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INTERNATIONAL ELECTRONIC
JOURNAL OF ELEMENTARY EDUCATION

www.iejee.com

March 2018 Volume 10 Issue 4

T&K ACADEMIC

iejee

INTERNATIONAL ELECTRONIC
JOURNAL OF ELEMENTARY EDUCATION

ISSN: 1307-9298

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Editorial

Dear IEJEE Readers,

It is a great pleasure for me to present volume 10, issue 4 of International Electronic Journal of Elementary Education (IEJEE) for you.

In this issue fourteen interesting and important topics are addressed by twenty-eight researchers from seven different countries and more than ten universities.

Different educational contexts and students at different age groups have their partly different and partly common challenges.

The researchers do their important contributions by addressing the current issues in their environments and sharing it with international readers.

International Electronic Journal of Elementary Education (IEJEE) is one of the scientific channels that the researchers around the world can use to publish their scientific works.

International Electronic Journal of Elementary Education (IEJEE) celebrating its 10th anniversary. As Editor-In-Chief I am proud of serving the international scientific community with this open access journal.

I would like to express my deepest gratitude for all the peer reviews, editorial board members, special issue editors and my closest executive editors Dr. Gökhan Özsoy and Dr. Hayriye Gül Kuruyer, Abdullah Kaldırım and for all the technical staff who materialized IEJEE as an scientific educational journal during the past ten years.

Editor-In-Chief

Kamil Özerk, Professor of Education

ISSN:**1307-9298**

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March 2018, Volume **10**, Issue **4**, **391-396**

Helping Students to Automatize Multiplication Facts: A Pilot Study

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Received: **26 November 2017**
Revised: **03 January 2018**
Accepted: **26 January 2018**
ISSN: 1307-9298

www.**iejee**.com

DOI: **10.26822/iejee.2018438128**

Abstract

Attaining automaticity with multiplication facts during the elementary school years provides students with a strong foundation for understanding the interrelationship of rational numbers and strengthening mathematics computation throughout schooling. Automaticity also supports the development of number sense and ongoing mathematics learning due to expansion of students' mathematics self-concept. This study explores the efficacy and feasibility of an intervention approach to facts acquisition for Grade 3 students in the northeastern U.S. Students in seven classrooms across two diverse suburban community schools participated in a ten-week supplementary intervention program designed to improve motivation for facts memorization and increase facts automaticity. An assessment of facts acquisition and retention was administered to participants the following September upon entering Grade 4. Analysis shows significant growth in facts acquisition and retention across study groups when compared to 4th grade students' facts retention in the study schools during September of the previous year.

Keywords: Elementary school students, mathematics, multiplication facts, automaticity

Introduction

Attaining automaticity with multiplication facts is both a desirable and commendable accomplishment for elementary school students. Unfortunately, this learning task requires considerable effort for most children (Burns, Ysseldyke, Nelson, & Kanive, 2015; Mahler, 2011), even with assistance by teachers in classrooms and families beyond the school day. Although it is a challenging process for many children, and for some teachers and families in support of students, allocating time and utilizing effective methods for acquiring multiplication facts automaticity is well spent given that facts automaticity has a significant impact on flexible computation, mathematics self-concept, and understanding of more advanced mathematical concepts during the elementary school years and into secondary education (Codding, Burns, & Lukito, 2011; Geary, 1994; National Research Council, 2005).

The problem in a larger context

Internalized facts allow for efficient mental computations that make easier multi-step problem solving or recognizing and making connections between mathematical concepts, such as multiplication and division, ratio comparison, fraction equivalencies, or exploration of object relationships in the world of geometry (Chapin & Johnson, 2006; National Research Council, 2005). Extending beyond successful school mathematics performance, broader options for college study and employment opportunity become increasingly likely when one feels confident in one's mathematical thinking and is able to demonstrate solid achievement (Atweh & Clarkson, 2001; Marsh & Hau, 2004; Valero, 2004; Williams & Williams, 2010). For myriad reasons, facts acquisition becomes an educational gatekeeper to true mathematical literacy. Consequently, helping children to be successful with this seemingly small element of early mathematics learning truly matters in a world rife with challenges requiring the mathematical communication of ideas between and within fields (D'Ambrosio & D'Ambrosio, 1994; Thomas, 2001).

