, AOL) to find information in the internet.	4.26	1.37	.838	.155	-.042	-.060	-.017
6. I can access my previous search by browsing the history menu of advanced search engines like Google, Bing and Yandex.	4.44	1.19	.846	.092	-.072	-.022	-.048
7. When deciding on the web page I will enter, I pay attention to the type of results listed on the search page such as video, visual, news.	4.71	.93	.777	-.138	.067	.015	.030
8. If I do not get results with the words I use in a Google search, I change the words.	4.60	.99	.788	-.021	.032	.077	.106
9. I know what the extensions like com, org, gov, edu, net mean.	4.34	1.32	.887	.153	-.090	-.051	.022
10. I use “quotation marks” and detailed search tools when needed.	4.35	1.32	.865	.083	-.062	-.014	-.015
11. I know that in Google search, there may be useful information in its lower ranking sites.	4.65	.97	.784	-.133	.072	.005	-.035
12. I can choose the web page according to the short explanations below the web addresses.	4.44	1.19	.570	-.038	.205	.061	-.085
13. I can use the "Advanced Search" option in the tools menu on the opening page of Google, Bing and Yandex.	4.14	1.42	.535	.128	.127	-.007	-.111
14. Since I know that the words written in bold, CAPITAL LETTERS, *italic* and underlined, I pay attention to these words first.	2.50	1.27	.008	.733	-.098	.120	-.071
15. I pick the ones that work for me from the information I find on the website.	3,23	1.48	.136	.709	.022	-.038	-.028
16. I can understand the purpose of creating images, audio or video recordings on the web page.	4.14	1.31	-.075	.807	.094	-.066	.124
17. I check the reliability of the page that I will open by paying attention to the extensions like edu, gov, com in the results listed on the page at the end of the search.	3.75	1.50	-.032	.813	.131	-.060	.069
18. I check the conformity of the writings on the web	3.23	1.50	.058	.778	-.008	-.016	-.091

page to the spelling rules.							
19. I pay attention to whether the images, sounds and other visuals on the web page comply with my purpose.	3.08	1.50	.031	.782	-.048	.104	-.084
20. I pay attention to the date on which the information in the website was created.	3.96	1.48	.052	.658	.015	.105	-.032
21. I prepare a new assignment by associating the information, images and videos I have obtained from different websites.	4.26	1.35	-.080	.094	.804	-.021	-.003
22. I question the suitability of the information on the website for the subject I am researching.	4.29	1.33	.065	.013	.664	.058	.134
23. I check the reliability of the web page by looking at the site extensions such as com, edu gov, sections such as "contact - about us" and whether there are any spelling errors.	4.75	.75	.076	-.025	.576	.095	.112
24. I pay attention to the interest in and expertise on the subject of the person who created the information on the web page.	4.11	1.45	.004	.084	.730	-.088	-.111
25. I compare the information on the web page with the information from different sources and reach a conclusion.	4.23	1.32	.214	.159	.383	.083	.055
26. I rearrange the thoughts on the web page from my own perspective.	4.14	1.42	-.023	.006	.694	.026	-.127
27. I can identify similar, different, or contradictory aspects of information on different web pages.	4.29	1.27	.029	-.070	.653	-.029	-.146
28. By using video, sound recording, visuals and written texts, I convey to the reader clearly what I want to tell.	2.69	1.42	-.014	-.013	.098	-.022	-.781
29. I convey the information I obtained from the web page to the concerned people by using tools such as blog posts, YouTube video, e-mail, Facebook Messenger, WhatsApp, Twitter, and Instagram.	2.98	1.39	.011	.000	.013	.003	-.831
30. I can attach files to communication tools such as WhatsApp, Facebook Messenger, e-mail.	2.95	1.43	.042	.047	-.046	.102	-.754
Eigenvalue			9.07	2.92	2.44	1.85	1.59
Percentage of Variance			30.25	9.75	8.14	6.20	5.30
Cronbach Alpha Reliability			.93	.89	.82	.70	.75
Total Variance: 59.63%							
Total Reliability of the Scale: .909							
Principle Components Analysis.							
Oblimin with Kaiser Normalization.							

As a result of the analysis, the five-factor construct in the online research and reading comprehension skills scale was found to account for 59.63% of the total variance and the total reliability coefficient of the scale was found to be .90.

The first factor is labelled as having access to online information and includes 9 items. This first factor explains 30.25% of the total variance. Its Cronbach alpha internal consistency coefficient was calculated to be .93. The factor loadings of the items in this factor were found to be ranging from .887 (I know what the extensions like com, org, gov, edu, net mean.) to .535 (I can use the "Advanced Search" option in the tools menu on the opening page of Google, Bing and Yandex.). The majority of the item factor loadings in this factor were found to be higher than .75.

The second factor is labelled as analysing online information and includes 7 items. This second factor explains 9.75% of the variance. Its Cronbach alpha internal consistency coefficient was calculated to be .89. The factor loadings of the items in this factor were found to be ranging from .813 (I check the reliability of the page that I will open by paying attention to the extensions like edu, gov, com in the results listed on the page at the end of the search.) to .658 (I pay attention to the date on which the information on the website was created.). The majority of the item factor loadings in this factor were found to be higher than .70.

The third factor is labelled as synthesising online information and includes 7 items. This third factor explains 6.20% of the variance. Its Cronbach alpha internal consistency coefficient was calculated to be .82. The factor loadings of the items in this factor were found to be ranging from -.804 (I prepare a new assignment by associating the information, images and videos I have obtained from different websites.) to .383 (I compare the information on the web page with the information from different sources and reach a conclusion.). The majority of the item factor loadings in this factor were found to be higher than .65.

The fourth factor is labelled as problem posing and defining and includes 4 items. This fourth factor explains 8.14% of the variance. Its Cronbach alpha internal consistency coefficient was calculated to be .70. The factor loadings of the items in this factor were found to be ranging from .861 (I do not waste time on irrelevant subjects while researching in the internet.) to .560 (I know how to research a topic I am researching in the internet without confusing it with other topics.). The majority of the item factor loadings in this factor were found to be higher than .65.

The last factor is labelled as conveying information by using multimedia and includes 3 items. This fifth factor explains 5.30% of the variance. Its Cronbach alpha internal consistency coefficient was calculated to be .75. The factor loadings of the items in this factor were found to be ranging from -.831 (I convey the information I obtained from the web page to the concerned people by using tools such as blog posts, YouTube video, e-mail, Facebook Messenger, WhatsApp, Twitter, Instagram.) to -.754 (I can attach files to communication tools such as WhatsApp, Facebook Messenger, e-mail.).

Pearson product-moment correlation coefficients were calculated between the total correlations of the five sub-scales called having access to online information, analysing online information, problem posing and defining, synthesising online information and conveying information by using multimedia (Cohen, 1988) and are presented in Table 4:

Table 4. Correlations between the Sub-scales of the online research and reading comprehension Skills Scale

	HAOI	AOI	SOI	PPD	CIUM
HAOI	1	.233**	.270**	.259**	.286**
AOI		1	.452**	.527**	.212**
SOI			1	.349**	.242**
PPD				1	.273**
CIUM					1

**p<.05

“HAOI: Having access to online information”; “AOI: Analysing online information”; “SOI: Synthesising online information”; “PPD: Problem posing and defining”; “CIUM: Conveying information by using multimedia”.

Strong correlations were observed between the first, third and fourth factors. Significant correlations were observed between the first and fifth factors and the second, third and fourth factors. All the correlations observed are significant at the level of 1%.

Confirmatory factor analysis was conducted for the next stage. In order to confirm the 30-item and 5-factor construct of the scale, the structural equation model was constructed in IBM Amos program.

In order to evaluate the results of the confirmatory factor analysis, the ratio of Chi-square to the degree of freedom, RMSEA (Root Mean Square Error of Approximation), SRMR (Standardized Root Mean Square Residual) TLI (Tucker-Lewis Index) and CFI (Comparative Fit Index) were used.

The ratio of Chi-square to the degree of freedom was found to be ($\chi 2$ /df) 2.58 (1011.93/391); RMSEA value was found to be .058; TLI value was found to be .906 and CFI value was found to be .915. When the standardized RMR value was examined, the fit index was found to be

.068. In general, the model yielded acceptable fit values. The standardized parameter values obtained for the online research and reading comprehension Skills Scale through the confirmatory factor analysis are given in Figure 1.

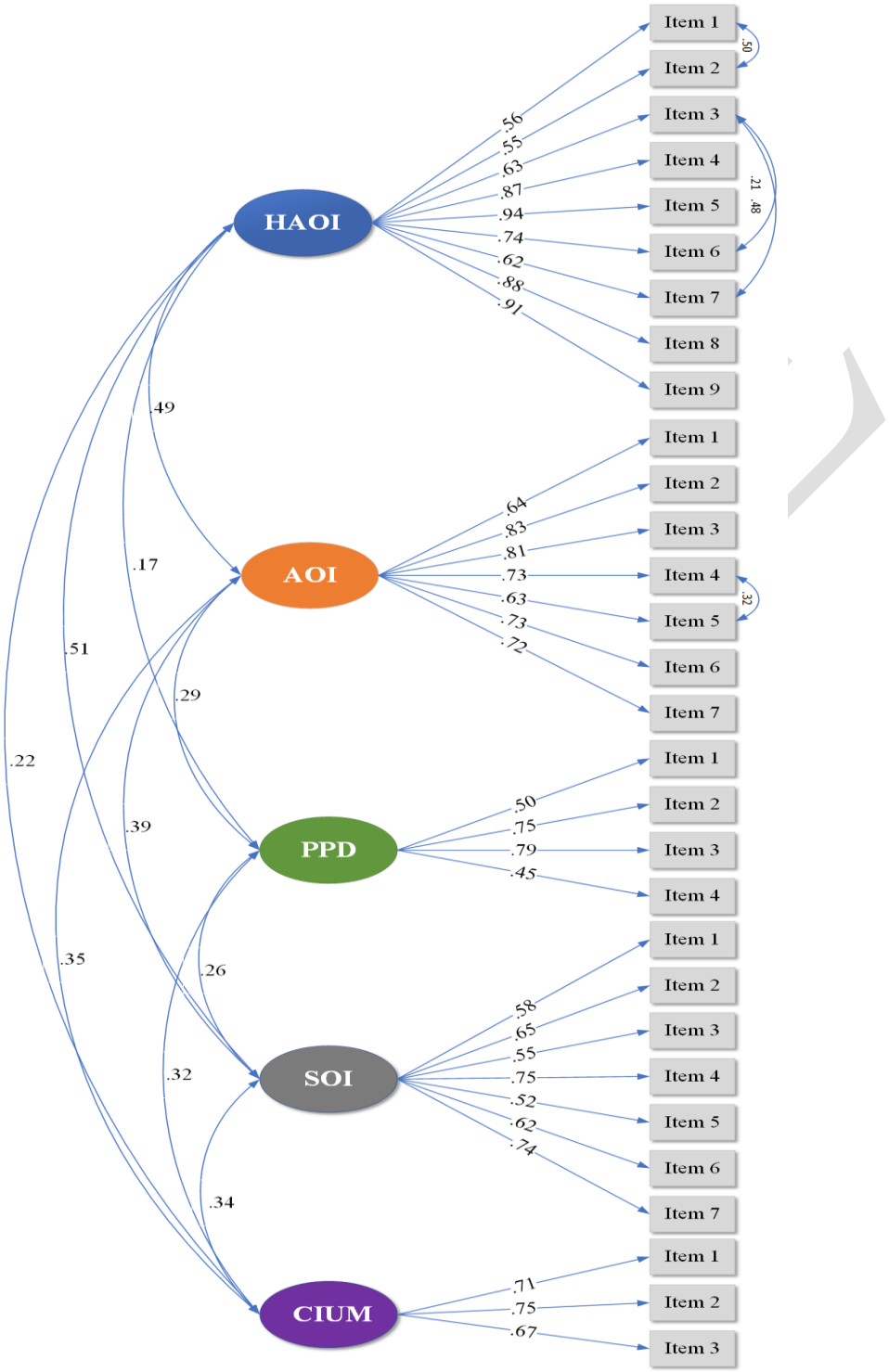

Figure 1. Online research and reading comprehension skills scale confirmatory factor analysis path scheme "standardized values"

Note. "HAOI: Having access to online information"; "AOI: Analysing online information"; "PPD: Problem posing and defining"; "SOI: Synthesising online information"; "CIUM: Conveying information by using multimedia".

DISCUSSION and CONCLUSIONS

Today, in line with the development of technology, the concept of literacy is changing and redefined. In order to adapt to the conditions of the technology age we are in, it is necessary to use the internet effectively together with information technology. Starting from the first stages of education, it is important to develop students' skills in using the internet, accessing information and organizing it as they need. In this context, we see that the concept of online research and reading comprehension comes to the fore.

While there are studies of online reading conducted on university students in Turkey, there is a very limited number of studies conducted with the participation of primary and middle school students. Among the studies conducted on university students, Baştuğ (2015) aimed to develop the online reading strategies scale. The participants of the study are 371 pre-service teachers attending the Elementary School Teaching Department of Niğde University. The collected data were subjected to exploratory and confirmatory factor analysis. As a result of these analyses, a construct consisted of 16 items gathered under 4 factors ("purposeful reading", "reading readiness", "selective reading" and "checking reading") was obtained. Geçer & İra (2014) aimed to adapt the scale of information seeking and interpretation strategies in the web environment developed by Wu and Tsai (2005) to Turkish. The study was conducted with the participation of a total of 676 pre-service teachers attending the Technical Education Faculty and Education Faculty in Kocaeli University. As a result of the study, a construct consisted of 23 items and 6 factors was obtained. Altay and Altay (2017) investigated the effect of online reading activities of the students learning English as a foreign language and their metacognitive reading strategies on their reading achievement scores. Ulusoy and Dedeoğlu (2015) examined the pre-service teachers' perceptions of their comprehension strategies they use while performing e-reading and of their using e-literacy and comprehension strategies in the classrooms where they will teach in the future. Askar & Mazman (2013) adapted the "Online Information Seeking Inventory" developed by Tsai (2009) into Turkish and conducted reliability and validity studies of the adapted inventory. There were a total of 788 participants of the study. After the translation of the scale, first level and second level confirmatory factor analyses were conducted for validity studies while Cronbach Alpha coefficient and McDonald's omega coefficient were calculated for reliability studies. As a result of the confirmatory factor analysis of the inventory consisted of 25 items and 7 factors ("getting lost", "evaluation", "purposeful thinking", "distinguishing basic ideas", "trial and error", "control" and "problem solving"), the model was found to have a good fit.

The number of the studies on middle school students seems to be very limited. Henkoğlu, Keser, & Mahiroğlu (2017) developed a measurement tool to determine the information seeking strategies used by middle school students in the internet. As a result of the factor analysis, the scale was found to have an eight-factor structure. Aydemir, Sakız & Doğan (2019) aimed to develop a valid and reliable alternative evaluation tool to measure the digital literacy skills at elementary level. The study group of the study is comprised of 31 elementary school fourth grade students. The Digital Literacy Skills Rubric (DLSR) was developed on the basis of the ORCA (Online Reading Comprehension Assessment-Elementary) used by Kingsley (2011). The reliability of the rubric was tested through internal consistency coefficient, item analysis, Fleiss Kappa coefficient and inter-rater reliability while its validity was tested through expert opinions and Pearson Product-Moment Correlation Coefficient. Thus, it is seen that there is a need for an online research and reading comprehension skills scale for middle school students.

The online research and reading comprehension skills scale to be developed in the current study for middle school students' skills to encourage readers to think critically, such as defining the problem, formulating questions and analysing and synthesizing various online resources, and communicating the acquired information to the necessary people is different from other scales developed before with its features and it is believed to fill an important gap in the literature.

In the current study, the online research and reading comprehension Skills Scale was developed, which is thought to contribute to the development of online research and reading comprehension levels of middle school students. The scale has the potential to provide middle school students with useful information for their ever-changing research and data access needs in the context of technology. In addition, it can be said that the scale will contribute to researchers on how students access information on the internet, how they organize the information they access, how they use the information, and how they select information and turn it into useful information.

On the basis of a literature review, the item pool was constructed. As a result of the analysis, a construct consisted of 30 items and 5 factors was obtained. Moreover, within the context of the reliability study, internal consistency coefficients were calculated. Seçer (2015) stated that an internal consistency coefficient that was .70 or higher was acceptable. In the current study, the internal consistency coefficients calculated for the sub-dimensions of the scale were found to be ranging from .70 to .93. A construct whose item loadings vary between .65 and .82 was obtained.

The first factor named as having access to online information and consisting of 9 items was found to be explaining 30.25% of the variance and its Cronbach alpha internal consistency coefficient was calculated to be .93. In this factor, the majority of the item factor loadings were found to be higher than .75. The second factor was named as analysing online information and included 7 items. This second factor explained 9.75% of the variance and its Cronbach alpha internal consistency coefficient was calculated to be .89. In this factor, the majority of the item factor loadings were calculated to be higher than 0.70. The third factor named as synthesising online information and including 7 items explained 6.20% of the variance and its Cronbach alpha internal consistency coefficient was calculated to be .82. In this factor, the majority of the item factor loadings were calculated to be higher than .65. The fourth factor was labelled as problem posing and defining and included 4 items. This fourth factor explains 8.14% of the variance and its Cronbach alpha internal consistency coefficient was calculated to be .70. In this factor, the majority of the item factor loadings were calculated to be higher than .65. The last factor named as conveying information by using multimedia and including 3 items explained 5.30% of the variance and its Cronbach alpha internal consistency coefficient was calculated to be .75. In this factor, the item factor loadings were calculated to be -.781, -.831, and -.754.

The scale items are designed in the form of a five-point Likert scale ranging from Never=1 to Always=5. The scale can be evaluated over the total score taken from the scale or over the scores taken from its sub-dimensions. Yet, when it evaluated over the total score, the scale is believed to be more useful in terms of revealing the level of online research and reading comprehension.

The scale proved to be valid and reliable is the first measurement tool to be developed to determine middle school students' perceptions of online research and reading comprehension skills in Turkey.

Given the results of the validity and reliability studies conducted on middle school students for the "Online Research and Reading Comprehension Skills" scale and given that the scale has psychometric features that can measure middle school students' perceptions of "Online Research and Reading Comprehension Skills" with its five factors;

It is thought that the scale has a valid and reliable structure,

That the results to be obtained from the actual administration of the scale can provide the necessary feedbacks about middle school students' perceptions of "Online Research and Reading Comprehension Skills",

That with the future applications of the scale in different samples, the developed scale can be examined at a meta-analytic level,

That the "Online Research and Reading Comprehension Skills" scale can be used in experimental and descriptive studies to determine middle school students' perceptions of their "Online Research and Reading Comprehension Skills".

Limitations

The study group of the current study is comprised of 469 middle school students attending five different state schools in different districts of the city of İzmir in the 2019-2020 school year and participating in the study on a volunteer basis.