Historical perspective

The importance of knowing multiplication facts is not a new concept, having been important throughout history for anyone wishing to efficiently compute (Boyer, 1991). In ancient times, multiplication tables were carved into stone, pressed into clay, or written on papyrus. The Babylonians took the notion of simple multiplication facts further and created tables of cubic numbers from the roots of numbers 1-32. While dates are uncertain, ancient peoples in China, India, Babylon and Egypt recorded the facts of their mathematical lives at minimum four thousand years ago (Dehaene, 1997; Smith, 1958). Half again as many years ago, the Egyptians developed a written calendar that rivals the mathematical and astronomical accuracy of any we might construct today (Smith, 1958). Understanding mathematics by studying the underpinnings of computation garnered personal and political power. This reality has traveled thousands of years into the present and will likely matter well into the future, even in the presence of technology that necessarily requires human creation. We continue to hold fast the notion that it is important for children to automatize facts for recall, even if it is possible to review factors and products on a constructed table of some sort, whether physical or digital. We are able to consider such ideas using new knowledge of the brain and mathematics cognition (Qin, Cho, Chen, Rosenberg-Lee, Geary, & Menon, 2014).

Reducing cognitive load

When one internalizes multiplication facts, less brainpower is required to perform tasks that require more complex or

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successive arithmetic manipulations (Geary, 1999; Geary, Saults, Liu, & Hoard, 2000). Flexible thinking and conceptual leaps between mathematical concepts are possible when products are not computed using successive addition or determined by visual inspection of tables or charts (Royer, 2003). The relationship between factors and products becomes a point of departure into more challenging mathematics. Beginning every new mathematical step forward with a return to multiplication as repeated addition or reliance upon visual assistance may interrupt intuitive mathematical thinking (Goswami, 2008).

Fluid mental computations are thwarted by the needs of working memory necessarily allocated to ascertaining the product of two factors or, conversely, the factors of a particular product. Memorizing facts reduces cognitive load, allowing for working memory to better allocate resources when processing number relationships required by more complex mathematics (Goswami, 2008; LeFevre, DeStefano, Coleman & Shanahan, 2005).

What has been done to help?

Many student texts and mathematics programs for elementary age learners rely on unwieldy methods for teaching facts, possibly due to a higher percentage of small problems offered as examples (Hamann & Ashcraft, 1986; Siegler, 1988). There are also few examples of how or when to focus on facts acquisition, with texts relying more on conceptual development because it is also important and often easier. Nevertheless, a poor success rate going back fifty years or more illustrates a long-standing deficit in facts automaticity by school children due to memorization challenges (National Research Council, 2005).

Because there is little help given in published mathematics programs (National Mathematics Advisory Panel, 2008), teachers continue to rely on methods that they themselves experienced, successfully or unsuccessfully, as young learners. Interestingly, a major 454-page U.S. mathematics achievement report by the National Research Council (2005), written and edited by scores of top researchers in mathematics education, failed to provide more than one and one-half pages of information related to single-digit multiplication due to little available research on this topic.

There is no doubt that the task of memorizing individual facts is important for school-age children. Nearly every adult has had to personally grapple with this process over the course of his or her own school history. Yet, finding dedicated time and methods to assist learners and guide teacher practice on this count is difficult at best.

Purpose of this study

1) To understand whether a dedicated multiplication facts instruction intervention improves facts acquisition and retention.

2) To investigate the feasibility of a ten-week instructional intervention within an elementary classroom schedule.

Research questions

1) Among a sample of 4th grade students who were taught by the same set of teachers in two consecutive years, where students tested in year two received a pedagogical treatment in year one and students tested in year one did not, what is the relationship between having the treatment and two outcome measures for facts acquisition and retention (number of correct attempted questions and number of correct out of all possible questions)?

2) What is the feasibility of including a 30-minute multiplication facts exploration and practice session during the constraints of a school week?