Ethics Committee Approval

The authors confirm that ethical approval was obtained from Uşak University the Committee for Research and Publication Ethics in the Social Sciences and Humanities (Approval Date: 16/09/2019 and Number 2019-46).

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COMPUTER SIMULATION INSTRUCTION AND PUPILS' ACHIEVEMENT IN BASIC SCIENCE, AKURE TOWNSHIP, NIGERIA

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Abstract

This study was designed to determine the effect of computer simulation instructional strategy on primary school pupils' achievement in basic science in Akure township in Ondo state, Nigeria. Constructivist theory was used as the framework, while the study adopted pretest-posttest control group quasi-experimental design. Four primary schools were randomly selected from Akure township in Ondo state, Nigeria, a total of four intact classes were used. A total of 151 primary IV school pupils (71-experimental group, 80–control group) participated in the study. Instruments used were instructional guides, Pupils' Basic Science Achievement Test (r =.82) and Pupils' Basic Science Self-Efficacy Questionnaire (α=.80). The study lasted 8 weeks. Data were analysed using Analysis of covariance and Estimated marginal means. There was a significant main effect of treatment on primary pupils' achievement in basic science $F_{(1,146)}$=632.99; partial η^2=.81). The pupils exposed to computer simulation strategy had a higher basic science achievement mean score (19.60) than their counterparts in the convention strategy (12.13). Computer simulation instructional strategy enhanced primary pupils' achievement in basic science in Akure township in Ondo state, Nigeria. Primary school teachers should adopt this strategy to improve primary school pupils' knowledge of basic science.

Keywords: Computer simulation instructional strategy, pupils' achievement in basic science, pupils' self-efficacy

INTRODUCTION

Science is a search for evidence in order to answer questions or solve problems. Since solutions to problems can have more than one answer, this challenges students to solve problems by observing and collecting data and constructing inferences from those data, through this process, students also acquire knowledge and develop a rich understanding of concepts, principles, models, theories and skills. In present age of science and technology when scientific knowledge has grown exponentially, technological innovations have progressed at a rapid pace, and the effects of science and technology are clearly witnessed in all aspects of our lives, it is obvious that science and technology plays a key role for the futures of societies (Aydoğdu, 2006). The British Science Council (2009) defined science as the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence.

In Nigeria, science is taught at the three level of education, elementary, secondary and tertiary education. At the elementary education level, basic science is taught as one of the themes in basic science and technology. The study of basic science at the elementary education level is essential foundation for the nation's scientific and technological development of every nation. This is due to its crucial roles in child's survival, adjustment and adaptation to his/her immediate and wider environments dominated by scientific activities. The lack of such fundamental knowledge in science would handicap pupils to participate meaningfully in some scientific activities. According to Nweke, Abonyi, Omebe & Njoku (2014), for a child to adapt, adjust and develop maximally in an environment he/she must be scientifically literate. In recognition of the indispensability of science in national development, the Federal Government of Nigeria (FGN) made the study of science and technology compulsory at all levels of basic education. Indeed, one of the objectives of basic education in Nigeria as stated in the national policy on education (NPE) is to lay a sound basis for scientific, critical and reflective thinking and to provide opportunities for the child to

develop manipulative skills that will enable the child function effectively in the society within the limits of the child capability (Federal Government of Nigeria FRN, 2014). Thus, the fundamental aim of Nigerian basic science is to develop in pupil's science-oriented skills that will make them function effectively in their immediate environment.

Basic science is taught at the primary level so as to prepare the child for the core science subjects (Physics, Chemistry, Biology, Mathematics and Geography) at the senior secondary school level. This indicates that for pupils to be able to study any science subject at the senior secondary school level successfully, such pupils had to be well grounded in basic science at elementary education level. The importance accorded Basic science in the elementary school curriculum from primary to junior secondary level reflects accurately the vital role played by the subject in contemporary society. The importance of the subject is not restricted to the development of the individual alone but for the advancement of the social, vocational and economic goals of countries all over the world.

Despite the importance accorded basic science in Nigerian education system, previous research findings indicate frustrating achievement in science and technology by pupils at the basic education level. Knowing fully well that for Nigeria as a nation that wants to develop and excel scientifically and technologically, average performance of pupils in basic science is not what should be yarning for, a 100% performance is needed. This frustrating performance in basic science raises obvious doubts on the science advancement in the country. This weak foundation at the basic education level may have affected learners' knowledge and disposition to science subjects which culminates in poor performance at the senior secondary school level (Nweke, et al, 2014). Ajagun (2006) revealed that students perform poorly in science subjects particularly in secondary education level may have been due to their weak foundation in basic sciene. Besides, research carried out by Umoren and Ogong (2007), supported the claim of a low level of performance in science subjects in Nigeria. In similar vein, Abonyi and Umeh (2014) observed that the performance of secondary school students in science and mathematics in particular is very discouraging. If secondary school students perform poorly in science and technology-based subject, it is obvious that the right foundation was not laid at the basic education level. This situation is particularly disheartening when realizing that the success of our country in science and technology depends to a great extent on the mastery of this fundamental aspect of science at the elementary level. Dajili (2001) maintained that the state of science at this level was very important. This is because the performance at this level determines the quality and quantity of intake into the secondary and tertiary levels in the country. This is why the performance in basic science examinations at this level as observed by Agbo and Mankilik (1999) and Dajili (2001) should be investigated.

This poor performance has been attributed to a number of factors, ranging from poor teaching method of basic science to so many other similar accusations, all pointing to teachers not doing their work properly (Ikwuka, 2013), neglect on the part of the government. Lack of use of ICT tools, poor teaching method and lack of competent teachers to teach the subject is reported as problem leading to poor performance (Ikwuka & Adigwe, 2017). Also, lack of practical activities and constant use of the conventional method are some of the factors contributing to this poor academic achievement. To make learning more meaningful, teachers should select suitable teaching strategies and provide instructional materials as well as adopt the teaching methods that make use of students' previous knowledge and transfer such knowledge to the publicly accepted one (Ikwuka, 2010). Several studies have been conducted to investigate the causes of students' poor academic achievement in science (Ezeugwu, 2009; Umoke & Nwafor, 2014) and the most recurring factors in all the reports were; inefficient teaching strategy employed by the teachers to impact knowledge to learners, which is the conventional teaching strategy; others are; attitudes to, inadequate instructional materials, and poor manipulation of science process skills.

From research evidence, educators see the pressing need to reconsider the techniques and methods of instruction at elementary school level. According to Hansen and Sefton (2005) learning is an active process and pupils need to actively participate in the pedagogical process to maintain their engagement with the content. In order to address these challenges, there is need for an instructional system that supported students' active participation in the teaching and learning activity. Several science education research reports (Okoli & Egbunonu, 2012; and Okoli & Abonyi, 2014) show the discovery of innovative teaching methods and technology driven instructional strategies which could enhance pupils' learning and doing of basic science, foster their interest and promote the development of positive attitude to the learning of basic science. These innovative teaching methods and technology-driven strategies can also be applied to basic science instruction at the elementary level. Research reports also indicate that they are effective in improving students learning outcomes in sciences in general (Okoli & Abonyi, 2014).

Information and communication technology (ICT) has become an integral part of modern life, basic building blocks and learning patterns of modern society. Phenomenal advances in ICTs have greatly increased the interdependence and interconnectedness of people educationally. The role of ICT in education is becoming more and more important and this importance has been growing and developing in the 21st century (Richard, 2015). This exponential growth of information that is now available to individual, their ability to access and share this information regardless of the his/her physical location have transformed the way in which people work, organize, socialize, create, participate in public forums and use their free time (Castells, 1999, in Claro and others, 2011). Meenakshi (2013) defined ICT as a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. UNESCO (2002) aims to ensure that all countries, both developed and developing, have access to the best educational facilities necessary to prepare young people to play full roles in modern society and to contribute to a knowledge nation.

According to Sexena (2017), the objectives of ICT in education include; improvement in learning pace and achievements; increased acquisition of knowledge, skills by individuals required for better living and sustainable development; promote and facilitates the relationship between human and the environment; implement the principle of long lasting education; increase the variety of educational methods and services and literacy rate through distance education; and promote the technology literacy among citizens, and the equal importance to slow and gifted children. Appropriate use of ICT can transform the whole teaching-learning processes leading to paradigm shift in both content and teaching methodology (Anu-Sharma, Kapil & Seema, 2011). By such ICT-driven strategies, they provide teachers with tools to illustrate some points or processes as well as to support long lasting learning. While on the part of the pupils, they enable them to associate between concrete, tangible facts from the abstract ones, to help promote the pupils' retention and to facilitate the simulation and recovery phases.

Computer is a device which can be used to present instructional events that are designed, developed and produced for individualized learning situation (Onasanya, 2002). The application of computer technology in a classroom has a significant role in enhancing teaching and learning. One of the ICT driven strategies is to individualize instruction such as computer assisted instruction (CAI) and simulation wherein individual differences of the pupils with respect to their learning capacities and capabilities will be considered. Pupils will be given ample time to criticize, learn the topics and at the same time answer all their questions and queries on their point of view. Lee (1999) defined simulation in a broad sense as a computer program which temporarily creates a set of images (items, objects) and connects them through cause-and-effect relations.

Thomas & Hooper (1991) defined computer-based instructional simulation as a computer program containing a manipulatable model of a real theoretical system. This process includes choosing a model; finding a way of implementing that model in a form that can be run on a computer; calculating the output

of the algorithm; and visualizing and studying the resultant data. The main advantage of this computer simulation is that it supplies the learner an immediate feedback and reinforcements from a computer. Lately, this type of instructions has made such a progressive movement that the learner can interactively use the software to help the understanding of a topic in science education. Olumide (2012 & 2019) and Sarıoğlan (2020) in their separate studies found that computer simulation-based instructions were more effective than the conventional-based instruction in students' achievement. Adebayo & Oladele (2016) and Tayo (2014) also noted the significantly greater effectiveness of computer simulation instruction as compared to traditional instruction.

A pupil's level of efficacy impacts the amount of effort applied and the degree to which he or she will persevere through a difficult task (Hibbs, 2013). Pupils with positive self-efficacy beliefs in basic science are more likely to use effective cognitive and regulatory strategies in a systematic way (Neber and SchommerAikins 2002). Self-efficacy beliefs influence achievement (Britner 2008; Yoon 2009), their choices of science related activities (Lodewyk and Winne, 2005), the effort they expend on those activities (Pajares 2008; Walker and Greene 2009), the perseverance they show when encountering difficulties (Dweck and Master 2008; Pajares 2008), and the ultimate success they experience in science (House 2008). Hence, Self-efficacy influences students' activities, effort and persistence, and it can help predict their academic performance (Lee and Mao, 2016). In light of the above, this study examined the effects of computer simulation package on primary pupils' academic achievement in basic science. The moderating effect of self-efficacy was also examined.

Theoretical Background of the Study

Constructivists theory which proposed that learning occurs through experience, provided the theoretical framework for this study. The constructivists theory states learners are active participants who gain understanding and make meaning from the surrounding environment (Driscoll, 2005). A major theme of the constructivist theory is that learning is an active process in which an individual learner must actively construct knowledge and skills (Bruner, 1990) that are based upon their past or current knowledge (Chi, 2009). Simulations is a modified form of cognitive tools, that allow students to test hypothesis and more generally "what-if" scenarios and give learners the opportunity to apply cognitive understanding of their action in a situation (Thomas and Milligan, 2004; Olumide, 2019), and encourage pupils to be actively involved in their learning by connecting prior experiences with new information (Ozmon and Craver, 2008). Thus, provided the needed support for simulation instruction.

Statement of the Problem

Basic science is one of the core subjects taught at the elementary education level in Nigeria. It laid the essential foundation for junior secondary school basic science and the basic knowledge required for biology, chemistry, physics, mathematics and geography at the secondary school level. Despite this importance, it is observed that the academic achievement of primary pupils in basic science at the elementary level is poor. This has a great on the advancement of science in the country. Previous studies have shown that this weak foundation at this level of education have effect on pupils' knowledge of science core subjects which may be one of the reasons for the poor performance of students at the senior secondary level. Several factors have been adduced to be responsible for this trend, one major cause has been attributed to the inefficient teaching strategy used by the teachers which is the conventional method. Other causes pupils' basic science self-efficacy. Different innovative intervention informs of strategies have been recommended and found to improve pupils' achievement in basic science, but this problem of poor performance still persist. Thus, the need for the introduction of strategy that is ICT oriented that would improve primary pupils' achievement in basic science. Furthermore, a review of research produced few studies that addressed the effect of computer simulation on pupils' achievement in Akure township, Ondo state Nigeria. This study was therefore embarked upon in order to investigate the effects of

computer simulation package on primary pupils' academic achievement in basic science. The study further explored the extent to which the moderating effect of pupils' basic science self-efficacy on their achievement in basic science.

Research Hypotheses

The following hypotheses were formulated and tested at $p<.05$ level of significance.

Ho1: There is no significant main effect of treatment on primary pupils' achievement in basic science

Ho2: There is no significant main effect of self-efficacy on pupils' achievement in basic science

Ho3: There is no significant interaction effect of treatment and self-efficacy on pupils' achievement in basic science

METHODS

Research design

This study adopted the pretest-posttest control group, quasi-experimental design using a 2x3 factorial matrix with the instructional strategies as treatment at two levels (computer simulation and conventional strategies) and pupils' basic science self-efficacy at two levels (high and low). This adopted research design model presented the opportunity to evaluate interventions in a study that is structured similar to a true experiment but do not use randomisation of participants to the independent variable (strategy) that can be manipulated and a pre-existing variable (moderator variable) that cannot be manipulated. It allows the researcher to obtain pretest and posttest measurements for both the intervention and control groups, thus allowing access to the initial comparability of the groups (Bradham, Baumgarten, Zuckerman, Fink & Perencevic, 2004). The factorial matrix of the study is presented in Table 1.

Table 1. Representation of the factorial matrix

Treatment/strategies	Self-efficacy		
	High	Medium	Low
Computer simulation Strategy E_1			
Conventional Strategy C			

Within the quasi-experimental design adopted, the computer simulation strategy was implemented on the experimental group, while the conventional strategy was implemented on the control group, both groups were taken as the independent variable. Pupils self-efficacy (high and low) was taken as the moderator variable, while pupils' achievement in the three topics investigated was taken as the dependent variable.

Selection of participants

The participants consisted of primary school IV pupils. Four schools were randomly selected from Akure township of Ondo State. An intact class in each school was used making a total of four intact classes. Two school each were assigned to the computer simulation strategy and the conventional group. The teachers used in the study were the class teacher teaching primary IV pupils in each school.

Research instruments

Pupils' Basic Science Achievement Test (PBSAT): PBSAT was designed by the researcher to measure pupils' achievement in basic science. This is made up of two sections. Section A contained information on pupils personal data such as name, gender, school. Section B consisted of 21 multiple choice items with four options (A-D) from which participants selected the correct alternative. All the questions were

answered by the participants. One mark is assigned to each correct answer. The maximum obtainable score is 21. To established PBSAT face and content validity, copies of the initial draft of 30 multiple choice items were given to experts in Science and Basic science Education. These experts were asked to determine its suitability for the targeted population in terms of clarity and language. 26 items survived scrutiny. They wer later trial-tested on twenty-seven (27) primary IV pupils in a school that was not selected for the main study. It was the 21 items with discrimination indices between .4-.6 and difficulty indices above .30 that were used. The data collected were analysed using Kuder-Richardson formula 20 (Kr20). The reliability coefficient of .82 was obtained.

Pupils' Basic Science Self-Efficacy Questionnaire (PBSSEQ): PBSSEQ was adapted from the self-efficacy scale developed by Lisa-Looney (2003) for the purpose of this study. This instrument was designed to measure the pupils' basic science self-efficacy. The initial instrument consists of twenty (20) items on five-point Likert scale ranging from Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. To modify the instrument for the purpose of this study, the Likert format was changed to YES and No format due to the level of the participants. In scoring of the modified instrument, the positive statements were graded Yes-2 and No-1 respectively while the negative items were reverse scored. In total, the maximum obtainable score is 40. Pupil that scored between 30-40 is rated as high self-efficacy pupil while 0-29 as low. In validating the modified instrument, it was given to experts in guidance and counselling for their expert advice in respect to the language level, suitability and over all face validity of the instrument. Their corrections were incorporated to the final draft. The final draft was later trial-tested on twenty-seven (27) primary IV pupils in a school that was not selected for the main study. The reliability coefficient was determined using Cronbach alpha which gave 0.80.

Contents of the program applied

The study was conducted on two sub-themes of the primary IV basic science and technology curriculum "Learning about Our Environment, and Living and Non-Living Things". From these sub-themes, 'changes in nature and changes in plants and animals' were the topics investigated. These topics aim to help pupils observe and describe changes taking place in their surroundings (e.g. construction of new roads; sprouting of grass in the rainy season; burning of candies, melting of ice blocks; burning pieces of wood; wetting a piece of cloth among others), differentiate and group these changes as temporary and permanent changes, observe and describe changes in the life cycle of common animals (e.g. housefly, cockroach, toad), identify and name the young ones of different animals, compare the young ones with their adults and state reasons for the observed differences, and draw the life-cycle of some insects. These contents were prepared in computer-based software for the experimental group by consulting primary school basic science and technology teachers and experts in technology education, and saved on CDs. While for the control group, these contents were presented conventionally by the teachers to the pupils.

Research Procedures

The researcher, first administered the instruments (Pupils' Basic Science Achievement Test and Pupils' Basic Science Self-Efficacy Questionnaire) as pretest to the pupils and their scores were recorded. The researcher then exposed the experimental group to the topics in Basic science using computer simulation strategy for 5 weeks. The control group was also subject to conventional strategy for the same number of weeks. The treatment procedures for the groups were presented below.

Experimental group (Computer Simulation Strategy)

The following steps guided the use of computer simulation strategy which lasted 80 minutes for lesson period.

1. The disc containing the lesson to be learnt is mounted on the computer system which is connected to the projector.

2. The teacher explains features of computer simulation classroom to the pupils and the objectives of the topic to be achieved as displayed on the screen
3. The teacher executes the lesson base on the prepared content pages while the time allotted for lesson teaching is displayed on the right down corner of the screen. This is done on unit basis as stated on the primary IV basic science curriculum.
4. Pupils watch and listen to the simulation.
5. After each unit, the next page displays the worksheet for pupils' activity
6. Pupils ask questions on part of the simulation presentation they did not understand or not clearly explained.
7. The teacher explained and clarified any misconception
8. Pupils give feedback gained after the clarification of misconception aspect by their teacher
9. Pupils write the modified summary in their note books

Control Group (Conventional Strategy)

The steps below guided the presentation of lessons in this strategy which lasted 40 minutes.

1. Teacher introduces the topic and states the objectives for the lesson
2. Teacher outlines the content of the topic on the chalkboard
3. Teacher presents the content of the topic
4. Pupils listen to the teacher explanation
5. Teacher allows pupils to ask questions on areas of the topic that are not clear to them.
6. Teacher answers the pupils' questions
7. Teacher summaries the lesson, while the pupils write down the summary
8. Teacher evaluates the pupils and give them home assignment

Methods of Data Analysis

Data obtained were analysed using inferential statistics of paired sample t-test and Analysis of Covariance (ANCOVA) of the posttest scores with the pretest scores as the covariates. Estimated marginal mean was used to determine the means of different groups in order to find the magnitude of the difference among the groups. Paired t-test was used to analyse research questions 1 to 3, while ANCOVA was used to test the null hypotheses 1 to 3.

RESULTS

1. Is there any significant difference between pupils pretest and post achievement test before the implementation of the interventions (computer simulation and conventional strategies)?

Paired sample t-test was used to answer research question 1, and the results presented in Table 2.

Table 2. Paired sample t-test showing the comparison of pre-test and post-test

Treatment	Test	N	Mean	Std. Deviation	Mean Difference	t	df	Sig. (2-tailed)	Remarks
Computer Simulation Strategy	Pretest	71	9.50	2.78	10.42	-22.39	70	.00*	Significant
	Posttest	71	19.92	3.89					
Conventional Strategy	Pretest	80	8.19	2.85	4.38	-4.31	79	.00*	Significant
	Posttest	80	12.57	3.12					

*p<.05

Table 2 shows the comparison of pretest and posttest mean scores for both experimental and control groups. It reveals that pupils post basic science achievement test (19.92) mean score after been taught with the computer simulation strategy is higher than their pretest mean score (9.50) when they have not been introduced to the strategy. It is observed that the mean score of 9.50 obtained during the pretest increased by 10.42 to 14.04 in the posttest after the introduction of the treatment. Table 2 indicates that there is a significant difference between pupils pretest and their post achievement test after the computer simulation strategy intervention (t=-22.39, df=47; p<.05). The absolute t-test value of 22.39 with significance level less than 0.05 indicate that there is a significant difference between pupils pretest and post achievement test after the computer simulation strategy intervention. The results indicate that computer simulation strategy had improved pupils' achievement in basic science.

Table 2 reveals that the control group pupils who learnt basic science using conventional strategy had significantly higher mean score in the post achievement test (12.57) than pretest (8.19). Table further shows that the control group pupils' mean score have increased significantly by 4.38 in the post achievement test as compared to the pre-test. This implies that there is a significant difference between pupils pretest and their post achievement test of pupils exposed to conventional strategy (t=-4.31 df =102; p<.05). This means that conventional strategy had also improved pupils' achievement in basic science.

2. Is there any significant difference between pupils pretest and post achievement test after the implementation of the intervention (computer simulation and conventional strategies)?

Paired sample t-test was used to answer research question 2, and the results presented in Table 3.

Table 3. Paired sample t-test showing the comparison of experimental and control strategies

Test	Treatment	N	Mean	Std. Deviation	Mean Difference	T	Sig. (2-tailed)	Remarks
Pretest	Computer Simulation Strategy	71	9.50	2.78	1.31	-1.37	.61	Not Significant
	Conventional Strategy	80	8.19	2.85				
Posttest	Computer Simulation Strategy	71	19.92	3.89	7.35	6.67	.00*	Significant
	Conventional Strategy	80	12.57	3.12				

*p<.05

Table 3 shows the comparison of pupils' scores between the experimental and control groups. On the pupils' pretest results comparison, the mean score for experimental group is 9.50, while that of conventional strategy is 8.19 with a mean difference of 1.31. The t-value of 1.37 which is significant at .61 implies that there is no significant difference between the mean pretest scores of pupils exposed to computer simulation strategy and those taught with the conventional strategy. This means that pupils under both strategies are of equal level prior to the implementation of the interventions. While on the posttest results, it is observed that mean score of pupils in the experimental group is 19.92, while that of their counterparts in the control group is 12.57 which indicates a mean difference of 7.35. The results also reveal the t-value of 6.67 which is significant at p<.05(.00), this indicates that there is a significant difference between the mean posttest score of pupils in the computer simulation strategy and those in the conventional strategy. This implies that there is an improvement in pupils' basic science achievement after the implementation of both interventions, and that there is variation in their achievement in favour of those exposed to computer simulation strategy

3. Is there any significant difference in the pre-test of low and high self-efficacy pupils before the interventions (computer simulation and conventional strategies)?

Paired sample t-test was used to answer research question 1, and the results presented in Table 4.

Table 4. Paired sample t-test showing the comparison of experimental and control pre-test by self-efficacy

Treatment	Test	Self-efficacy	N	Mean	Std. Deviation	Mean Difference	t	Sig. (2-tailed)	Remarks
Computer Simulation Strategy	Pretest	Low	42	27.11	3.73	12.23	3.41	.11	Not Significant
		High	29	39.34	4.06				
Conventional Strategy	Pretest	Low	47	28.76	3.09	10.22	2.84	.09	Not Significant
		High	33	38.98	4.33				

*p<.05

Table 4 indicates the comparison of pupils' scores between the experimental and control groups in respect to their self-efficacy. On low self-efficacy, it shows that pupils mean scores with low self-efficacy in the computer simulation and conventional strategies had 27.11 and 28.76 respectively, while their high self-efficacy counterparts had 39.34 and 38.98 respectively. Table 4 also reveals that there is no significant difference in the pre-test of pupils with low and high self-efficacy under computer simulation strategy [t=3.41; p>.05(.11)] and those exposed to conventional strategy [t=2.84; p>.05(.09)].

Note: No post-test was given for self-efficacy, it was only administered once (before the implementation of interventions, in order to have even distribution of pupils from low and high self-efficacy into the experimental and control groups).

Ho1: There is no significant main effect of treatment on primary pupils' achievement in basic science

ANCOVA was used to test null hypotheses 1 to 3 (Ho1 to Ho3) and the results presented in Table 5.

Table 5. Analysis of covariance (ANCOVA) of post-achievement by treatment and self-efficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4596.932[a]	4	1149.233	507.620	.000	.933
Intercept	888.775	1	888.775	392.575	.000	.729
PreAchievement	4517.686	1	4517.686	1995.478	.000	.932
Treatment	1433.065	1	1433.065	632.990	.000*	.813
Self-efficacy	.615	1	0.615	.272	.603	.002
Treatment x Self-efficacy	1.074	1	1.074	.474	.492	.003
Error	330.538	146	2.264			
Total	41004.000	151				
Corrected Total	4927.470	150				

R Squared = .933 (Adjusted R Squared = .931), *p<.05

Table 5 showed that there was a significant main effect of treatment on primary pupils' achievement in basic science ($F_{(1,146)}$ = 632.99; p<0.05, partial η^2 = 0.81). The effect is 81.0%. This indicated that there was a significant difference in the pupils' post-achievement mean scores in basic science. Thus, hypothesis 1 was rejected. In order to determine the magnitude of the significant main effect across

treatment groups, the estimated marginal means of the treatment groups was carried out and the result is presented in Table 6.

Table 6. Estimated marginal means for post-achievement by treatment and control group

Treatment	Mean	Std. Error
Computer Simulation Strategy (CSS)	19.60	.21
Conventional Strategy (CS)	12.13	.18

Table 6 indicated that primary pupils in Computer Simulation Strategy (CSS) treatment group had the higher adjusted post-achievement mean score in basic science ($\bar{x}$=19.60), while the Conventional Strategy (CS) control group had the least adjusted post-achievement mean score ($\bar{x}$ = 12.13). This order can be represented as CSS > CS.

Ho2: There is no significant main effect of self-efficacy on pupils' achievement in basic science

Table 5 showed that there was no significant main effect of self-efficacy on pupils' achievement in basic science ($F_{(1,146)}$ = 0.27 p>.05). Therefore, hypothesis 2 was not rejected. This implies that self-efficacy had no effect on pupils' achievement in basic science

Ho3: There is no significant interaction effect of treatment and self-efficacy on pupils' achievement in basic science

Table 5 revealed that there was no significant interaction effect of treatment and self-efficacy on pupils' achievement in basic science ($F_{(1,146)}$ = .47 p>.05). Therefore, hypothesis 3 was not rejected. This implies that treatment and self-efficacy had no effect on pupils' achievement in basic science

DISCUSSION

The results revealed a significant main effect of treatment on primary pupils' achievement in basic science. It is observed that pupils in both the treatment and control group had gained high scores in their post-achievement compare to their pretest before the intervention is applied. These results indicate that both computer simulation and conventional strategies had improved pupils' cognitive ability, comprehension, understanding and analysis in Basic science. However, the results also indicate that there is a significant difference in pupils' achievement between the group who was exposed to computer simulation and those group taught with the conventional strategy. The magnitude of achievement scores in basic science favoured the group computer simulation groups than the conventional group. This indicates that the computer simulation strategy is more effective than the conventional strategy in improving pupils' achievement in Basic science.

The efficacy of the computer simulation strategy in terms of the higher achievement scores recorded could be due to the fact that the strategy helps pupils to learn and understand basic science through visualization. This improvement could be attributed to the opportunity students had to take initiative while learning about a given topic which is the basic traits of computer simulation, where pupils build their own mental model based on the observation to be recorded in the form of schemas in their long-term memory (Ali & Zamzuri, 2007; Zumyil, 2019). Furthermore, the efficacy of computer simulation strategy could be attributed to the "engaged exploration" offered by the simulation, as pupils were able to use the simulations to explore the topic under investigation in ways that were similar to how scientists explore such phenomena. Another factor that contributed to the success of computer simulation was the high level of interactivity with dynamic and immediate feedback to the pupils (Aoude, 2015). It encourages pupils to develop an understanding of learnt concepts and support their memory retention which improve their achievement (Kiboss, Ndirangu, & Wekesa, 2004).

The result of this study is in agreement with the findings of Sarıoğlan (2020) who found that computer-based instruction was more effective in increasing students' success compared to traditional teaching method. This also aligns with Zumyil (2019) who indicated that the use of computer simulation instructional strategy enhanced students' interest and achievement in Ecology. In the same vein with the findings of Olumide (2019) who found that computer simulation enhanced students' achievement in genetics and ecology than the conventional strategy. The findings agree with Adebayo & Oladele (2016) that there was a significant main effect of computer simulation on students' mean achievement score in DNA replication and transcription students' achievement and memory retention in biology. Also, in relation with Elangovan &Ismail (2014) revealed that realistic computer simulation based teaching method is more effective than the non-realistic simulation and it improves Biology students' achievement and memory retention. In agreement with the findings of Ezeudu and Ezinwanne (2013) that students exposed to simulation instructional strategy had their achievement improved in chemistry. The findings of this study also support the findings of Tayo (2012) who found that students exposed to developed animated agricultural package performed significantly better than those exposed to the conventional lecture method.

The findings revealed that there is no significant main effect of pupils' self-efficacy on primary pupils' achievement in basic science. The implication of this finding is that the efficacy level of pupils either high or low has nothing to do with their achievement in basic science. The finding is in line with the findings of Nwosu and Okoye (2014) who in their study revealed that self-efficacy had no relationship with students' achievement. The finding disagreed with Asaaju (2018) who found that self-efficacy had significant main effect on academic achievement in population. It is in contract to the finding of Aurah (2017) found that students' science self-efficacy is highly correlated to academic achievement. Lee & Mao (2016) and Dogan (2015) concluded in their separate study that self-efficacy could predict pupils' academic performance. The results also disagreed with the findings of Goulao (2014) and Sinan & Jongur (2016) found that there was a strong positive correlation between academic self-efficacy of students in mathematics and the performance of students in mathematics among secondary school students. In the same vein, the finding negates the findings of Loo & Cho (2013) that students' self-efficacy and academic achievement are strongly-related. Galyon, Blondin, Yaw, Nalls & Williams (2012) found a stronger relationship between academic self-efficacy and exam performance. The finding of this study is not in line with Uzuntiryaki and Çapa-Aydın (2007)'s findings that there was a significant correlation between chemistry self-efficacy beliefs in cognitive skills and chemistry achievement.

The result of the findings showed that the interaction effects of treatment and self-efficacy had no significant effect on primary pupils' achievement in basic science. The implication of this is that the treatment is suitable to both levels of pupils' self-efficacy, that is, the treatment is not self-efficacy biased. Also, the findings indicated that it is only the treatment that accounted for primary pupils' achievement in basic science. This finding of no significant interaction effects of treatment and self-efficacy is in line with the findings of Olumide (2019) who found in her study that the interaction effect of treatment and self-efficacy had no Significant Effect On Students' Achievement In Genetics And Ecology Concepts.

Conclusion

The result of this study showed that computer simulation instruction strategy improves primary pupils' achievement in basic science. This showed the effectiveness of computer simulation instruction strategy as tool for teaching abstract and difficult topics in basic science where it aids visualization of concepts thereby helping pupils required conceptual knowledge irrespective of their elf-efficacy in basic science.

Recommendations

The following recommendations are made based on the findings of this study.

i. Primary school teachers should adopt ICT-driven strategies such as computer simulation instructional strategy to enhance pupils' achievement in basic science.
ii. Computer simulation instructional strategy if adopted by primary school teachers would bring about an enriched classroom interaction which could enhance appreciable achievement in Basic science learning.
iii. Professional development programmes such as seminars, workshops, and conferences should be organized for teacher at primary school level on periodic basis to acquaint them with innovative ICT-driven strategies like the one used in this study. This would help them to effectively apply this strategy in teaching of basic science.

Limitations of the Study

The study is restricted to the topics, "Changes in Nature, and Changes in Plants and Animals, and Human Body (the mouth)" in the sub themes of Learning about Our Environment, and Living and Non-Living Things" of the basic science and technology curriculum for primary IV pupils. This research is limited to primary IV basic science pupils in Akure township of Ondo State in the 1st term of 2016/2017 academic session. The study lasted 8 week using quasi-experimental research implementation of computer simulation and conventional strategies while self-efficacy was the only moderator variable examined limited this study.

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THE REASONS FOR YOUNG CHILDREN TO LIKE AND DISLIKE PLAYING WITH THEIR FRIENDS

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Abstract

The purpose of the study is to reveal the reasons for young children to like and dislike playing with their friends. There were two groups in the study. The first group included 147 preschool children who were in the age group of 5-6 years and were living in Turkey. The second group included 60 preschool children who were in the age group of 5-6 years and were living in the North Cyprus. Interview method was used as data collection tool. In the sociometry technique-based method, the researcher asked the children four questions in a quiet room outside the classroom. According to the results, young children attach importance to social skills, mutual sharing, spending time outside plays and relationships based on kindness and love in their peer relationships and they dislike rude, bullying and disorderly behaviors. While the children in the study groups expressed their playmate choices, they stated more criteria as their reasons to dislike than their reasons to like, which is noteworthy in terms of revealing problems young children faced in their peer relationships.

Keywords: Friendships, young children, play

INTRODUCTION

Preschool period is one of time periods when a child's life begins to take shape and holistic growth of all developmental areas matters. The children in this stage continues their life by internalizing the experiences (although reflections of these experiences may vary in the course of time) in their social-emotional relationships with other individuals in their life. In this period, their bonds with their peers and their emotional experiences play a key role in preparing them to the next stage of their life (Gifford-Smith & Brownell, 2003; Green, Cillessen, Rechis, Patterson, & Hughes, 2008; Özdoğan, 2009; Sakız & Yetkin Özdemir, 2014). Hay, Caplan & Nash (2009) state that peer relationships emerge in the first weeks of life when infants realize each other and respond to their cry. At the end of the first year, children begin to communicate with their peers, share things with them, conflict with them, and shape early friendships.

Also, peer is an element which is frequently mentioned as a playmate during preschool period. Peer and play constitute important steps for development, especially in the age range of 2-6 years (Gülay Ogelman, 2018). In their study, Göncü (2019) found that children's bonds with their peers developed by interacting with each other in plays and problem solving.

Positive peer relationships in preschool period have a distinct function for children to enhance their emotional intelligence level, establish positive relationships with their peers, reduce negative behaviors, and develop empathy skills (Şen & Özbey, 2017). Also, a positive increase in the development of children's motor-cognitive skills is associated with behavioral regulation skills of their peers (Rojas, Yoshikawa, Morris, Kamboukos, Dawson-Mcclure, & Brotman, 2020).

In her study examining peer relationships and peer victimization based on different variables, Salı (2014) observed that negative peer relationships increased with increasing peer victimization and prosocial behaviors increased with decreasing peer victimization. Positive peer relationships not only facilitate peer acceptance but also reduce peer victimization; whereas, negative peer relationships increase peer rejection and peer victimization, which may result in a vicious cycle in the course of time. When children who are rejected by their peers are exposed to relational peer victimization, they may display depressive and anxious behaviors compared to those exposed to physical peer victimization. It is possible to state that children, who are exposed to such situations, can become disadvantaged in terms of prosocial behaviors such as obeying the authority and rules and showing empathy (Martin-Anton, Monjas, García Bacete, & Jiménez-Lagares, 2016; Metin-Aslan, 2018). Accordingly, the importance of guidance of preschool education teachers and parents appears.

In the study by Göl-Güven (2017), it was determined that an adult's arranging a peer group environment via plays and activities supporting collaboration and participation led children to make a positive progress in their conflict transformation skills. In addition, children's reconciliatory attitudes, adult-oriented solution seeking behaviors, attitudes of obeying rules, and skills of offering suggestions increased; whereas, their aggressive and abstaining attitudes decreased.

Parten (1932) divides children's plays into categories ranging from non-social to social plays and states that as children grow up, they spend more time in social plays compared to non-social plays (Cited by Eggum-Wilkens Fabes, Castle, Zhang, Hanish, & Martin, 2014, p. 345).

Considering the effect of peers in the children's socialization, one of the essential elements in socialization through plays is undoubtedly peer interaction. Social relations established by the children with peers during this period affect their social and emotional adaptation during adulthood period (Gülay, 2009, p. 85). The children begin to face with different social experiences in play groups with peers during this period (Gülay, 2008, p. 27) and learn their future roles by means of these experiences.

Close relations that are established among children through plays strengthen their sense of trust (Beyazkürk, Anlıak, & Dinçer, 2007, p.15). The researchers (Ahmetoğlu, Acar, & Aral, 2016, p.37; Göktaş, 2019, p.184) have expressed that positive peer relationships improved through plays have a positive effect on many skills such as self-regulation, creativity, cognitive, language and social skills.

As is seen, friendship relationships and play are two crucial concepts for preschool children. In Turkey, the number of studies on young children's peer relationships has gradually increased along with diversification of measurement tools. However, the number of studies revealing dynamics concerning peer relationships and play in accordance with children's views is limited. It is thought that this study would be guiding for future related studies since it determines the reasons for young children to like and dislike playing with their friends.