Methods

Research design

This school-based study employed a quasi-experimental approach utilizing comparison groups rather than control groups. Since it was possible that students receiving the treatment would benefit from the instructional treatment, all Grade 3 students across the two schools participated in the treatment so that none were programmatically disadvantaged. The results of facts acquisition assessments administered when the 3rd grade treatment group students became 4th graders were compared with assessments administered to all 4th graders in the same schools the previous year.

A two-part teacher, principal, researcher reflection process provided qualitative data in support of determining intervention feasibility. The aim of the qualitative element of this pilot study is to inform the design of a follow-up mixed methods study with a more substantial qualitative element.

Research sites

Two community public schools in suburban cities with diverse student populations were selected for this study. As shown in Table 1. the student majority identifies as Hispanic or other minority, and a majority of study sites students receive free or reduced lunch. Most students in the study schools walk to school each day.

Table 1. *Study Sites - School Demographics*

	Ethnic	Socio-economic	Gender	School Math Scores
School #1	Hispanic 62.1%	Free Lunch 60.3%	Female 49%	Pass 42.3%
	White 16.6%	Reduced Lunch 12.6%	Male 51%	
	Black 17.0%			
	Asian 3.8%			
School #2	Hispanic 88.5%	Free Lunch 72.5%	Female 47%	Pass 40.0%
	White 7.7%	Reduced Lunch 14.6%	Male 53%	
	Black 1.9%			
	Asian 1.6%			

Participants

Participants in academic year one included early fall 4th grade students (*N*= 160) in seven comparison group classrooms and spring 3rd grade students (*N*= 133) in seven treatment group classrooms across two elementary schools in the same Northeastern U.S. county. In their own Grade 3 year, the 4th grade comparison group students had the same set of teachers and were exposed to the same state mandated mathematics curriculum as the 3rd grade students who received the treatment in this study. Participants in academic year two included seven classrooms of early fall 4th grade students who had experienced the study treatment in the spring of academic year one. In the fall of the second academic year of this study,

students new to the schools (*N*= 13) took assessments, but their scores were not included in the study analysis. School principals and the author's Institutional Review Board approved and granted permissions for all assessment and treatment procedures.

Procedures

Assessments

Year one. At the beginning of their 4th grade school year, comparison group students in seven classes across the two study schools (*N*= 160) completed a timed multiplication facts inventory to ascertain multiplication facts acquisition and retention from their 3rd grade year. Classroom teachers administered the assessments.

Year two. Rising 4th grade students who received the treatment intervention during Grade 3 were tested using the same facts inventory instrument used for the comparison group classrooms the previous fall. Students in year two who were new to the schools took the assessment administered by classroom teachers. However, new student scores were omitted from the study analysis given that they had not experienced the intervention in Grade 3.

Treatment

The treatment took place in Grade 3 classrooms from March through May during the spring of academic year one. Treatment consisted of ten 30-minute sessions of multiplication facts exploration activities and practice. For example, students explored first the products of square numbers 1-12. Children engaged in matching activities where partners had sets of cards with products in one pile and factor pairs in another. They worked together and then independently to arrange corresponding cards in tabular fashion at their desks or on the floor. Another day they "tested" one another using homemade fact flip books of the nines fact family after inspecting and discussing interesting nines products relationships on a 10x10 products grid commonly found in elementary classrooms.

The fact families were addressed in non-linear fashion, with facts in the sevens and eights families explored before the fours and sixes. This non-linear process was adopted to address participants' problematic recall of sevens facts, in particular, as well as eights facts due to possible discrimination difficulties for even numbered products in the fact families of both four and six. For products in the sevens family of facts, participants were asked to work with just two sequential facts during any study time–for example, 7x6 and 7 x7 to help learners gain confidence. After most products were automatized for recall, the family of products was fitted together as a complete set 1-12.

The researcher conducted all treatment sessions, systematically replicating activities and materials in each of the seven classrooms. Intervention sessions took place with one-week intervals. A week was missed on two occasions at each school to accommodate school-based state standardized testing and district spring vacations.

Data collection instruments

The multiplication facts inventory included a paper and pencil test of forty-eight facts representing 1x1 through 9x9 (plus 0x5, 0x6 and 0x7) with no reverse facts. For example, 7x9 was presented, but not 9x7. Even though students had worked with all facts during the intervention, regardless of operand order, this inventory design was utilized as a possible way to capture internalization of more facts due to lower leading operands in the facts presentation (see Steel & Funnell, 2001; Zhou et al., 2007). Consideration of student motivation and test-taking stress was also a factor in minimizing the number of inventory items.