The purpose of the study is to reveal the reasons for young children to like and dislike playing with their friends. In this context, two questions were asked to young children: "What are the names of top three friends you like playing with in the classroom? Why do you like playing with them?" and "What are the names of top three friends you dislike playing with in the classroom? Why do you dislike playing with them?". The answers of the following questions were sought based on the children's answers:

- How is the distribution of the reasons for the young children to choose their friend in the first rank they like playing with?
- How is the distribution of the reasons for the young children to choose their friend in the second rank they like playing with?
- How is the distribution of the reasons for the young children to choose their friend in the third rank they like playing with?

- How is the distribution of the reasons for the young children to choose their friend in the first rank they dislike playing with?
- How is the distribution of the reasons for the young children to choose their friend in the second rank they dislike playing with?
- How is the distribution of the reasons for the young children to choose their friend in the third rank they dislike playing with?

METHODS

This is a qualitative study conducted to determine the reasons for preschool children to like and dislike playing with their friends.

Participants

The participants were divided into two groups in the study. The first group included 147 preschool children (77 (52.4%) girls, (70 (47.6%) boys) who were in the age group of 5-6 years and were living in Turkey. The second group included 60 preschool children (33 (55%) boys, (27 (45%) boys) who were in the age group of 5-6 years and were living in the Turkish Republic of Northern Cyprus. All the children had a normal development.

The participants were selected based on simple random sampling method. Two schools were chosen by lot method from each public preschool education institution in Vezirkopru district of Samsun and in Nicosia.

Measurement

Interview method was used as data collection tool. There are two sociometric approaches that present the social position of preschool children: Nomination-based sociometric measurement and grading-based sociometric measurement. In this study, the nomination-based sociometric measurement technique was utilized. In the nomination -based sociometric measurement, the child chooses among her/his peers in accordance with specific criteria. Used for preschool children; the nomination -based sociometric measurement was introduced by McCandless & Marshall in 1957 (McCandless & Marshall, 1957. Cited by Gülay Ogelman, 2019). During the application, choices can be made according to criteria such as my best friend (friends) / my least favorite friend (friends) and friend (friends) I like/dislike playing with. For example, each child can give the names of three or more friends that she/he likes or dislikes playing with. Each child's acceptance (those indicated to like playing with her/him) and rejection (those indicated to dislike playing with her/him) scores are calculated. (Gottman, 1977. Cited by Gülay Ogelman, 2019). In this technique, positive choice scores (Liking-L) and negative choice scores (Disliking-D) are determined for each child and the two scores are standardized within the group. Then, the Social Preference (SP) and Social Impact (SI) scores are determined. The social preference formula is most liked-most disliked, while the social impact formula is most liked+most disliked. The social preference and social impact scores are also standardized. Finally, the scores acquired are divided into five categories according to the following intervals:

For popular children: Social preference > 1, most liked > 0 and most disliked < 0,
For rejected children: Social preference <-1, most liked < 0 and most disliked > 0,
For excluded children: Social impact < -1, most liked < 0 and most disliked < 0,
For disputable children: Social impact > 1, most liked > 0 and most disliked > 0,
For average children: All the remaining group members (Coie, & Dodge, 1983; Coie, Dodge, & Coppotelli, 1982).

In the sociometry technique-based method, the researcher asked the children four questions in a quiet room outside the classroom: "What are the names of top three friends that you like playing with in the classroom? Why do you like playing with them?" and "What are the names of top three friends you

dislike playing with in the classroom? Why do you dislike playing with them?". The researcher recorded their answers during the application.

In the study the sociometry scores obtained by the children regarding the four questions were not included. The study discussed the reasons for children to like and dislike playing with their peers whose names they had given.

In order to reveal the reliability of the sociometry technique, the test-retest analysis was conducted. Of the children in the two study groups, 30 were chosen by lot. Sociometry was applied to the children chosen twice in 15 days. According to the result of the Pearson's Product-Moment Correlation Coefficient technique, the correlation between the two measurements was found to be 0.81 ($p<0.01$).

Analysis

Frequency and percentage distributions related to determine the reasons for the young children to like and dislike playing with their peers were calculated.

RESULTS

Table 1. Distribution of the reasons for the young children to like their friends in the first rank, in their response to the question "What are the names of top three friends you like playing with in the classroom?"

Preschool Children in Turkey			Preschool Children in North Cyprus		
Reasons of liking their peers in the first rank	**f**	**%**	**Reasons of liking their peers in the first rank**	**f**	**%**
We play very well.	87	59.2	We play very well.	23	38.3
She/he shares her/his toys.	12	8.2	She/he is my friend.	20	33.4
She/he is my friend.	11	7.5	I don't know.	7	11.7
It is because she/he is quiet.	8	5.4	She/he is my buddy.	2	3.3
It is because she/he tidies up the toys quickly.	8	5.4	She/he shares her/his toys and everything else.	2	3.3
It is because she/he likes me.	8	5.4	We chat.	2	3.3
It is because I go to her/his house.	6	4.1	I have known her/him for a long time.	2	3.3
It is because she/he helps me.	3	2.0	She/he is fun, not boring.	1	1.7
She/he asks for permission before taking things.	1	0.7	We do activities together.	1	1.7
It is because she/he is small (short).	1	0.7			
We go home together.	1	0.7			
It is because she/he finishes her/his food.	1	0.7			
Total	147	100.0	Total	60	100.0

Table 1 shows that while 12 variables were effective in the reasons for the young children in Turkey to like playing with their friends in the first rank, 9 variables were effective for the young children in North Cyprus. The first three reasons for the children in Turkey to like playing were "We play very well (59.2%)", "She/he shares her/his toys (8.2%)", and "She/he is my friend (7.5%)". The first three reasons for the children in North Cyprus to like playing were "We play very well (38.3%)", "She/he is my friend (33.4%)", and "I don't know (11.7%)".

Table 2. Distribution of the reasons for the young children to like their peers in the second rank, in their response to the question "What are the names of top three friends you like playing with in the classroom?"

Preschool Children in Turkey			Preschool Children in North Cyprus		
Reasons of liking their peers in the second rank	**f**	**%**	**Reasons of liking their peers in the second rank**	**f**	**%**
We play very well.	22	29.3	She/he is my friend.	26	34.8
It is because she/he helps me.	11	14.9	We play very well.	24	32.4
She/he is my friend.	11	14.9	I don't know.	7	9.5
She/he shares her/his toys.	9	12.2	She/he shares her/his toys and everything else.	4	5.4

It is because she/he is small (short).	7	9.5	We spend good time together.	4	5.4
It is because she/he is funny.	5	6.8	She/he is fun, not boring.	3	4.1
It is because she/he likes me.	3	4.1	She/he is my buddy and my sister/brother.	1	1.4
She/he is my first friend.	2	2.7	We chat.	1	1.4
It is because I go to her/his house.	1	1.4	She/he sits next to me.	1	1.4
It is because she/he tidies up the toys quickly.	1	1.4	It is nice to hug her/him.	1	1.4
We spend good time together.	1	1.4	She/he never makes noise.	1	1.4
She/he listens to me.	1	1.4	I like her/his behaviors.	1	1.4
Total	74	100.0	Total	74	100.0

Table 2 shows that the young children in Turkey and North Cyprus expressed 12 variables concerning their reasons of liking playing with their friends in the second rank. The first three reasons for the children in Turkey to like playing were "We play very well (29.3%)", "It is because she/he helps me (14.9%)", "She/he is my friend (14.9%)", and "She/he shares her/his toys (12.2%)". The first three reasons for the children in the North Cyprus to like playing were "She/he is my friend (34.8%)", "We play very well (32.4%)", and "I don't know (9.5%)".

Table 3. Distribution of the reasons for the young children to like their peers in the third rank, in their response to the question "What are the names of top three friends you like playing with in the classroom?"

Preschool Children in Turkey			**Preschool Children in North Cyprus**		
Reasons of liking their peers in the third rank	**f**	**%**	**Reasons of liking their peers in the third rank**	**f**	**%**
We play very well.	7	17.1	We play very well.	24	48.0
It is because she/he helps me.	6	14.6	She/he is my friend.	14	28.0
It is because she/he tidies up the toys quickly.	6	14.6	I don't know.	5	10.0
It is because she/he likes me.	5	12.2	She/he is my buddy.	1	2.0
It is because she/he is funny.	4	9.8	She/he shares her/his toys and everything else.	1	2.0
We draw together.	4	9.8	She/he is so sweet.	1	2.0
It is because she/he is quiet.	4	9.8	She/he is never annoying.	1	2.0
She/he is my friend.	2	4.9	She/he is fun, not boring.	1	2.0
She/he shares her/his toys.	1	2.4	We spend good time together.	1	2.0
It is because I go to her/his house.	1	2.4	She/he always smiles.	1	2.0
I don't know.	1	2.4			
Total	41	100.0	Total	50	100.0

Table 3 shows that while 11 variables were effective in the reasons for the young children in Turkey to like playing with their friends in the third rank, 10 variables were effective for the young children in North Cyprus. The first three reasons for the children in Turkey to like playing with their friends were "We play very well (17.1%)", "It is because she/he helps me (14.6%)", "It is because she/he tidies up the toys quickly (14.6%)", and "It is because she/he likes me (12.2%)". The first three reasons for the children in North Cyprus to like playing were "We play very well (48.0%)", "She/he is my friend (28.0%)", and "I don't know (10.0%)".

Table 4 shows that while 12 variables were effective in the reasons for the young children in Turkey to dislike playing with their friends in the first rank, 15 variables were effective for the young children in North Cyprus. The first three reasons for the children in Turkey to dislike playing with their friends were "She/he does not play with me (42.7%)", "She/he ruins the plays (13.6%)", and "She/he is naughty (11.7%)".

Table 4. Distribution of the reasons for the young children to dislike their peers in the first rank, in their response to the question "What are the names of top three friends you dislike playing with in the classroom?"

Preschool Children in Turkey			Preschool Children in North Cyprus		
Reasons of disliking their peers in the first rank	**f**	**%**	**Reasons of disliking their peers in the first rank**	**f**	**%**
She/he does not play with me.	44	42.7	She/he does not play with me, speak to me, spend time with me, or call me to play.	7	18.4
She/he ruins the plays.	14	13.6	I don't know.	6	15.8
She/he is naughty.	12	11.7	She/he does harm.	5	13.2
She/he never obeys the rules.	8	7.8	She/he is frustrating and annoying.	5	13.2
She/he hits me.	7	6.8	She/he is naughty.	3	7.9
It is because she/he never shares.	7	6.8	She/he talks badly.	2	5.3
She/he always sits next to me.	4	3.8	She/he hits me.	2	5.3
She/he ruins my drawings.	2	1.9	She/he beats me.	1	2.6
She/he steps on my foot.	2	1.9	She/he scolds me.	1	2.6
She/he spits.	1	1.0	She/he hit my friend.	1	2.6
She/he breaks the toys and messes up.	1	1.0	She/he ruins the plays.	1	2.6
She/he throws the toys.	1	1.0	I don't play with her/him.	1	2.6
			She/he makes bad jokes.	1	2.6
			She/he plays with another kid.	1	2.6
			She/he always likes boy plays.	1	2.6
Total	103	100.0	Total	38	100.0

The first three reasons for the children in North Cyprus to dislike playing with their friends were "She/he does not play with me, speak to me or spend time with me, or call me to play (18.4%)", "I don't know (15.8%)", "She/he does harm (13.2%)", and "She/he is frustrating and annoying (13.2%)" (Table 4).

Table 5. Distribution of the reasons for the young children to dislike their peers in the second rank, in their response to the question "What are the names of top three friends you dislike playing with in the classroom?"

Preschool Children in Turkey			Preschool Children in North Cyprus		
Reasons of disliking their peers in the second rank	**f**	**%**	**Reasons of disliking their peers in the second rank**	**f**	**%**
She/he never obeys the rules.	17	25.0	She/he is frustrating and annoying.	6	18.8
She/he is naughty.	9	13.2	She/he does not play with me, speak to me, spend time with me, or call me to play.	5	15.6
She/he hits me.	8	11.8	I don't know.	4	12.5
It is because I find her/him strange.	6	8.8	She/he hits me.	4	12.5
She/he ruins the plays.	5	7.4	She/he is not my friend.	3	9.4
She/he does not play with me.	4	5.9	She/he does harm.	2	6.3
It is because she/he never shares.	4	5.9	She/he is naughty.	2	6.3
She/he spoils the turns.	3	4.4	She/he talks badly.	1	3.1
She/he ruins my drawings.	2	2.9	She/he scolds me.	1	3.1
She/he never gives back what she/he takes from me.	2	2.9	She/he plays games that I don't like.	1	3.1
She/he calls me "dad".	2	2.9	She/he has offended at me.	1	3.1
It is because she/he tickles me.	2	2.9	I don't like her/his jokes.	1	3.1
She/he beats me.	1	1.5	She/he takes my toys without permission.	1	3.1
She/he misbehaves.	1	1.5			
She/he always runs around.	1	1.5			
She/he yells.	1	1.5			
Total	68	100.0	Total	32	100.0

Table 5 shows that while 16 variables were effective in the reasons for the young children in Turkey to dislike playing with their friends in the second rank, 13 variables were effective for the children in North Cyprus. The first three reasons for the children in Turkey to dislike playing with their friends were "She/he never obeys the rules (25.0%)", "She/he is naughty (13.2%)", and "She/he hits me (11.8%)". The first three reasons for the children in North Cyprus to dislike playing with their friends were "She/he is frustrating and annoying (18.8%)", "She/he does not play with me, speak to me, spend time with me, or call me to play (15.6%)", "I don't know (12.5%)", and "She/he hits me (12.5%)".

Table 6. Distribution of the reasons for the young children to dislike their peers in the third rank, in their response to the question "What are the names of top three friends you dislike playing with in the classroom?"

Preschool Children in Turkey			Preschool Children in North Cyprus		
Reasons of disliking their peers in the third rank	**f**	**%**	**Reasons of disliking their peers in the third rank**	**f**	**%**
She/he does not play with me.	10	35.7	She/he is frustrating and annoying.	4	23.3
She/he never obeys the rules.	4	14.3	She/he does not play with me, speak to me, spend time with me, or call me to play	2	11.8
It is because she/he is quiet.	4	14.3	She/he does harm.	2	11.8
She/he ruins the plays.	2	7.1	She/he is naughty.	2	11.8
She/he is naughty.	2	7.1	She/he is not my friend.	1	5.9
It is because she/he never shares.	2	7.1	I don't know.	1	5.9
She/he never gives back what she/he takes from me.	1	3.6	She/he scolds me.	1	5.9
She/he beats me.	1	3.6	She/he plays games that I don't like.	1	5.9
She/he does things I don't like.	1	3.6	She/he has offended at me.	1	5.9
She/he misbehaves.	1	3.6	She/he always wants me to play with her/him.	1	5.9
			It is because she/he never shares.	1	5.9
Total	28	100.0	Total	17	100.0

Table 6 shows that while 10 variables were effective in the reasons for the young children in Turkey to dislike playing with their friends in the third rank, 11 variables were effective for the children in North Cyprus. The first three reasons for the children in Turkey to dislike playing with their friends were "She/he does not play with me (35.7%)", "She/he never obeys the rules (14.3%)", "She/he hits me (14.3%)", "She/he ruins the plays (7.1%)", "She/he is naughty (7.1%)", and "It is because she/he never shares (7.1%)". The first two reasons for the children in North Cyprus to dislike playing with their friends were "She/he is frustrating and annoying (23.3%)", "She/he does not play with me, speak to me, spend time with me, or call me to play (11.8%)", "She/he does harm (11.8%)", and "She/he is naughty (11.8%)".

DISCUSSION and CONCLUSION

The primary reason for the children in Turkish and North Cyprus samples to like playing with their friends in the first and third ranks in ranking of friends they liked playing with was "We play very well". Among their reasons for choosing the children in the second rank, "We play very well" was mostly mentioned in the sample of Turkey; whereas, "She/he is my friend" was mostly mentioned in the sample of North Cyprus. When examining the answers, the criteria called by the young children as "We play very well", including also the quality and diversity of plays, came to the forefront for indicating how they like playing with their peers. In addition, it was seen that variables such as "She/he is my friend", "She/he shares her/his toys", "It is because she/he helps me" and "It is because she/he tidies up the toys quickly", were among the first three reasons for the children to choose their peers. It was observed that only some children in the North Cyprus sample were not able to explain their reason for liking playing with their friends and thus said "I don't know" (Tables 1, 2, and 3).

This answer might be explained with their failure to focus on the subject due to their short time of attention. Additionally, it can be thought that the children may have had difficulty in choosing the right words to express their feelings. When examining the tables, it was seen that the children expressed themselves successfully in subjects of liking and disliking playing with their peers in general.

It was observed that the variables which were effective on the children's state of liking playing with a peer, were involved in the emotional and social skill dimension. The young children from these two countries gave answers in the emotional dimension such as, "She/he is my friend, It is because she/he likes me, She/he is my buddy, It is nice to hug her/him, I like her/his behaviors, and She/he is so sweet.". These answers revealed the importance of emotional satisfaction in play friendship. Another dimension of friendship is emotional bond. Positive friendships not only make a social contribution to children's emotional development, but they may also increase emotional dynamics in the peer group (Berndt, 1989; Bukowski, Newcomb, & Hartup, 1996). It can be asserted that the young children from these two countries were affected by social skills in the social skill dimension such as "Sharing, chatting, being fun and funny, asking for permission, tidying up the toys, helping, being quiet/making no noise, listening, being non-annoying, and smiling". Social skills may provide young children with advantages both in plays and friendship relationships (Gregoriadis, & Grammatikopoulos, 2014). Children can also learn social skills while playing with their friends (Vidoni, 2007). As is seen, there is a mutual correlation between social skills and playing. Spending time was another variable that may affect young children's choice of playmate in this study. The answers "We go home together, I have known her/him for a long time, we do activities together, we spend good time together, she/he is my first friend, she/he sits next to me, it is because I go to her/his house, and we draw together" revealed the importance of spending time other than playing. In the study conducted by Dietrich (2005) to examine preschool children's friendships, it was determined that spending time in similar plays and activities, having similar interests, affection, and familial factors were effective in shaping friendships for children

The reasons for the young children living in both Turkey and North Cyprus to like and dislike playing with their peers were usually parallel. This result can be explained with basic elements in plays and peer relationships. To be more precise, young children's individual differences reflect on their plays (Howes & Matheson, 1992). Some of these individual differences are self-regulation or emotional regulation strategies (Fabes, Hanish, Martin & Eisenberg, 2002), cognitive and language competencies (Rubin & Daniels-Beirness, 1983). Besides individual differences, parent-child relationship may shape social and emotional competencies, as well (McCollum & Ostrosky, 2008). Moreover, young children may be selective in peer groups in terms of gender, race, behavioral patterns, social participation, and cognitive capacity. They may display more interested attitudes in their fellows and/or peers who exhibit similar behaviors. Because of such selectiveness, they may develop positive or negative reactions against their peers (Coplan & Arbeau, 2009). It may not always be easy for young children to make friends and be a good friend. Howes & Matheson (1992) state that cognitive and emotional skills have an important role in young children's peer relationships.

The primary reason for the children to dislike playing with their friends in the first rank in ranking of friends they disliked playing with was the variable "She/he does not play with me, speak to me, spend time with me, or call me to play". Accordingly, it is important for children to invite each other to play, accept such invitation and establish a dialogue, in terms of play friendship. Friendship is a type of relationship including special interests and mutual close interaction that show continuity (Rubin, Bukowski, & Parker 2006). In the study conducted by Persson (2005) on four-year-old children, it was stated that prosocial behaviors corresponded to the same kind of behaviors in the circle of friends; whereas, negative behavior examples such as aggression reduced positive behaviors in the circle of friends. The children included in the study expressed that they disliked playing with their peers who did not invite them to play or communicate with them. When expressing their reason for choosing the

peers they liked playing with, they stressed spending good time together. In this context, it is possible to assert that the study results are consistent.

In addition, it was revealed that they had positive feelings and affection for their peers who were shorter than them with the answer, "It is because she/he is small". The relevant studies have shown that physical appearance may direct young children's peer relationships. For example, in the study conducted by Sanefuji (2013) on five-year-old preschool children in Japan, it was stated that similar physical characteristics may be effective on selecting friends.

The children from the two countries had also parallel views about unfavorable characteristics of a playmate. Accordingly, the young children did not want their friends to "ruin the plays/activities, be naughty, do harm, display violence, get angry, annoy, talk differently, spit, break the toys, mess up, make bad jokes, choose the same child all the time, disobey the rules, get offended, tickle, run all the time, misbehave, be quiet and behave oppressively", although the ranking of these characteristics changed. In the study conducted by Coelho, Torres, Fernandes and Santos (2017) in Portugal, they revealed that there was a correlation between problems experienced by children during plays and sociometric measures. To be more precise, there was a negative correlation between communication problems in plays and close friendships. As the quality of plays enhances, social acceptance and friendship levels also increase. As is seen, relationships established by children during plays in preschool education institutions may become a determinant in terms of friendships.

Based on the results it was determined that obeying the rules was also an effective variable for the children's choice of a playmate. The children from the two countries also stated that their reasons to choose their favorite peers for a playmate were behaviors expressed as classroom rules, such as "tidying up the toys quickly, finishing their meal and making no noise". When examining their reasons of disliking their friends for a playmate, they mentioned classroom rules either directly or indirectly with statements, such as "not obeying the rules, ruining the turn and running all the time".

According to the results, young children attach importance to social skills, mutual sharing, spending time outside plays and relationships based on kindness and love in their peer relationships and they dislike rude, bullying and disorderly behaviors. While expressing their playmate choices, the children in the study groups stated more criteria as their reasons to dislike than their reasons to like, which is noteworthy in terms of revealing problems of young children in their peer relationships.

Limitations and recommendations

This study revealed which variables children liked and disliked in their playmate choices. In accordance with the results, preschool education teachers should closely follow the dynamics in children's peer relationships. They should observe play behaviors, types of play, playmate choices, conflict status and the consequences of conflicts. Ladd (2005) states that peer interactions expressed with conflict might be useful for teaching children how to balance between their own desires and other people's desires. Thus, teachers should focus on developing conflict solution skills of children. Also, they should apply various guidance activities like coaching in order to enhance social competence of children and develop their social skills. Studies aimed at children's playmate choices can be increased. In line with the limitations of the study, further studies can be conducted with more crowded sample groups. Changes occurring in children's playmate choices in the course of time can be followed with longitudinal studies.

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ETHICS WITHIN ONTARIO (CANADA) ELEMENTARY HEALTH AND PHYSICAL EDUCATION

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Abstract

Following the qualitative research mode commonly known as content analysis unfolded while exploring the current Ontario provincial government positions arising from the recent 2019 Ontario Health and Physical Education curricular document which includes directives supporting the teaching of ethics. Several questions provoked and framed this content analysis which asked: How should ethics be taught in Health and Physical Education? What level of ethical awareness should Ontario Physical Educators and students have? What are the existing ethical guidelines and orientations impacting Ontario teachers? To what extent are Ontario teachers urged via the curricula to focus and emphasize ethics in the classroom and gymnasium? Eventually, the curricular emphasis on ethics emerges via references to Ontario teacher unions, the Ontario Teachers College, the Ontario Ministry of Education and implications for various other stakeholders complete the picture within a contemporary ethical infused landscape.

Keywords: Health and physical education, ethics, values, curriculum, pedagogy

INTRODUCTION

An Ontario teacher begins each day knowing what the rules are in the school, classroom, gymnasium, hallways and in all other areas of the school. This is a necessary type of knowledge to help students learn in a respectful environment that is fair and free from harm. Teaching as a profession is guided by rules, and it is each educator's legal obligation to know, apply, and follow rules (Darling-Hammond, Flook, Cook-Harvey, Barron & Osher, 2019). Rules in a classroom can be flexible if necessary; however, "ethical rules of a profession are analogous in many ways to the rules of the game in sports. One might conclude that there would be no game of baseball without rules and thus no sense of professionalism without the constraint of ethical rules" (Elkins, 1985, p. 41). In the classroom an educator is supporting the development of student maturity and an ability to care, whereas baseball rules only ensure the game is played reliably and fairly.

Each Ontario teacher endeavors to be an ethical leader and works to provide an ethically sound teaching environment which requires demonstrative values commonly known as honesty, love, responsibility, trust and credibility. Teachers try to be caring, inclusive and fair while valuing honesty as they guide students (Ryan, Schruder, & Robinson, 2013), in the classroom, all the while demonstrating and modelling respect for others (Frank et al., 2011). Teachers care and trust students to be fair, and it is only the ethically challenged student that puzzles teachers. Bellini (2018) believes that "telling teachers to think and behave ethically is simply not enough. Teaching them a step-by-step cognitive process that is straightforward . . . would help the teaching profession enormously" (p.149). This awareness of ethical conduct is first delineated in teacher training and hopefully becomes habitual (Ryan et al., 2018) however, a persons' inner compass needs to be calibrated, refined and maintained throughout life to stay within ethical professional margins.

Theoretical Background

Ethics is forever linked to our enduring beliefs (philosophy) and theoretically this positioning suggests ethics has logical foundations that can be entangled with educational conceptualizations such as curricula and curriculum (Bishop, 1992). Ethics is infused in written curricula and is "not simply a matter of following rules or calculating consequences. It is a matter of discerning, "(Lebacqz, 1985, p. 29). Each of us possesses a philosophical orientation that is guided and informed by both morals and values (enduring beliefs) (Ryan et al., 2013). Ethical behaviour surfaces via the interplay of morals,

values and philosophy that each person perceives and applies daily. Therefore, in theory it is possible to examine and influence human ethics via behaviour in schools and within the guiding curriculum documents.

Purpose of the Study

To illuminate and determine the prevalence of ethics within the recent 2019 Ontario Health and Physical Education curricular document via content analysis.

Research Questions

To what extent is ethics emphasized within the recent 2019 Ontario Health and Physical Education curricular? How should ethics be taught in Health and Physical Education? What level of ethical awareness should Ontario Physical Educators and students have? What are the existing ethical guidelines and orientations impacting Ontario teachers? To what extent are Ontario teachers urged via the curricula to focus and emphasize ethics in the classroom and gymnasium?

Limitations of Study

Herein this research effort is limited since sampling included only curricula used at the Ontario elementary level (kindergarten to grade eight) and only one author directed the study. As an outcome this study does not detail past curricula nor speculate on future directions, instead it is a snap-shot of a document produced in 2019 by the Ontario Ministry of Education. Moreover, search terms and selection of content, and eventual results are linked to researcher bias. The researcher is a senior and experienced elementary educator now training teachers at the post-secondary level. Using this background, the term ethics was demarcated, which informed and guided the research in such a way that possible inaccuracy resulted while examining text and selecting content. As is the case in most research, further work may be required to ascertain trustworthiness and reliability of the content associated with ethics in Ontario elementary curricula.

METHOD

Herein this investigation employed a qualitative content analysis (Elo et al., 2014) which involved "a systematic, replicable technique for compressing many words of text into fewer content categories (headings) based on explicit rules . . ." (Stemler, 2001, p. 1). The close reading of a small quantity of text (Schreier, 2012) is the core element of iterative content analysis ". . . in order to understand what they meant to people, what they enable or prevent, and what the information conveyed by them does" (Krippendorff, 2004, p. xviii). The text is revisited to reduce, reinterpret and reshape textual interpretations (Schreier, 2012) to develop qualitative insights, and link these to other elements in much the same way as a mind-map (Schreier, 2012; Weber, 1990). A number of researchers have emphasized that content analysis is "a research method for the subjective interpretation of the content of text data" (Hsieh & Shannon, 2005). Content analysis is highly descriptive, describing and summarizing text to uncover new perspectives (Schreier, 2012) while grounding evidence in content data.

Ontario (Canada) Stakeholder Orientations: Ethics

In the province of Ontario, it is the education act developed and maintained by the provincial government which directs each teacher employer to acknowledge and follow certain rules as detailed in the Ontario Education Act. The Education Act continues to evolve as rules (laws) are refined, erased and new ones are introduced within maturing and changing school systems. Currently, the Ontario Ministry of Education (2020) provides a code of conduct which sets clear,

> standards of behaviour for individual school boards to follow, so that they can develop their own codes of conduct. The standards of behaviour in school board codes of conduct must be consistent with the requirements outlined in the provincial code of conduct. (p.1)

The provincial code of conduct includes fundamental beliefs that suggest:

- Everyone has a responsibility to promote a safe environment.

- Everyone should be aware of their rights, as active and engaged citizens. More importantly, everyone should also accept responsibility for protecting their rights and the rights of others. Responsible citizenship involves taking part in the civic life of the school.
- All members of the school community are to be treated with respect and dignity, especially those in positions of authority.
- Everyone has a responsibility to resolve conflicts in a way that is civil and respectful. Insults, hurtful acts and a lack of respect for others disrupt learning and teaching in a school community.
- Everyone is expected to resolve conflicts without using violence. Physical aggression is not a responsible way to deal with other people. No one should use an object to injure another person, or even threaten to use an object to injure another person. This is unacceptable and puts everyone's safety at risk. (Ontario Ministry of Education, 2020, p. 1)

This provincial code of conduct details roles and responsibilities for many stakeholders including parents, students, administration, School Boards and teachers and staff. However, one organization has been empowered by the Ministry of Education to put in place rules solely for Ontario teachers. Indeed, the most recent ethical guidelines for Ontario teachers surfaced via the Ontario College of Teachers (OCT) who are an arm of the provincial Ministry of Education. OCT laid the foundation for specific rules teachers must follow via their ethical framework (Figure one) which builds on the Ontario Education Act. OCT also established vital legal guidelines in the Ethical Standards for the Teaching Profession and the Standards of Practice for the Teaching Profession (Ontario College of Teachers, 2009). The current guidelines, policies and ethics where an outcome of the Ontario College of Teachers who began working on these standards in 1997 (Ontario College of Teachers, 2013b), and has worked since to oversee and enforce rules teachers must follow. The OCT implemented their Ethical Standards for the Teaching Profession in the year 2000, when it also became a College bylaw (Ontario College of Teachers, 2013a).

Figure 1. Ethical standards of the teaching profession
(Ontario College of Teachers, 2013a).

In a recent study of teachers, one participant reflected upon being a beginning teacher: "It was pretty much an unspoken rule to do what we do and do not speak when you are a beginning teacher" (Trendowski, 2013, p. 52). This quote portrays teachers as rule followers when in fact many new teachers simply follow what other teachers do in their classrooms and schools. This imitation can perpetuate a way of life in schools where new teachers simply do what has previously been done. It

could be that teachers follow others with more experience to avoid or decrease stress since teaching is quite a stressful occupation (Leroux & Theoret, 2014; Ryan & Lielkalns, 2011). What new and experienced teachers actually prefer is a, "warm mentoring environment in the school to provide reassurance about their expectations and self-efficacy, good collaboration with colleagues, family support, and professional development opportunities to help them improve their emotional competence and better cope with challenges" (Leroux, Beaudoin, Grenier, Turcotte, & Rivard, 2016, p. 1).

In the absence of this warm mentoring environment teachers new and experienced may have difficulty following rules and making appropriate decisions. Indeed, job intensity and unremitting role demands increase teacher stress which in turn can result in wanting teacher performance and attrition (Klassen & Chiu, 2010; Montgomery & Rupp, 2005). Many educators feeling the stress of classroom management, professional development obligations and a plethora of role responsibilities do leave teaching to the extent that up to half of those hired today may leave within the first five years of teaching (Clandinin et al., 2015; Leroux & Theoret, 2014; Roness, 2011). Stress can impair brain functionality and thereby affect decision-taking, yet exercise can provide relief (Medina, 2008), as long as the educator can find time to exercise.

In spite of significant adversity in the first few years of teaching and beyond, many teachers find refuge in teaching. For instance, the province of Ontario is identified as a curriculum leader in critical areas including mental health, cyber safety, and consent, underscoring our commitment to building an education system that prioritizes inclusion, safety, and respect (Stockton, 2020, p.1). The problem is that teachers who are themselves at-risk of dropping out of the profession due to perceived stressors or the realization of wanting teacher skills or conflict with peers (Leroux, 2013; Yong & Yue, 2007), must now teach students about the very things that may be causing them distress. It could be that in some situations, it is therapeutic for teachers to address stress in everyday life in order to ease pressure for themselves. It is a case wherein the teacher is both instructor and student, learning and leading in one reflexive action.

Ethics: The Health and Physical Educator and Curricula

The recent 2019 Ontario Health and Physical Education curriculum includes important updates concerning mental health, online safety, bullying, cannabis, concussions, and healthy body image (Ottawa-Carleton School Board, 2020). It is mental health that resonates with many educators as they search for answers and coping mechanisms within their teaching role (Jepson & Forrest, 2006). The Mental Health Commission of Canada (2013) determined that over 20% of workers in Canada experience mental illness or mental health problems hence the need to learn about these issues early within the elementary grades. As physical educators prepare to teach by planning lessons and units, they become aware of the inherent qualities and emphasis in the new 2019 curriculum which suggests,

> as students learn and apply the principles of fair play – through concepts such as inclusion and respect for all – in a variety of settings and activities, they are developing an understanding of ethics. This understanding deepens as they develop social-emotional learning skills – as they learn about themselves and their interactions with others, and as they practise thinking critically and creatively (Ontario Health & Physical Education, 2019, p.86)

Health and Physical education classes present an opportunity to learn about oneself in a way that is quite different from the typical classroom subjects since a student can increase his or her own physical literacy. Herein, "physical literacy is the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life" (International Physical Literacy Association, 2014, p.1). Building knowledge in health and physical education can be augmented via the challenge to think critically and creatively which requires an ability to sort, sift and process experience and debate while rendering decisions that can affect both health and physical well-being of students and teachers.

The OCT recently, released: Inquiring into *Ethical Dimensions of Profession Practice* (2015) which suggests the, "ethical efficacy of educators is strengthened through participation in critical reflection and ethical inquiry based on the ethics of Care, Respect, Trust and Integrity" (p.5). The need to be reflective and revisit experiences allows educators to deeply explore all actions and being able to reflect with others instigates a community of learners. Ethics has been linked to the "norms that a community defines and institutionalizes to prevent individuals from pursuing self-interest at the expense of others" (Costa, 1998, p. 71). OCT has become both a community and an institution revered globally by setting high standards and working to uphold the same.

OCT (2015) further adds that "ethical confidence of educators is reinforced when they collectively reflect upon, explore and critique ethical experiences" (p.5). Communal reflection is much more accessible since Teachers in Ontario are part of one union or another which creates linkages and a sense of community; an identity, as a member and in response to this grouping, collective ethical principles are constructed. For instance, one union suggests all members "will strive to achieve and maintain the highest degree of professional competence and will always uphold the honour, dignity, and ethical standards of my profession" (Ontario Secondary School Teachers Federation, 2020, p. 1). Another Ontario union, the Elementary Teacher's Federation of Ontario (ETFO) is the largest teachers' organization in Canada, outside of Quebec. ETFO represents 83,000 people, both teachers and educational workers in the public elementary schools of Ontario. ETFO aims to "promote a high standard of professional ethics and a high standard of professional competence" and to "promote and protect the health and safety of members, both physically and psychologically" (ETFO, 2020, p.1). By having unions, the college, the Ministry of Education echoing these complementary ethical guidelines there really is no excuse for an Ontario teacher to be unaware of ethical conduct requirements.

Learning about Ethics in the Health and Physical Education Program

The health and physical education curriculum provide varied opportunities for students to learn about ethical issues, explore ethical standards, and demonstrate ethical responsibility (Ontario Ministry of Education, 2019). For instance, fair play can be understood as ". . . respect for the interests of the game (or sport) as a practice. . ." (Butcher & Schneider 2007, p.127); students abide by the rules in order to play properly. Fair play can be sampled in efforts to be inclusive, demonstrating respect for the activity and others within "a variety of settings and activities, they are developing an understanding of ethics" (Ontario Health & Physical Education, 2019, p.86). Students who participate ". . . have understood and agreed to the rules of the game and the principles upon which any fair victory in that game must rest" (Leaman 2007, p.206). Fritzsche (2005) claims that as a "child matures, correct behavioural guidance gradually evolves to internal control" (p.68). Therefore, being informed of the need to be honest can become both a value and a part of an ethical being (Festini, 2011; Ryan & Robinson, 2013), when participating in health and physical education games and activities that have both written and unwritten rules.

The health and physical education program of Ontario (2019) offers "opportunities to explore ethical issues related to topics such as violence in sport, the use of performance-enhancing substances, and the notion of winning at all costs" (p. 86). The opportunities unfold in classrooms and gymnasiums with groups of students who are peers, participants, community members and stakeholders who will take-part and monitor the activity providing both feedback and a source of camaraderie. The community aspect is especially interesting since "individuals must consider the consequences of their behaviors and actions, both for themselves and their communities, and for both the short and long term" (Teehan, 1995, p. 845). Dewey (1989) reminds us that "the admiration and resentment of others is the mirror in which one beholds the moral quality of his act reflected back to him" (p. 246).

Within the 2019 Ontario Health and Physical Education curriculum students "explore how sports and physical activity can be used to build community, and they can consider ethical questions. . ." (p.86). A teacher can augment the curricula by turning to the Canadian Centre for Ethics in Sport who provide insight and "direction for teachers and students for many related issues such as health promotion and the use of human subjects in research" (Ontario Health & Physical Education, 2019, p.86). Similarly,

students can study and "apply citizenship education skills through health and physical education. Educators can consult the Citizenship Education Framework that appears on page 10 of *The Ontario Curriculum: Social Studies, Grades 1 to 6; History and Geography, Grades 7 and 8, 2018* to make relevant connections" (Ontario Health & Physical Education, 2019, p.86).