Students were given up to two minutes to complete the inventory administered by their classroom teachers. Teachers read instructions from a script that asked students to complete the assessment as quickly as possible, checking first for familiar facts on the page. They were also asked to quietly turn over their paper as soon as they were done. Since the goal was to examine automaticity for presented facts, this prompt served to dissuade children from reviewing their answers before signaling completion.

Some students needed more time than others depending upon actual facts retention and/or the ability to properly record handwritten numerical answers. Even so, no participant had more than two minutes to attempt completion. At the beginning of the following year, 4th grade students who had experienced the intervention during the spring of their Grade 3 year in these same two schools were tested using the same multiplication facts inventory instrument. As in the previous year, classroom teachers administered the assessments.

Results

Research question #1: Working with the data

Table 2. *Shows Descriptive Statistics for Measures Used In The Present Study*

	Treatment	*N*	Mean	Std. Deviation	Std. Error of Mean
Attempted Correct	No Treatment	160	.90482	.118077	.009335
	Treatment	133	.95372	.062699	.005437
Possible Correct	No Treatment	160	.46868	.235569	.01623
	Treatment	133	.66349	.219112	.018999

Independent-samples t-tests were conducted to compare "attempted correct" and "correct out of possible" scores between the no treatment and treatment conditions. There was a significant difference in the "attempted correct" scores for no treatment (*M*= .90, *SD*= .12) and treatment (*M*= .95, *SD*= .06); $t_{(250)}$= 4.53, *p*< .001, *d*= 0.52. Additionally, there was a significant difference in the "correct out of all possible" scores for no treatment (*M*= .47, *SD*= .24) and treatment (*M*= .66, *SD*= .22); *t*(291)= 7.274, *p*< .001, *d*= 0.86.

These results suggest that having 3rd grade students experience facts learning support for multiple short exploratory sessions during the spring did have an effect on facts retention into the 4th grade year. Relative to research question #1, student scores for both attempted correct and scores for correct out of all possible facts improved. Specifically, when students experienced supplementary activities that support learning facts in Grade 3, their memory retention for multiplication facts increased.

Pearson product moment correlations were computed for the treatment group and both "attempted correct" and "correct out of possible" test scores. Results shown in table 1.3 suggest that correlations between treatment and scores in both situations were statistically significant and were greater than or equal to $r_{(291)}$= .244, *p*< .01 and $r_{(291)}$= .392, *p*< .01.

Table 3. *Correlations*

		Attempted Correct	Possible Correct	Treatment
Attempt Correct Correlation	Pearson	1	.499**	.244**
	Sig. (2-tailed)		.000	.000
	N	293	293	293
Possible Correct Correlation	Pearson	.499**	1	.392**
	Sig. (2-tailed)	.000		.000
	N	293	293	293
Treatment Correlation	Pearson	.244**	.392**	1
	Sig. (2-tailed)	.000	.000	
	N	293	293	293

Research question #2

A second aim of this pilot study was to examine feasibility for the ten-week intervention. As mentioned previously, the timeframe for the study intervention was actually twelve weeks in both schools due to two missed weeks, one for mandatory state educational testing and another for the scheduled spring vacation. Principals and teachers agreed upon feasibility benchmarks before the study commenced. Criteria included:

1) Timing – 30 minutes sessions preceded or followed regular mathematics instruction periods in each classroom, whichever best suited individual teacher plans
2) Instructional materials – these were designed to be easily procured or replicated for teachers future use
3) Student engagement – moderate to high levels were to be maintained for the duration of the intervention
4) Classroom teachers' role – teachers served as instructional assistants, but were not responsible for intervention planning or activity presentations

Working with the data

Teachers in each school met first with their principal before gathering with the researcher to debrief following the study intervention. Quantitative results had not been analyzed at the time of the reflection, so it was not yet known whether gains had occurred from one year to the next. Teachers offered anecdotal evidence of student facts acquisition gains when they believed these to be present. However, these comments did not influence quantitative analysis of the data involving assessments completed by comparison and treatment groups. Teachers also provided feedback regarding student engagement during the intervention and whether they felt it was important or possible to set aside dedicated time blocks for the purpose of student multiplication facts acquisition. Reflection elements and feedback on the intervention process were meant to provide a framework for a future, more balanced mixed-methods study.

Table 4 displays data from reflection sessions. Stakeholder feedback is set out in separate columns for each reflection topic.

Teachers and principals agreed that implementing focused multiplication facts instruction in novel ways was desirable and ultimately feasible during the late winter and into spring of the Grade 3 academic year. Teachers felt that student confidence with facts increased over the treatment weeks compared to their students in other years. This anecdotal evidence was important to them in their professional practice, but it did not specifically support research questions for this study.

Discussion

Treatment group students received a total of five hours of supplemental instruction for facts memorization. Results suggest that these students had better facts retention at the beginning of their Grade 4 year, as compared to school peers who experienced the same mathematics curriculum and set of teachers the previous year. Importantly, improvement was evident even though all students experienced some facts memorization activities embedded in programmatic mathematics instruction both years.

The Pearson correlation between treatment and both "attempted correct" and "possible correct" on the facts inventory was in both cases statistically significant (p<.001) with a Pearson correlation value for possible correct approaching medium range at .392. An important finding is that the correlation between attempted correct and correct solutions out of all possible facts (.499) sits on the precipice of fitting into the medium range generally accepted for correlations (.500). These results suggest that treatment group students attempted to complete more items on the facts assessment inventory and, in the process, provided more correct solutions than comparison group students.

Treatment students may have attempted to answer more items than their comparison group peers because they had confidence in their ability to answer additional items correctly. While this element is beyond the scope of the current study, a follow-up study may seek to gather data about student mathematics self-concept related to multiplication facts interventions. It would be important to understand, among other things, how students feel about their level of automaticity with multiplication facts, the facts acquisition assessment process, and what types of assistance are personally meaningful during the memorization process.

In terms feasibility of a dedicated focus on facts acquisition for automaticity, teachers felt that with professional development they would be able to institute such an approach without compromising an already full teaching schedule designed to meet curricular requirements at the school, district, and state levels. If five hours spread over a number of weeks could make a difference, they would find the time to work with their students toward facts automaticity. Principals concurred.

Study Limitations and Future Research

While the same set of teachers at each of the study schools taught both student groups during the 3rd and 4th

Table 4.

	Stakeholders		
Reflection Topic	Teachers	Principals	Researcher
Benefit of dedicated time block for facts	Agreement that students benefitted from a dedicated facts acquisition time block	Wanted to see data before making a decision	Observed student facts acquisition gains, but did not know whether gains would be statistically different from year one 4th graders when 3rd graders rose to Grade 4 in the fall
Scheduling	Agreement that a 30-minute period could be inserted at times other than preceding or following the regularly scheduled mathematics instruction	Agreement that teachers should be the decision-makers regarding the management of dedicated time in a schedule	Agreement that teachers should decide when to incorporate dedicated facts acquisition time when they were in charge of the instruction
Timing ¬– 30-minutes	Agreement that 30-minutes was suitable for student focus and flexibility within the weekly school schedule. Agreement that 30 minutes was often not long enough given high student engagement.	Agreement that time for facts every week, for ten weeks was acceptable as long as literacy did not experience a reduced focus	Thirty minutes was not long enough for particular sessions, given student engagement. The time block was likely suitable, however, for continuing the process if gains were actualized.
Timing – academic year	Two teachers felt the Mar-May timing was correct. Five teachers felt the sessions could be scheduled late Jan-Mar.	Principals deferred to teachers regarding timing for their particular classes.	Conceptual understanding of multiplication as repeated addition of like number groups is recommended before asking students to memorize facts. Explorations for conceptual understanding were well underway in Grade 2 and Grade 3 classrooms before the interventions commenced.
Teaching load	Agreement that if facts acquisition gains were measureable, teaching load would not be affected. Student learning could be more streamlined overall. Dedicated sessions could be repeated every year, with little extra planning.	Agreement that teachers could not experience increased teaching load without various approvals. Teachers would have to recognize gains and plan accordingly, fitting dedicated facts sessions into weekly teaching plan.	
Student engagement	Students enjoyed participating in the intervention with an instructor new to them. Student motivation was "somewhat" to "significantly" elevated due to changed perception that facts automaticity was both important and possible.	Principals had first-hand impressions of "good" and "elevated" student engagement due to periodic classroom visits during intervention sessions.	Most students participated fully in activities, some needing small amounts of assistance from time to time, all within the realm of usual classroom proceedings. No judgments pertaining to greater or less mathematics engagement was possible for the researcher.