While illuminating and examining issues associated with "health and physical education as part of an inquiry process, students may need to make ethical judgements. Such judgements may be necessary in evaluating evidence and positions on various issues or in drawing conclusions about issues, claims, or events" (Ontario Health & Physical Education, 2019, p.86). Teachers need not avoid ethical content or related judgements when reflecting upon the past as these positions are important and inescapable (Vann, 2004). Reflection when combined with an open mind may encourage further understanding and learning. Teachers can support "students in determining the factors to consider when making these judgements. In addition, teachers provide support and supervision throughout the inquiry process, helping students become aware of potential ethical concerns and of appropriate ways to address those concerns" (Ontario Health & Physical Education, 2019, p.86). At some point students may realize that "social inequality is embedded in our individual values and beliefs, and the systems and institutions we create reflect these inequalities. Therefore, change must begin with individuals transforming" (Springtide Resources, 2008, p. 2). In order to initiate self-change, there can be a need to investigate issues and research topics to discover via inquiry-based learning (IBL).

Instructional Modes

To help students develop their sense of self and an awareness of their own abilities, likes, and dislikes, programs in the junior grades should encourage them to think in terms of self-improvement rather than peer comparison. This change is possible if we accept the notion that "we construct our own and each other's identities through our everyday encounters with each other in social interaction" (Burr, 1995, p.9). Student interaction is unavoidable at school, and for some this interaction is a problem that needs to be addressed possibly through dialogue and inquiry that is both creative and structured by the teacher in an authentic way.

Perhaps the teacher opts to use Inquiry-based learning (IBL) which is an attractive teaching mode and ". . . a system of learning that supports the development of students' problem solving and critical thinking skills, which is crucial for them in everyday activities" (Maxwell, Lambeth, & Cox, 2015, p.3). Students and teachers who practice thinking critically and creatively may realize that the development of their own rules and value systems is vital to their development. Moreover, "authentic, engaging tasks with real-world connections motivate student effort and engagement, which is supported through teacher scaffolding and a wide range of tools that allow for personalized learning and student agency" (Darling-Hamond, et al. 2019, p. 1). And yet, "they also need to be exposed to models of fair decision making and be given many opportunities to think about and solve their own problems" (Ontario Health & Physical Education, 2019, p.154). IBL is "a cluster of teaching and learning strategies where students inquire into the nature of a problem(s) or question(s) [which] . . . serves as a mechanism and catalyst to engage actively and deeply in the learning process" (Blessinger & Carfora, 2015, p. 5). Students and teachers who are inquiring may be conducting surveys or interviews and,

> may need guidance to ensure that they respect the dignity, privacy, and confidentiality of their participants. Teachers also supervise the choice of research topics to ensure that student researchers are not inadvertently exposed to information and/or perspectives for which they are not emotionally or intellectually prepared (e.g., personal interviews that lead to disclosure of abuse. (Ontario Health & Physical Education, 2019, p.86)

All program activities should "emphasize participation and teamwork and help students understand the concepts of fair play, ethics, and healthy competition. Students at this level [grade 4-6] should be encouraged to ask questions and take responsibility for their learning" (Ontario Health & Physical Education, 2019, p.154). A "primary reason for discussing ethical issues in the . . . classroom is for the

students to develop a process which considers the ethical implications" (Oddo, 1997, p. 296), of their decisions. In doing so, some research has shown a positive change in moral and ethical reasoning (Ritter, 2006; Webber, 1990)

The Ontario Physical Health Education Association (OPHEA) (2016) is an association funded by the Ontario provincial government to augment and develop curriculum materials for Ontario teachers, and in doing so publishes useful reports, guides and activities for teachers that link directly to the Ontario curriculum. For example, in a resource entitled*: Approaches to teaching healthy living: A guide for secondary educators*, the document suggests that students should demonstrate "positive responsible social behaviour [while] adhering to ethical and fair play standards to create an enjoyable environment for everyone to participate in physical activity, working effectively and collaboratively as a group while participating in physical activities, and encouraging others" (p.47). Role-play, case studies, and simulations help students realize implications of their actions. What is noteworthy is the specific nature of the OPHEA directive which allows teachers to work towards this goal while exploring ethical behavior with students. Within a bigger global picture, the guide also suggests, students consider their own ethical and environmental values (p.13), while pursuing a healthy lifestyle. This emphasis on ethical living is littered throughout OPHEA resources in order to revisit ethics in various health and physical education areas and provoke both cognitive and emotional responses.

Affective Domain

Within the 2019 Ontario Health & Physical Education curriculum document it is suggested that students in the intermediate grades [7-10] "are in the process of forming their adult identities and consolidating their moral beliefs and values. They are very much influenced by the world around them, and especially by their peers, who are a major source of motivation" (p. 234). Therefore, involving peers in a discussion concerning current issues and tensions that entangle student views and positions can be a positive teaching mode within the school. In fact, Jagger (2013) found that "debating the ethics of familiar topics trigger affective characteristics and are beneficial in developing levels of student engagement, critical analysis, flexibility of thinking and motivation to learn" (p.38). Many believe that the closest two people can get without physicality would be to enter into a verbal argument (debate/conflict) which may have a lasting emotional memory via the meeting of the minds. Emotions instigate lasting memories and intensify learning making the learning a felt experience (Simonton & Garn, 2018). When experience is rooted in emotional responses the intensity seems to be greater than experience that is quite impassive hence an educator who can trigger emotions of students may witness enhanced learning and achievement.

How emotions are addressed in the classroom and gymnasium is important since student anger, for example, must be decoded to understand its purpose and function within a classroom context. Each teacher needs to consider the context to respond to the student anger appropriately. Similarly, shame, pity and/or fear needs to be processed by the teacher and students to decide on the next step(s) in a gymnasium or classroom. "Stimulation of the affective domain plays an integral part in developing ethical sensitivity – an important component for moral development" (Jagger, 2013, p.38). Understanding student emotions helps teachers navigate and take next steps, for example not following the rules within a game may cause other students to become angry with the rule-breaker. By arguing and verbally joisting students are "continuing to develop their interpersonal skills and generally enjoy participating in activities with their peers. Their responses to winning and losing vary individually but can be very emotional" (Ontario Health & Physical Education, 2019, p.234). Debates and other deliberations "provide opportunities for students to interact positively with their peers, to continue developing and improving their relationship skills, and to learn and apply concepts of equity, fair play, ethics, and social justice" (Ontario Health & Physical Education, 2019, p.234). Students need time to adjust to this verbal exercise since "adolescence is a key time for using the opportunities provided within health and physical education to reach and connect with youth and provide them with positive social, emotional, and physical experiences" (p.234).

Sport and physical activity can be powerful socializing agents for adolescents. In some cases, they can also create environments of exclusion. Some adolescents move away from "physical activity because of physical, social, and emotional changes or stresses at puberty" (Ontario Health & Physical Education, 2019, p.234). People who may feel uncomfortable in one environment tend to try to avoid this reoccurrence even if it means being inactive and avoiding health and physical education classes. "Teachers need to develop empathetic strategies if they are to respond to their students in appropriate ways" (Barker et al., 2019, p. 2). By accepting and handling student emotions the teacher is actually helping students to form their identities and modelling responses an adult may have towards such emotions. Students learn about themselves and others while fine-tuning their own moral and ethical positions based on experiences and contexts.

CONCLUSIONS and RECOMMENDATIONS

Reviewing the content of resources noted herein guides Ontario teachers in a professional and ethical manner. Others who read these documents will be struck by the efforts to be inclusive and protect students, for instance one OPHEA facilitators guide (2015) states how,

> it's important to be proactive in examining these reflective and guiding questions to have optimal understanding of themselves and their students before examining any of the topics in a learning environment. Once this is achieved, it's the responsibility of the teacher to promote open discussion with students by providing a safe, positive and confidential (if necessary) environment for students to discuss matters of their own experience. (p.3)

Each Ontario teacher strives to be ethical, while providing an ethically sound teaching environment. Teachers both in training and in-service are guided to model values such as honesty, love, responsibility, trust and humor while teaching and leading students (Ontario College of Teachers, 2013b). The key is to communicate, to inquire, and to trust each other in the classroom and gymnasium. As we learn from one-another it is possible to establish an ethic of care in the school. This goal can only be achieved in a warm mentoring environment that provides support to all. Teachers demonstrate care and model cooperation with colleagues, offer support to families, and seek-out professional development opportunities to continue to learn and improve the educational conditions.

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EXPLORING STUDENT "FLOW" WITH 1:1 TECHNOLOGY

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Abstract

Students live in a technology-rich environment, which aids in shaping their learning and access to information. A teacher's instructional challenge lies in creating a bridge between students' capacity to learn and the resources at their fingertips. The focus of this study was to investigate the impact technology use has within the classroom in relation to its impact on student-monitored self-engagement and teacher-monitored engagement. The exploration of technology's impact on student engagement seeks to provide a better understanding of the shared traits between lessons that effectively integrated 1:1 technology into the classroom. Survey data was collected from student self-reports and two forms of teacher observation. Lessons that result in states of *flow* reflect the highest levels of engagement and 21st century skills, which are promoted by the use of 1:1 technology.

Keywords: Technology, engagement, 21st century skills, 1:1, flow

INTRODUCTION

Teachers are faced with the challenge of creating engaging lessons that teach standardized objectives using technology. These will ultimately prepare students for the advancing digital world in which they learn, work, and engage with others. Throughout the last ten years, educators have confronted a dramatic change in the digital landscape, moving from desktop computers in classrooms and labs, to laptop carts, to 1:1 technology platforms for every student (Heppleston et al., 2011). The latest vision of technology within schools takes form of 1:1 initiatives that provide *all* students with the same device to use throughout their learning experiences in school. While educators are motivated to transition towards 1:1 technology platforms, the question remains: are students more engaged in their learning experience when using technology? Although 1:1 approaches are viewed as advancements, there has been limited research evaluating the relationships among technology use in classrooms, student perception of their cognitive and behavioral engagement, and teacher perception of student engagement.

A Technological Change: Desktop to 1:1

Current students living in an information-saturated and hyper-adaptive digital world have redefined the skill sets needed to be a successful adult (Costa, 2012). To address this changing paradigm in our schools, many schools have opted to put a device in the hands of every student and teacher. A 1:1 technology platform within schools allows students to have immediate access to information through a personal device, thus, changing communication methods as well as altering strategies of collaboration. Immediate access to information puts students in control of their educational experience as they can discover additional support to course content or expand upon their own interests in connection to their learning within the classroom.

This shift to a 1:1 ratio of classroom technology use has accelerated our students into adaptive real-world problem solving, communication, and collaboration skills (Carver, 2016; Barrios, 2004). Teachers are called to create learning experiences that will replicate, introduce and prepare students for real world, digitally rich contexts. Teaching students to be fluent in problem solving and

adaptability, as well as digitally literate adults requires lessons that consistently reinforce this skill set throughout their formative school years (Costa, 2012). Allowing students within the same school access to gaining 21st century skill sets include: access to continue digital learning, financial literacy, communication, problem solving, independent and collaborative work skills, demonstrate creativity, innovation, adaptability, responsibility, character and ethical behavior. These skills better prepare students for their future work and overall well-being beyond school (Costa, 2012).

Studies have shown successful implementation focused on unleashing the learning potential of students within a familiar context of technology in preparing schools for teaching 21st century skills (Karlin, Ottenbreit-Leftwich, Ozogul, & Liao, 2018); however, there is nothing in the research that discusses the best practices for using this type of 1:1 technology (Bebell & O'Dwyer, 2010). The infusion of technology in classrooms is a purview of the expansion of technology available to our students that makes learning available and applicable to their lives (Downes & Bishop, 2012). Therefore, educators need to understand the phenomenon of 1:1 computing, and the influence it has on teaching and learning (Bebell & O'Dwyer, 2010; Moustakas, 1994). There is still a need for empirical research to be conducted on the efficacy of cognitive and affective engagement when using a device.

Engagement in Learning

To frame this study we used a definition of student engagement by Dunleavy (2008), who defined it most commonly as the cognitive time-on-task, homework completion, response to challenges in learning, effort directed toward learning, cognition and strategic learning. After completing additional research (Milton & Dunleavy, 2009), this definition of engagement was altered by adding "intellectual engagement" (p. 5). *Intellectual Engagement* is defined as a serious emotional and cognitive investment in learning using higher order thinking skills (i.e., analysis and evaluation) to increase understanding, solve complex problems, or construct new knowledge. Another type of engagement that has been further researched is affective engagement (Hidi & Renningeer, 2006). *Affective Engagement* is conceptualized as student motivation paired with situational or personal interest in a particular concept or topic (Hidi & Renninger, 2006). While we focus on cognitive engagement when addressing classroom learning, we often neglect to focus on the affective ways students are engaged in their learning, which comes from observing their emotional connection their learning experience.

To build upon the framework, the emotional and motivational merge through the work of Shernoff, Csikszentmihalyi, Schneider and Shernoff (2003), defined student engagement as "high involvement in classrooms, which includes concentrated attention, interest and enjoyment, as opposed to apathy and a lack of interest in instruction" (p.3). This definition stems from using Csikszentmihalyi's (1990) "*Flow* Theory" as a student engagement model, which theoretically leads to optimal learning experiences. *Flow* is "the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it" (Csikszentmihalyi, 1990, p. 4). The *flow* experience is intrinsically rewarding—people seek to replicate those moments or experiences. Students who report high challenge and skill when surveyed on engagement are considered in *flow* during that time period (Csikszentmihalyi, 1990). Similarly, if students report high challenge and low skill then they are functioning in a state of anxiety. Conversely, however, if students report high skill and low challenge they are bored with the lesson. Finally, when students are in experiencing low skill and low challenge they are apathetic in the classroom (Csikszentmihalyi, 1990). Students and teachers must find a niche that helps create these *flow* moments in a classroom (Parsons & Taylor, 2011). While *flow* is a subjective state of complete involvement in a classroom activity, the definition of *flow* provides a conceptualization that represents high emotion and motivation in their work.

Since this research focuses on student engagement, we must deeply analyze pedagogy, purpose of education, future students, and the world we are launching them into. The literature commonly states the need to re-examine our assumptions in learning about students and changing daily classroom practices by infusing practices with engaging pedagogy-based research focused primarily on academic

achievement (Parsons & Taylor, 2011; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010). There is little definitive research on how technology enhances students' "capacity to learn" (Claxton, 2007) or how technology engages them in learning. There is a need for more research coming from the voices of teachers and students, as they are most able to implement and benefit from the research being conducted on engagement. Implementing a culture of learning and genuine student engagement in our classrooms should be a primary goal for all educators (Gilbert 2007; Claxton, 2007; Parsons & Taylor, 2011). Exploring the questions of student engagement raise discussions about the purpose and direction of education.

Engaging Students with Technology

Student engagement has traditionally been a popular topic of research as educators seek to understand and apply specific, research-based strategies that support student learning in the classroom and beyond. Today, creating a classroom experience that is engaging is more prevalent than ever as students have immediate access to information and desire to acquire 21st century skills (Carver, 2016; Taylor & Parsons, 2011). Authentic intellectual engagement requires reciprocity between teachers and students as their relationship becomes a partnership of learning where they work together towards a deep conceptual understanding and contribute their ideas to building new knowledge and devising new practices (Dunleavy & Milton, 2009). Technology is the tool that allows learning to be accessible and relevant. Coupled with an open, caring, and respectful classroom environment, student learning is optimized through self-motivation and deeper psychological engagement in their own education. As students have more control of their learning experience, they become increasingly interested in course content (Taylor & Parsons, 2011). Technology used in a 1:1 environment provides the resources for students to access information, immediately bridging teacher instruction and student learning which promotes student engagement in the course (Barbell & O'Dwyer, 2010). To better understand the degree to which teachers are using technology, the use of Puentedura's contextual framework of Substitution, Augmentation, Modification, Redefinition (SAMR) model to categorize technology is implemented.

SAMR Model

Puentedura's SAMR Model's (2012) four levels describe how learning can be transformed through the integration of technology in a classroom. SAMR consists of four levels of implementation: Redefinition serves as the highest level of integration in a classroom and Substitution is the lowest level according to this model. The SAMR model (**Figure 1**) clearly depicts what types of technology is being used in correlation to effect on student learning. The foundational level of SAMR is *substitution,* which portrays a direct substitution of technology from an earlier technological model, essentially doing the same thing effectively, with or without the presence of the technology, such as the use of a word processer for a lab report. The next level is *augmentation,* which is still a direct substitution of technology; however, improvements occur in functionality that were originally not present. Examples of augmentation are not limited to, but would include, creating a collaborative Google Presentation and sharing with the teacher. The lower two levels (substitution and augmentation) lead to enhancement of instruction, but not total transformation (Strother, 2013). The top two levels (modification and redefinition), however, lead to transformation of teacher instruction in classrooms. The *modification,* which is the first of these higher levels, is when teachers and students alike are able to redesign learning tasks to create an assignment that could not be completed without technology such as, creating a QR code for their project or portfolio of student work. As stated, the highest level of SAMR is *redefinition,* which allows for transformation of learning by creating an assignment that could not be conceivable without technology. This ultimately allows for authentic learning experiences and require formative feedback from students such as the use of a collaborative class blog. The use of the SAMR model for technology is used in classrooms because of its simplicity, which allows teachers and students to clearly understand the differences in implementation levels as well as being the best supported by research (Puentadura, 2012). To best measure student engagement in real time in 1:1 classrooms teachers use *back-channeling* or experience sampling models as evaluation tools (Clesson, 2011).

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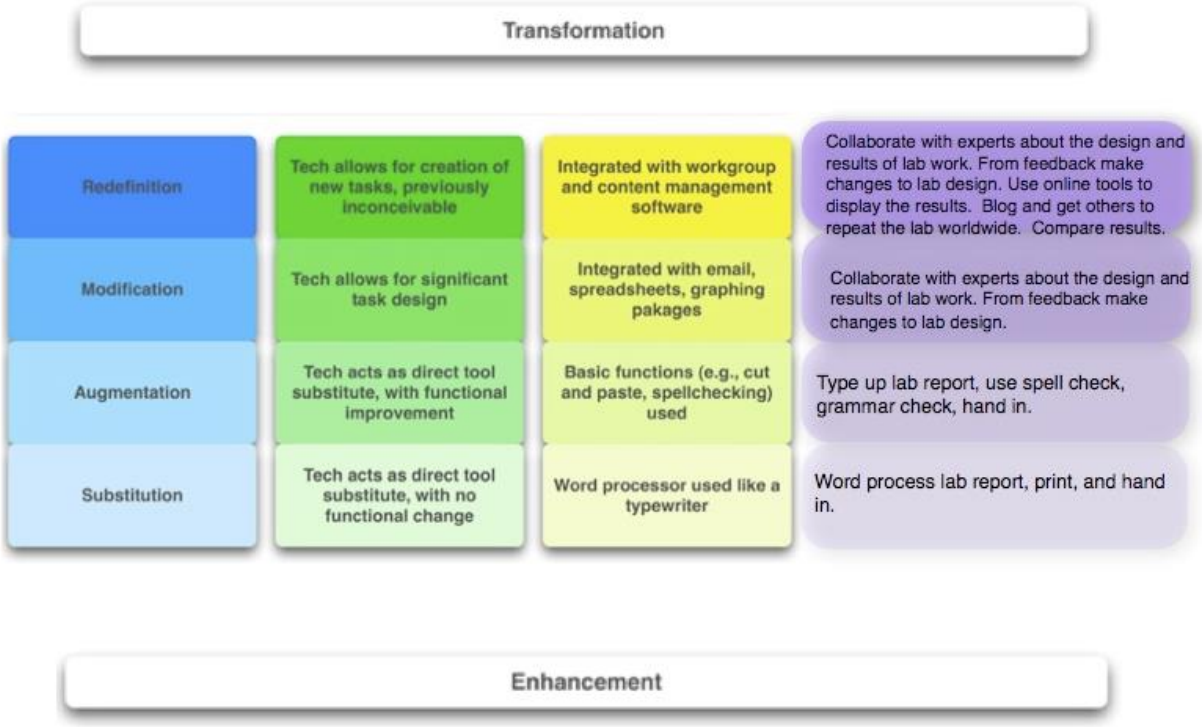

Figure 1. SAMR Model of Technology Classroom Integration

Back-channeling

The use of *back-channeling* emerged as a communication tool to allow students to voice their engagement at a point in time, giving all students an empowering environment to take ownership of their learning through active engagement and participation (Toledo & Peters, 2010). In today's classrooms *back-channeling* is considered to be *student voice*, which we can measure through *experience sampling model*, or ESM, questionnaires buzzed to students. These questionnaires prompt students to determine their level of skill, challenge, enjoyment or expectation of a given learning experience. This allows the student to rate their experience in order to provide the opportunity to self-report their learning experience. The student voice, which is drawn from such ESM questionnaires, provides a unique perspective in educational research on student engagement.

Addressing student engagement means taking the time to understand what high school students find engaging and place student voice as a key factor in determining engagement levels (Prusha, 2012). Awareness of the learners' perspective of their own cognitive engagement can provide a basis for educators to reflect and develop relevant and authentic learning experiences for students within their classrooms (Prusha, 2012). Students' perceptions on their own educational experiences, specifically in conjunction with their increased use of 1:1 technology, present an educational challenge worthy of study. Educators may then have the necessary insight to close the gap between what is perceived to be engaging to high school students and what is actually engaging to students.

Bridging 1:1 Technology and Engagement

Teachers are faced with teaching many digital natives, who may have higher expectations and skills in technology than themselves or their past students. This "net generation" of students learns best through trial and error; this generation of students process information quickly, typically connects with graphics before text, and requires clear relevance to their learning (Downes & Bishopy, 2012). However, as Prensky (2010) argued, "There is a huge paradox for educators: the place where the biggest educational changes have come is not our schools, it is everywhere but our schools. The same young people we see bored and resistant in our schools are often hard at work learning after school" (p.1). It is not surprising that many teachers struggle to engage students of the net generation. Students

may not be learning what teachers want them to learn and see little worth in that desired content (Shlechty, 2001). A world where the teacher is the keeper of knowledge is obsolete—we have emerged into an era where teachers have, instead, become facilitators of learning. This requires teachers to shift their roles. Teaching students the skills needed to find, evaluate, analyze and interpret information they find at their fingertips has become a large part of the educator's current role. Those who are willing to take more risks have been found to be more willing to integrate technology with observations of increased student achievement because of improved intrinsic motivation and engagement in the student's own learning process (Howard, 2009). A key to understanding the use of technology in our students' world is listening to their voices while evaluating how technology aids students' awareness of their learning process.

Summary of the Literature

Engagement no longer means solely core knowledge and traditional literacy (i.e., 3R's); instead, students want to learn in more engaging ways while also learning how they learn. Today, students desire to learn in a classroom where the instruction is delivered in socially, emotionally, and intellectually engaging way, where they are drivers of their own educational experience. Technology is part of students' worlds and requires them to have the skills and knowledge to be successful as adults. As a reflection of the increased presence of technology in their daily lives, schools are turning to 1:1 learning environments to give students more ownership of their own learning. As students are learning 21st century skills necessary for the workforce, they are concurrently developing the opportunity to gain awareness of their own learning and acquisition of information. With the increase of awareness comes student understanding of their engagement in their learning experiences. Technology not only provides a platform for understanding student engagement, but also a tool for measuring their cognitive engagement. The challenge still lays in the lack of research and understanding if teacher perceptions of engagement align with student interpretation of their engagement in their learning process (Henrie, Halverson, & Graham, 2015). Through the use of surveying students through the experiential sampling model, student voice can be recorded providing personal observation of their intrinsic motivation or engagement. Teacher observation of student engagement and technology can be monitored through SAMR and IPI surveys. It seems inevitable that technology will play a factor because it has become a standard part of the 21st century classroom. It is our challenge to adapt our current pedagogy to effectively meet the changing face of our classrooms.

Research Questions

The primary goal of an educator is to prepare students for the world in which they will work and live. As a result, it is the teacher's responsibility to create meaningful, authentic learning experiences that will keep students engaged and excited about their own learning. The focus of this research was to investigate the impact of technology use within the curriculum in relation to its impact on student-monitored self-engagement and teacher-monitored engagement. Given that minimal research has been conducted on technology's impact on engagement, the following questions were explored to have a better understanding how to most effectively integrate 1:1 technology into a high school classroom:

1. What are the most effective ways to assess student engagement in 1:1 technology?
    1a. How does student cognitive engagement compare when using teacher observation and student self-reporting methods?
    1b. How does teacher observation of student cognitive engagement relate to the use of technology in the classroom?
2. Is student cognitive engagement higher with the use of 1:1 technology in the classroom?

METHODS

The most effective way for teachers to assess 1:1 technology and engagement is through student self-reports and teacher observations. The focus of this study was to discover any connections between students' self-reports of engagement in their learning process during 1:1 technology use and teacher

observation of their engagement. Two types of "engagement observations" were matched to students' use of technology within specified classrooms through the use of the Substitution, Augmentation, Modification and Redefinition (SAMR) scale (Puentedura, 2012).

School Context

The high school involved in this study is located in the northern suburbs of Chicago, Illinois. According the 2010 census data collection, the median family income of the district was $109,135 with an average home price of $565,133 from data collected between 2006-2010 (Illinois Department of Education, 2011). The U.S. Department of Education awarded the community schools with "National Excellence in Education" awards at the elementary, middle school and high school levels. The high school employs nearly 180 faculty members with over 60 different course offerings for students, 24 of those being advanced placement courses. Based on the 2011 Illinois School Report Card, the racial/ethnic background compared to the total enrollment of 2,639 includes: 69.9% White, 17.9% Asian/Pacific Islander, 8.1% Hispanic, 1.4% Black, and .2% Native American.

After receiving institutional review board approval, 46 students were recruited and 45 voluntarily agreed to participate in the study. Participants were enrolled in two sections of *Child Development 161* ranged from ninth to twelfth grade. The course sections chosen were identified at the beginning of the school year for their student size, consistency in curricula pedagogy and diverse populations. The course used in the study was an introductory child development high school elective, which required no prerequisite coursework. Course topics included working with young children, careers in human relations fields, principles of growth and development, brain development, fetal development, pregnancy, parenting and human growth and development from birth to age nine. There was minimal disruption or interruption to the classroom routine except for the few moments when participants were asked to record their answers anonymously to online surveys.

Student participants

The participants in this study were: 17 ninth grade students, 16 tenth grade students, 10 eleventh grade students, and 2 twelfth grade students. Participants identified themselves as follows: 21 White, 13 Asian, 10 Hispanic, and 1 Black student.

Participating colleagues

Four teacher researchers participated in observations of student engagement using the Instructional Practices Inventory (IPI) observation tool. The colleagues ranged in their professional experiences from a second year educator to a veteran educator of 20 years. Two of the four participating colleagues served as instructional coaches within the building for curriculum development. One colleague served on the administrative board within the school and the final colleague was a classroom teacher. All four participating teacher researchers were provided formal training in the IPI walkthrough method (Valentine, 2007). Each participating teacher researcher voluntarily used their planning periods to observe the classroom of study.

Teacher participant

The teacher participant was a seventh grade female teacher who taught Family and Consumer Sciences with a concentration in human growth and development. This was her fifth year teaching at the high school. She was trained in *Instructional Practices Inventory* evaluation (Valentine, 2007), and the *SAMR Model* (Puentedura, 2012). For this research study, the teacher participant was the sole observer for the *SAMR Model*, and recorded data necessary for each observation.

Data Collection Methods & Analysis

Evaluation of student engagement provided an opportunity for both teacher and students to review their level of cognitive involvement in the course curricula at a given moment in time. Data was collected from one external source of observation that used the *Instructional Practices Inventory (IPI)*, which served as the tool for teachers to evaluate student engagement. There was one internal observation tool used to measure self-report of engagement from the students that was gathered using an *Experience Sampling Method* (ESM survey), which would later be coded to score student

engagement at a given point in time. Finally, a secondary tool for external observation was used that focused on the use of technology within the classroom; the *SAMR Integration Model* (Puentedura, 2012). These three sources (i.e., IPI, ESM, SAMR) of data allowed for triangulation of data collection to later determine relationships between student engagement and technology within the classroom.

Peer Observation Method: IPI

The Instructional Practices Inventory (IPI) survey was taken by a teacher researcher's observation of the classroom. There was a team of two trained teacher researchers who would validate the level of student engagement during their observation of the class. The data was quantitatively collected through the use of codes provided from the IPI observation tool to measure student engagement within a classroom at a given snapshot of time. Student-engaged instruction, teacher-directed instruction and student disengagement are the three groupings associated with cognitive student engagement according the IPI model. These three groups are then further defined and coded numerically into six categories: student active engaged learning (6), student verbal learning conversations (5), teacher-led instruction (4), student work with teacher engaged (3), student work with teacher not engaged (2), and student disengagement (1). The highest level of coding numbers (5-6) refer the student to student engagement where the lower codes (1-4) are more teacher driven levels of engagement (Valentine, 2007). The codes are then categorized into three levels of engagement: high, moderate, and low by natural intervals. The codes were dated and time stamped in a Google Form to provide reference for later data correlation first in relation to high levels of *flow* extracted from the ESM data then referenced in relation to the level of technology implementation in the classroom during specific lessons of interest (Appendix A).

Student Self-Report: ESM

There are eleven items on the ESM questionnaire that students completed, the questions fit into categories of cognitive engagement, affective engagement and *flow*. Questions on the survey ranged from monitoring student challenge to enjoyment to self-perception of expectations and skills. The students were prompted by the teacher to access the pre-determined series of questions, which originate from engagement surveys adapted from Csikszentmihalyi's (1990) research on science students learning and engagement (Schmidt, Shumow & Durik, 2010). This measured student cognitive engagement through asking a series of questions regarding their status at a given point in observation. The survey was distributed to students through an online Google form. The questions focused on students' cognitive and affective engagement in the work they were participating in at the time, with two items that determined whether students were operating in a state *flow* during a given lesson. The questions evaluated using a Likert scale from 0 ("not at all") to 3 ("Very Much") allowing for no neutral selection to be declared by the student. The responses were then totaled for a given timestamp and divided by the total number of students surveyed to bring up to a class total. The class total was then divided by the total possible scores, which created a score between 0 and 1. We discarded most questions from the survey and focused only on questions number 10 and 11 to collect data in this study. Question 10 would determine student's level of challenge and question 11 would evaluate student's report of skill during the given lesson. Questions such as, "Do you feel positive about yourself during the activity?" and "Did you feel in control of your own learning experience?" are found in the survey given to students. The mean rating acquired from the ESM survey would be plotted onto a grid of challenge and skill to decipher which lessons reported high challenge and skill. The z-scores computed from these plots will discern which lessons students were in a state *flow* during their learning (Hatcher, 2013). In a case where, an observation results in a positive z-score, scores above 0, for both challenge and skill, the observation would identify students functioning in a state of *flow*. Students were prompted to complete the survey at each point in time when the IPI walkthrough took place. This allowed for students to self-report their level of engagement while simultaneously being observed by a trained teacher researcher skilled in evaluating student engagement.

Teacher Technology Observation: SAMR

The SAMR observation was completed by the teacher participant who observed the level of technology use at the determined point in time decided by the IPI observation from the third party. The observation would take place concurrently with that of the two other engagement observations. When the teacher observed classroom activity such as word processing, printing, submitting work it would be coded as *substation*. When typing the creation of written work, use of spell check or development of a presentation was the primary activity it would be coded as *augmentation.* When students are collaborating, researching, designing, gathering information and providing feedback it would be noted as *modification*. Finally, if use of technology in the classroom allowed students to collaboration with a field expert, blog, disseminate, compare and create new material, the teacher would code their technology use at the highest level of the SAMR model at *redefinition.* A diagram outlining the SAMR model of technology can be viewed in **Figure 1**.

When evaluating the data collected SAMR levels will be coded as (1) *substitution,* (2) *augmentation,* (3) *modification* and (4) *redefinition.* These codes are similar to IPI codes in the sense that the codes are used to identify levels of engagement where 1 is consider low engagement, 2-3 moderate engagement and 4 high engagement of technology use. The observations were completed and recorded using a Google form, which provided a timestamp that would later be used to correlate to the other data observations, collected in this study. The level of technology use during each lesson was recorded to determine SAMR scale code that would later be correlated to data with high levels of *flow* and IPI engagement.

Procedures

The research required no formal understanding of the study as students were required simply to provide their observations of their cognitive engagement at given points in time. The participating colleagues were selected for their prior training in the use of the IPI observation tool to measure student engagement from an external observation method. The participating colleagues were selected about one month prior to data collection so that schedules for observation dates could be coordinated amongst the four participants.

The data collection was gathered towards the end of the fall semester during a two-week span, which was divided, into two periods due to holiday break. The data collection began at least ten minutes into the period and concluded before the last ten minutes of class on the random observation dates. There were two data points gathered each class period. The observations for each day would be triggered by the IPI observation from the external source. At the moment of the external observation students would note the task they were participating in at the moment when prompted by the teacher participant. Then after being prompted students would complete and experience sampling model online survey that would gather their response to their cognitive engagement at the moment. Simultaneously, the teacher participant would complete an observation of their technology usage at the same time of the external observation and internal report of engagement. Bias is addressed as the teacher researchers designated all observation times throughout the study to eliminate any alteration in lesson or execution of the lesson. Data was collected a total of 14 times throughout the course of the two-week observation window. The multiple data points provide opportunity to identify trends in the data as the researcher's explored correlations between student engagements both internally and externally recorded in relation to technology use within the classroom.

Data Analysis among Sources

After all data was collected, it was coded numerically according their original scale for the purpose of plotting the data points in time were all coded by letter. The first observation was coded "OB 1" through the last observation coded "OB 14". A number code system was used for two forms of observation: (1) IPI observation of student engagement from third party observers, and (2) SAMR observation of technology use within the classroom. For the ESM, student self-report of engagement, a z-score would be used to evaluate data collected from students. The z-score was determined by taking the mean of the given observation subtracted by the variance of the observation. Then that

number was divided by the standard deviation of the focused observation (Cohen & Lea, 2004). The z-scores were established to determine the probability of a score occurring, which created a standard score. Through establishing the two z-scores for challenge and skill we were better able to relate those two independent data sources to each other because we were analyzing distribution of scores (Cohen & Lea, 2004). The two z-scores established for skill and challenge were then used to plot on a t-graph to their state of engagement (i.e. *flow*, apathy, anxiety or boredom).

To address the first research question, we compared the levels of engagement between the IPI teacher observation data and ESM student self-report data. The analysis of the ESM data collected was compiled into a mean rating amongst the sixteen classes observed. The z-scores were then plotted on a grid based upon challenge and skill. The scores plotted would determine if students were in a state of apathy, anxiety, boredom or *flow*. To determine students who were functioning in a state of *flow* in during this study, we took their scores from their ESM self-reported engagement survey. Their responses to the questions "How challenging was this activity?" and "How skilled are you at this activity?" determine their state of *flow*. The positive z-scores, anything above 0.00, for both challenge and skill are considered high levels of *flow* and will be looked in closer detailed compared to the IPI data collected on the same lesson.

If codes were 1-2 for IPI observations and z-scores were both negative, less than 0.00, meaning in an apathetic state of engagement, we determined those observations to be low levels of engagement. If codes were 3-4 for IPI observations and z-scores partial positive and negative for challenge and skill, meaning in state of anxiety or boredom, a moderate level of engagement was noted. Lastly, if the IPI codes were 5-6 or students were in a state of *flow* for ESM observations, it was determined those observations were high levels of engagement. The data was listed as low, moderate or high for each tool in each observation. The observations in which all levels matched, particularly in the high range, were of greatest interest to the study. A deeper look at characteristic traits of lessons were later noted to determine trends in student engagement based upon the reporting.

Through qualitative analysis of the data collected, the researchers charted the sixteen lessons coding their IPI and SAMR in relation to the ESM *flow* or z-scores (Hatcher, 2013). The data collected was categorized into three levels of engagement low, moderate or high. The observations in which all three tools matched were of greatest interest considering all three tools provided the same level of engagement through the observation. The lessons where all three tools matched on low, moderate or high levels were evaluated by characteristics. A qualitative evaluation of the data allowed for the data to be reviewed by finding observations where all tools matched in their view and determine what characteristics of that lesson made the results occur.

Finally, the magnitude of technology integration were matched to the qualitative analysis of engagement reported from internal (ESM) and external (IPI) observation of engagement data. This was completed by noting the level of SAMR on for the lessons that match high in *flow* and high in IPI coding. Lessons with similarities and extreme differences were addressed to identify any trends in engagement and learning experience. For example, if lesson one reports a high z-score from the ESM questionnaire signifying *flow*, a high IPI rating of 5 and a SAMR rating of "R" or 4 then we know that student are highly engaged with the highest form of technological use. From data correlation like this, conclusions were made about the impact technology and its implementation has on student engagement in the classroom. It determined if technology is a factor in twenty first century students reaching a state of *flow* in their learning experience.