Grade years, there are other variables that may have affected facts acquisition from one year to the next beyond the study treatment. Teacher attitudes about mathematics in general and the value of facts automaticity; attention to individual learning needs; and memorization expectations both in school and at home, are just a few. Additionally, teachers would need professional development to become more attuned to efficient, flexible, exploratory instructional methods for facts acquisition with their students.

Teacher attitudes, mathematics pedagogical content knowledge, and pedagogical styles may be taken up in a qualitative element of a larger study. In addition, a follow-up study would seek to control for additional elements regarding information that can be garnered for each individual student in comparison and treatment groups.

Conclusion

Educators want students to achieve their full potential in mathematics. If it is known that multiplication facts automaticity matters in the long-term for both student self-concept and success with mathematics at higher levels, teachers, families, and school administrators must find ways to systematically support the automatization process. Research on facts acquisition methods and materials is important to consider in light of there being so little available upon which teachers might draw in order to ameliorate weak facts automaticity in their students. Methods used for decades do not seem to help enough students, and now busy families may be less available or able to encourage or assist children with facts practice in the home. Rather than rely on a concept-based only approach to multiplication facts in schools in the face of difficulty helping children to attain automaticity, we must seek to successfully combine concept development with real automaticity for optimum student achievement.

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March 2018, Volume **10**, Issue **4**, **397-405**

Investigation of Reflecting Reading Comprehension Strategies on Teaching Environment among Pre-service Classroom Teachers*

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Received: **07 December 2017**
Revised: **19 December 2017**
Accepted: **21 December 2017**
ISSN: 1307-9298

www.iejee.com

DOI: **10.26822/iejee.2018438129**

Abstract

The purpose of the study is to define the reading comprehension strategies considered by pre-service classroom teachers to be applicable in the classroom and their practical designs related to these strategies in terms of selecting text appropriate strategy, and full and correct use of the strategies in reading process (pre-reading, during-reading, post-reading, whole reading process) in accordance with the conceptual framework defined in the literature. The study has been conducted as a case study which is one of the qualitative research designs. The sampling group has been composed of 140 undergraduate students. Data collected through interviews, have been analysed with the help of document analysis method. Results indicate that pre-service teachers have used almost half of strategies defined as pre-reading strategies in the literature. Among the used strategies, the most repeated ones are guesses by visuals and stimulating prior knowledge. According to another finding of the study, pre-service teachers used only a few of the during-reading strategies defined in the literature. Finally, pre-service teachers designed post-reading strategies the most, and the strategy variation was accordingly the most for post-reading.

Keywords: Reading comprehension strategies, pre-service classroom teachers, activity designs

Introduction

Attaining automaticity with multiplication facts is both a de Reading comprehension is a skill that is founded during primary school years and can be developed within process. Teaching skills of reading and making meaning of what is read takes its place in educational programs and teaching process as the most important contribution to making human life meaningful (Akyol, 2011). Since the main purpose of reading is the efficacy of the communication between the ideas and the readers, students need to have skills and strategies required to obtain information from print sources (Collins & Cheek, 1999). At this point, the concept of "reading strategies" comes into prominence. Haris and Hodges (1995) define reading strategy as a systematic plan used consciously to increase learning performance. Reading strategies can also be defined as a series of problem solving behaviour used to make meaning of the text or cognitive tools that can develop students' academic performance and mental processes that can be chosen consciously when comprehension gets difficult (Barnett, 1988; Piloneita, 2006; Cohen, 1990).