RESULTS

The four research questions that guided this study were as follows: (a) What are the most effective ways to assess student engagement in 1:1 technology?, (b) How does student cognitive engagement compare when using teacher observation and student self-reporting methods?, (c) How does teacher observation of student cognitive engagement relate to the use of technology in the classroom? and (d)

Is student cognitive engagement higher with the use of 1:1 technology in the classroom? The data that presented itself from the observations and evaluations were analyzed by each research question.

What are the most effective ways to assess student engagement in 1:1 technology?
Student engagement data was collected using three different tools to assess the efficacy of their observation. The results of three assessment tools were compared to determine if observations corroborated each other's results. After the data was collected from participants, the data sets were coded by observation time and given names such as "OB 1" through the final 14th observation. Initially, the observations were compared to responses from the ESM (**Table 1**). The IPI was then compared to the SAMR Model by levels of low, moderate or high (**Table 2**). Only questions 10 and 11 of the ESM data were used to create a class score for each question on the ESM survey

Table 1. Student level of flow by observation using z-score from challenge and skill survey items

			Student Z-Scores from ESM	
	State	**Level**	**Challenge**	**Skill**
Observation #1	Apathetic	L	-.468	-1.283
Observation #2	Boredom	M	-.270	.348
Observation #3	Apathetic	L	-1.460	-.739
Observation #4	Boredom	M	-2.452	1.978
Observation #5	Anxious	M	.722	-.739
Observation #6	Anxious	M	.127	-.196
Observation #7	Anxious	M	.127	-.196
Observation #8	Flow	H	.921	.891
Observation #9	Boredom	M	-.667	.891
Observation #10	Flow	H	1.516	1.435
Observation #11	Apathetic	L	-.071	-1.827
Observation #12	Anxious	M	.524	-.196
Observation #13	Anxious	M	.524	-.196
Observation #14	Anxious	M	.524	-.196

"Low" levels were always in a state apathy, "Moderate" levels were either in the state of anxiety or boredom, and "High" levels were always in a state of "flow"

The IPI and SAMR survey results had one data point entered for each observation. A "low" score was considered between 1.00-1.99 for SAMR, 1.00-2.00 for IPI and 0-.99 for ESMs. A "moderate" score was considered between 2.00-2.99 for SAMR, 3.00-4.00 for IPI and 1.00-1.99 for ESM. Finally, "high" scores were above 3.00 for SAMR, 5-6 for IPI and 2-2.99 for ESM. The data was then categorized in accordance to the scale listed to determine if there were matches between observation forms (See **Table 2**). Matches were considered if two or three of the three forms of data collection provided the same coded level. This information was used in the comparisons between engagement observations throughout the remainder of the study.

Table 2. Comparison of IPI, SAMR and ESM level by observation

	Observation Level		
	IPI	**SAMR**	**ESM**
Observation #1	M	M	L
Observation #2	L	H	M
Observation #3	L	M	L
Observation #4	M	H	M
Observation #5	M	H	M
Observation #6	M	M	M
Observation #7	M	M	M
Observation #8	M	M	H
Observation #9	M	H	M
Observation #10	H	H	H
Observation #11	M	M	L
Observation #12	H	H	M
Observation #13	H	H	M
Observation #14	H	H	M

IPI: Low =1.00-1.99; Moderate = 2.00-2.99; High = 3.00+
SAMR: Low= 1-2; Moderate = 3-4; High = 5-6
ESM: Low= 0.00-0.99; Moderate = 1.00-1.99; High = 2.00-2.99

When comparing the three tools, there were 14 observations total. Out of the 14 observations, three of the lessons matched using the three evaluation tools. This was seen in OB 6, 7, and 10. OB 6 and 7 reported moderate levels of engagement, and OB 10 reported high levels of engagement. There were 10 observations where two of the evaluation tools matched in their observation of student's engagement (i.e., 1, 3, 4, 5, 8, 9, 11, 12, 13, 14). OB 1, OB 8, and OB 11, the IPI and SAMR reported moderate levels of engagement. In OB 1 and OB 11, the ESM reported low levels of engagement, where in OB 8 the ESM reported high levels of engagement. OB 4, OB 5, and OB 9 the IPI and ESM reported moderate levels of engagement and the SAMR reported high levels of engagement. In OB 12, OB 13, and OB 14, the IPI and SAMR reported high levels of engagement, and the ESM reported moderate levels of engagement. In OB 3, the IPI and ESM reported low levels of engagement, and the SAMR reported moderate levels. OB 2 was the only observation where all three tools mismatched in their record of engagement levels in students. The IPI reported a low level, the SAMR reported a high level, and the ESM reported a moderate level.

How does student cognitive engagement compare when using teacher observation and student self-reporting methods?

From the data collected, there were 7 occasions when both ESM and IPI resulted in the same level of engagement (low, moderate, or high). OB 3 was reported as low levels of engagement. OB 4, OB 5, OB 6, OB 7, and OB 9 reported moderate levels of engagement. OB 10 reported high levels of engagement.

Low engagement observation

During the IPI observation and student ESM reports of low engagement, students were participating in note taking with the support of a PowerPoint presentation, which was provided for personal navigation on the course Google Site. Students reported to be in an apathetic state during this lesson (i.e., low challenge and low skill), which was also noticed by the teacher evaluator and from the students themselves.

Moderate engagement observation

The five remaining matched observations were all considered moderate levels of engagement. During these lessons, students were using their Chromebooks for their coursework. Common characteristics of these lessons included work that students were doing to research information for worksheets that were on topics currently being discussed in class, or working on their portfolio project which included organization of research, annotation and word processing. All moderately engaged lessons included previously introduced material, which is unique in comparison to the low or high engagement observations.

High engagement observation.

The highest engagement lesson was during OB 10. Students reported to be highly engaged in their researching and use of online portfolio development through new applications such as Pinterest, which was dually noted by the teacher evaluator during their observation of student engagement. During this lesson, students were introduced to new material and a new final project that would be their work for the next week in class.

There were seven comparisons that resulted in no matches between IPI and the ESM students were using technology to complete their project work, take notes or complete continued research. In six of the seven observations where IPI and ESM levels of engagement did not match, the teachers observed higher levels of engagement than the students. Therefore, IPI to ESM comparison proved to be 50% effective in matching engagement teacher observations to student self-reports of engagement in this study because 7 of the 14 observations recorded the same level of observation or matching of engagement based upon the low, moderate and high level scale. These two forms of engagement

observation, teacher observation and student self-report, matched in 50% of the observations conducted.

How does teacher observation (i.e., teacher evaluator and teacher researcher) of student cognitive engagement relate to the use of technology in the classroom?
In this study, nine of the 14 observations using the IPI and SAMR were recorded at the same level (moderate or high). These two forms of teacher evaluation of student evaluation matched in 64% of the observations conducted. Of the observations using the IPI and SAMR, zero were recorded as low, five were recorded as moderate (e.g., OB 1, 6, 7, 8, 11), and four were recorded as high (e.g., OB 10, 12, 13, 14).

Similar to the matches between IPI and ESMs, seven of the 14 observations using these tools were recorded similarly; one was recorded as low (e.g., OB 3), five were recorded as moderate (e.g., OB 4, 5, 6, 7, 9), and one was recorded as high levels of engagement (e.g., OB 10, see Table 3). These two forms of teacher evaluation of engagement and student's evaluation of their engagement matched in 50% of the observations conducted.

In the observations where moderate to high peer-teacher observations and technology observations were reported, students were participating in activities such as note taking (OB 1, 7, and 8), research (OB 6, 10, 12, 13, 14), and discussion with the support of technology (OB 11). In the two lessons that reported high engagement and technology use, students were using their Chromebooks to conduct research and create their final portfolio.

How does the IPI, ESM, and SAMR relate when evaluating student cognitive engagement to the use of technology in the classroom?
The two observation tools that matched the least in this research were ESM (student self-report) and SAMR (technology teacher researcher observation). There were only three instances of the 14 observations that matched with two being at a moderate level (e.g., OB 6, 7) and one being at the high level (e.g., OB 10). There were only 21% of the observations matched between these two tools engagement observation tools. In fact, these three observations were also matched with the IPI, so there were no instances to report where just the ESM and the SAMR observations matched.

Moderate engagement observation
In the two matched observations at the moderate level (OB 6, 7), students were conducting research and taking notes on course content based upon information introduced in earlier in class. Moderate observations would include technology use in an augmentation to the normal course curriculum.

High engagement observation
There was one observation that extracted a high engagement level observation across all three measuring systems, which suggests that students were using technology in a modification or redefinition implementation. This means that students were unable to complete their coursework without the use of technology in that lesson.

Finally, the IPI tool managed to be the most reliable form of observation as it matched most frequently with the SAMR and ESM, 13 of the 14 observations. The SAMR matched either the IPI or the ESM in 9 out of 14 observations, and the ESM matched either the IPI or the SAMR in seven out of 14 observations. The IPI had 93% accuracy among the tools, the SAMR had 64% accuracy among the tools, and the ESM had 50% accuracy among the tools.

Is student cognitive engagement higher with the use of 1:1 technology in the classroom?
To determine if students are in a state of *flow* a comparison of the challenge and skill ratings was used to determine their learning experience. The scores from the challenge level ranged from -2.452 to 1.516 and from -1.827 to 1.978 for skill across the 14 different observations. The average challenge rating across all observations was 1.44 and the average rating for skill was 2.44, suggesting that students generally reported higher levels of skill than challenge (See **Table 1**). To take a closer look at each observation, the ratings were converted to z-scores to compare each of the 14 observations to

each other. The observations of most interest were those with the highest positive z-scores for both challenge and skill because those lessons would identify students who were reporting the highest likelihood of being in a state of *flow*. A high z-score for *flow* was considered when both scores where positive in challenge and skill. There were only two observations that suggested students were in *flow* (i.e., OB 8, OB 10). In both lessons, students were introduced to new content, given opportunity to extend their concept understanding through research and then create a product from the increased understanding. These two lessons relied on the use of technology as a tool to create their final product as well a tool to redefine or modify their learning experience. OB 8 had a z-score of .921 for challenge and .891 for skill and OB 10 had average z-scores of 1.516 for challenge and 1.435 for skill.

Students reporting anxiety, boredom and apathy

Observations that were classified as moderate were considered to have either challenge or skill z-scores between less than 0.00 or a negative value. In OB 5, 6, 7, 12, 13, and 14, students reported positive challenge and negative skill this is where students would be classified anxious in the lesson. Characteristics of lessons where students were anxious included observation and research on a sensitive topic such as Sudden Infant Death Syndrome, taking notes and observing a simulator. In OB 2, 4, and 9 where students reported negative challenge and positive skill scores, students would be classified as bored throughout the lesson. Characteristics of lessons were students reported boredom included research and creation of an online resource account. Similarities in the content of these lessons for specific scores reference can be found in **Table 1**. There were three sets of ESMs in which the mean student ratings were negative z-scores for both skill and challenge were OB 1 (skill = -0.70, challenge = -1.28), OB 3 (skill -1.460, challenge -0.739) and OB 11 (skill -0.071, challenge -1.826). In observations that students reported averages indicating negative skill and challenge z-scores, the students are suggesting to be in a state of apathy with the activity, thus reporting little engagement in their learning experience. Characteristics of the lessons when student reported being bored included note taking with presentation support both through a presentation and individual access to presentation.

DISCUSSION and CONCLUSIONS

The purpose of this research study was to methodically explore student engagement with the use of 1:1 technology, as technology is a prominent feature of the 21st century classroom. Throughout the study, student engagement was evaluated through using a framework of three different observation tools (i.e., IPI peer teacher observation, SAMR technology use through teacher observation and ESM engagement student-survey). This data was then divided by natural intervals into low, moderate and high levels of engagement. The levels of engagement allow for critical qualitative evaluation of how the tools measured student engagement in the classroom.

IPI Best Student Engagement Observation Tool

The most rated student engagement observation tool proved to be the IPI peer teacher evaluation. When looking critically at the engagement levels of students, the IPI survey engagement levels most frequently matched those of the students. This shows that the classroom teacher has a better gauge of their students' engagement with the use of technology than either the isolated SAMR survey or ESM survey. The SAMR survey did identify the context, or environment, of the lesson within the classroom but it did not work in evaluating students' ability to reach a state of *flow* within a lesson. The observations of technology did not address the cognitive and affective engagement of interest in this study, which could be a result of the design of the chosen tool. The data collected from students through the ESM surveys to solely determine students' engagement state are self-reported, which may be a limitation because of errors in student self-reporting due to memory, completion attitude, exaggeration or deliberate falsification (Shernoff et al. 2003; Prusha, 2012). Furthermore, the ESM survey shows mostly that students were not reaching a state of *flow* within the lessons. Students more often showed states of boredom or anxiety within the lesson, which connects to the 2003 research conducted by Shernoff and Csikszentmihalyi because their work was somewhat active, structured and

intellectually challenging for at least part of the time (i.e. note taking, individual work, research and project production). However, it was not active to the point that would sustain a state of *flow* (Shernoff et al. 2003, p. 171). While the students are honest in their evaluation of their state of engagement within a course, a holistic perspective from teacher observations shows the impact or role that technology can play in student engagement within a classroom.

Student engagement is higher with 1:1 technology

The lessons that exhibited the highest levels of engagement across all of the observation tools, had specific characteristics of the lessons. Throughout the two lessons of *flow*, students were working independent of direct teacher instructions; however, they were working collaboratively in small groups. The students were given the option to use their 1:1 device as a method or tool for research, analysis and communication of their found information. A majority of the class opted to use their device to research as it was noted through the IPI observation. These lessons with the use of technology allowed for students to practice and enhance their 21st century skills that are the foundation of high engagement in 1:1 environments (Wagner, 2008).

Characteristics of an optimal *flow* lesson

There was one lesson of particular interest in the study that showed high levels of engagement across all three of the observation tools. The lesson observed during OB 10 was unique because new information was presented to students, then they were released to conduct independent work with teacher facilitation. Students were cognitively challenged with the task of researching various components of their portfolio projects. Likewise, the positive emotions extracted from students because of their autonomous work and skill competency provided an affective learning experience during this lesson, which reflected in the high levels of engagements. In this lesson, students were in control of their learning pace, direction and reliance on support of their teachers and peers. When students feel a sense of autonomy and decision in the direction of their learning experience, they are more driven to self-motivate their depth and quality of their work in that particular activity (Taylor & Parsons, 2011). This lesson did just this as students were given the new challenge to explore vast resources through the portal of technology with their Chromebook, and as a result they own their learning experience that particular lesson. Learning opportunities such as this lesson are intrinsically rewarding to students, and by human nature, we strive to replicate experiences such as these. As students strive to master their understanding of the work they are collecting for their portfolio, students seek new challenges and develop greater levels of understanding and skill (Nakamura & Csikszentmihalyi, 2002).

In summary, the results of this study suggest that the IPI engagement observation tool is the most successful in determining consistent levels of student engagement with the most reliable results. The IPI provides opportunity for technology to be incorporated into the coding of the classroom engagement levels. Ideally, teachers are tasked to develop lessons with challenging, relevant and technology infused activities that allow students to feel in control of their learning environment and confidence in their ability that is holistically their learning experience (Taylor & Parsons, 2011). In lessons that note high levels of engagement, students concentrate, experience enjoyment, are provided with feedback and build continued interest in continuing the work begun in that lesson (Shernoff et al, 2003). When creating lessons for the future, teachers must strive to provide such engagement by balancing challenge and skill, but also know their learners to adapt lessons to ensure all students have the opportunity to experience learning in a state of *flow* in our technology infused 21st century classroom.

Limitations

Readers should bear in mind that there are limitations of this study. First, being the logistical limitation of the student population used to survey throughout the study as students were from two different classes of the same course. Similarly, the second limitation was also logistical as the winter break for the district fell in the middle of the data collection period, which may have minimally affected the results provided by students. Third, this study relied on student self-reported data that

forced students to subjectively evaluate their learning experiences. Student self-reported data is vulnerable to inaccuracies due to students potentially failing to remember their experiences, purposely misrepresent, exaggerate or have hasty completion of the survey (Henrie, Halverson, Graham, 2015).

For this study, it was important to use multiple observation tools to seek data from teachers and students alike. The triangulation of the three observation tools: (a) IPI peer teacher observation, (b) ESM student self-report and (c) SAMR technology observation provided opportunities for reliability in the observations conducted.

Implications

After conducting this study, there is more of an understanding surrounding the challenge of engaging students in learning at high levels within the classroom. Now more than ever, the importance of promoting independent learning that teaches students how to critically analyze, process and produce, as well as learn how to learn, is not only what is suggested for teachers to implement (Bebell & O'Dwyer, 2010; Bowen, 2005), but it is also what students are craving if they are to be at high levels of engagement or reach a state of *flow* within the classroom. Creating those environments in a 21st century classroom includes the infusion of technology in a nature that is seamless to the work created that balances challenge and their skill (Carver, 2016; Downes & Bishop, 2012). Technology appears to have a positive impact on student's level of engagement as noted in the lesson of this study where students were motivated to autonomously learn, collaborate with peers and produce their own work (Blazer, 2008).

There is a need for continued research to expand on the understandings found in this study. It would be most desirable to find more lessons similar of the 10th observation to better understand the current characteristics of *flow* lessons and discover additional characteristics that promote students to be in a state of positive challenge and skill. For example, would students feel engaged when assigned highly effective and relevant tasks of their choice if they are too easy or too challenging? There is a need for continued exploration of the relationship between teacher crafting of such lessons and the role of the teacher as a facilitator of learning that promotes *flow*. It is only then that we will have a more holistic view an understanding of how we can promote highly engaged learning with the infusion of 1:1 technology in our classrooms.

Conclusions

Teachers should continue to focus on the development of lessons to reflect the characteristics of the lessons that support *flow* in this study (Csikszentmihalyi, Schneider & Shernoff, 2003). Practices such as (a) creating interactive materials, (b) providing opportunities for collaborative learning, and (c) giving students feedback which was evident from the characteristics of the lessons that reported high levels of engagement. The reciprocal relationships of these four components provide students with high levels of engagement because their challenge and skill are appropriate to each student's learning abilities. It is in the development of lessons which extract states of *flow* we are optimizing student engagement in the course material. In the lessons that extracted the highest levels of engagement, 21st century skills such as collaboration, critical thinking and analyzing information (Bebell & O'Dwyer, 2010) were all being promoted by the use of 1:1 technology. By appropriately integrating technology into classrooms to promote collaboration and interactive experiences we have potential to increase student achievement because of improved intrinsic motivation and engagement in the student's own learning process that occurs through student reaching a state of *flow* in such lessons (Howard, 2009).

Moving forward, the key component of this study is that teachers must develop learners who are focused, committed, and self-regulated in order for them to lead us to creating a learning culture and environment that promotes high levels of engagement (Martin & Downson, 2009). By appropriately and continuously challenging students to optimally perform tasks, paired with student self-motivation due to their empowerment of control of their learning pace, a state of *flow* is established which ultimately leads to increased students achievement (Csikszentmihalyi, Schneider & Shernoff, 2003).

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