Reading comprehension strategies are classified under different titles in the related literature. One of these classifications was made by Taraban et al. (2004), who took reading strategies in two dimensions as analytical reading and pragmatic reading strategies. Analytical reading strategies involve the use of strategies requiring the readers to evaluate, think how they can use what they obtain from the text later, deduce from the title what they read, make use of their prior knowledge, review, reflect, distinguish, make inferences, re-evaluate their purposes, select the relevant information, guess, make meaning, check the correctness of the guessed information, reveal their strengths during reading, visualize and define the difficulty level of the text. Pragmatic reading strategies can be defined as strategies that help readers to remember what they read more by using activities such as note taking, colouring or underlining important points, taking notes on the margins, highlighting, reading more than once and re-reading.

Another common classification in the literature organizes reading comprehension strategies in the order they are used during reading process and separated under four main headings (Daly et al., 2005; Duke & Pearson, 2002; Collins & Cheek, 1999; Susar, 2006; Epçaçan, 2009; Topuzkanamış & Maltepe, 2010). These are; (1) pre-reading strategies, (2) during-reading strategies, (3) post-reading strategies and (4) strategies used during whole reading process.

Pre-reading strategies are used by readers to prepare themselves for reading. Some of the pre-reading strategies mentioned in the literature are: (1) forming the purpose of reading; (2) helping students with guessing the topic of the text by checking the title, publication date, author and scanning the text and brainstorming with this purpose; (3) Title, Examine, Look, Look, and Setting (TELLS)-preparing story/concept map; (4) creating/checking pre-teaching vocabulary; (5) using sources such as dictionaries; (6) pre-teaching using concept maps and story maps; (7) carefully selecting the reading material and letting the students select reading texts in accordance with some criteria; (8) reviewing/investigating; (9) stimulating prior knowledge; (10) writing questions; (11) guessing, forming hypotheses; (12) making word pools; (13) making schemas; (14) creating KWLWH chart (Know-Want to Know-Learned-What else to learn-How).

The second dimension in classification referring to the order of strategy is during reading strategies. The main objective of during-reading strategies is to focus on the target defined in pre-reading. Some of the during-reading strategies mentioned in the literature are: (1) providing fluent and

* A certain portion of this study has been presented in 15th International Primary Teacher Education Symposium in 11-14 May 2016, Mugla-Turkey

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absorbing reading; (2) taking story map into consideration for narrative texts; (3) using drafts and study guide for informative texts; (4) strategic note taking for informative texts; (5) using timelines and flow diagrams for informative texts; (6) making complicated plans, tables; (7) using visuals for narrative texts; (8) checking comprehension; (9) defining words; (10) establishing relationships; (11) visualising; (12) answering questions and forming new questions; (13) focusing on the target.

The third dimension in the classification is post-reading strategies. The main purpose of post-reading strategies is strengthening and synthesizing the relations between pre-reading knowledge and post-reading knowledge. Some of the post-reading strategies mentioned in the literature are: (1) summarizing for all kinds of texts; (2) using the question-answer relations; (3) summarizing; (4) answering questions; (5) synthesizing; (6) expressing the text with visual elements; (7) evaluation; (8) analysing; (9) drawing; using graphic organizers; (10) reflective thinking; (11) checking the correctness of the pre-reading guesses; (12) finding the main idea; (13) discussing the text with others.

The fourth dimension of classification involves the strategies that should be used during whole reading process. These are: (1) strategic note-taking; (2) SQ4R: Scan, Question, Read, Reflect, Recite, Review; (3) Multi-pass; (4) Reciprocal Teaching; (5) KWL: Know-Want to Know-Learned; (5) Collaborative Strategic Reading; (6) Concept Map And Graphic Organizers; (7) Coop-Dis-Q: Cooperative Learning-Discussion-Questioning; (8) POSSE (Predict-Organize-Search-Summarize-Evaluate); (9) PQRS (Preview-Question-Read-Summarize); (10) Questions/Asking questions.

Reading strategies are activities that can develop individuals both in terms of knowledge and cognitively as they are defined as cognitive strategies used when there is a reading comprehension problem. From this perspective, reading strategies can be benefited from not only in reading comprehension but also in other classes (Topuzkanamış & Maltepe, 2010). The related literature involves many studies on the reading comprehension strategies using levels of teachers, who play an important role in raising strategic readers.

One of these was conducted by Çöğmen (2008), who aimed at defining the reading strategy using frequency of students of faculties of education while reading course texts and studying this in terms of various variables. In the study conducted with 230 pre-service teachers, Meta-Cognitive Reading Strategies Scale (MCRS) involving two dimensions as analytical and pragmatic strategies, developed by Taraban et al. (2004) was used to define reading comprehension strategies used by the participants. Some of the findings of the study are: (1) students' reading comprehension strategies using levels were 'frequently' for both dimensions and the whole of the scale. (2) Frequency of using reading comprehension strategies didn't vary by branches in 'analytical strategies' dimension, while they did in 'pragmatic strategies' dimension. Accordingly, Pre-Service Turkish Language Teachers reported using pragmatic strategies less.

Similarly, Karasakaloğlu (2012) aimed at investigating whether pre-service classroom teachers' levels of pragmatic and analytical reading strategies varied significantly by attitude, motivation, time-use, anxiety, concentration, processing knowledge, choosing main ideas, study helpers, self-testing and testing strategies, which are sub-dimensions of learning and studying strategies, being upper or lower level. According to the findings, pre-service classroom teachers used both analytical and pragmatic strategies 'frequently'.

Karatay (2007) studied pre-service Turkish language teachers' reading comprehension achievement and levels of using reading strategies. According to the findings, pre-service Turkish language teachers' reading comprehension achievement varied significantly by text types and their levels of using reading strategies were generally medium level.

Çöğmen and Saracaoğlu (2009) also conducted a similar study on pre-service teachers and reported that their participants' levels of using reading comprehension strategies were at 'frequently' level. The related literature involves studies on defining the types of reading comprehension strategies used by pre-service teachers, besides their using reading comprehension strategies frequency. Tabaran et al. (2004) tried to define the reading comprehension strategies used by pre-service classroom teachers, who thought analytically and holistically in problem solving and they reported the following findings. Pre-service classroom teachers mostly preferred using analytical thinking styles, used analytical and pragmatic reading strategies frequently and pre-service teachers' thinking styles didn't vary significantly by gender, grade and grade point average (GPA). They also reported that pre-service teachers' analytical reading strategies varied significantly by gender and GPA but not by grade.

Supancic (1995), who wrote his master's thesis on teachers' use of reading strategies and their achievement at vocational high schools, reported that teachers used the strategies. The total of 355 vocational high school teacher participated in the study and the questionnaire form developed by the researcher was sent to each participant by e-mail. 93% of the vocational high school teachers reported using reading comprehension strategies in their classes. This case didn't vary significantly by such variable as gender, seniority and number of students enrolled to the school. The participants' answers on the type of activity they used were as: 62% pre-reading activities, 68% vocabulary based activities, 45% supervised reading activities, 75% note-taking activities and 48% graphic organizers.

İnce (2012) tried to define classroom teachers' levels of using reading comprehension strategies in Turkish classes. According to the findings, the most frequently used pre-reading strategy was stimulating pre-existing knowledge while the least used was creating expectations; most used during-reading strategy was answering questions and asking new questions and the least used was taking notes on the margins; most used post-reading strategy was answering questions while the least used was strategic note taking.

A general evaluation of the related studies indicates that pre-service teachers use reading comprehension strategies frequently (Çöğmen, 2008; Karasakaloğlu, 2012; Karatay, 2007; Çöğmen & Saracaoğlu, 2009). Additionally, pre-service teachers use both analytical and pragmatic strategies (Supancic, 1995; Karasakaloğlu, 2012; Çöğmen, 2008; İnce, 2012). Most of the studies on the types of reading comprehension strategies used by pre-service teachers preferred the classification as analytical and pragmatic. Additionally, similar studies in the related literature used surveys for data collection and obtained teachers' or pre-service teachers' opinions through this technique. The present study aims at defining types reading comprehension strategies used by pre-service teachers on the basis of classification of the order of use in terms of the participants' departments at their faculties. At this point, we believe that the present study will contribute to the literature

with a different perspective. Additionally, we believe that pre-service teachers' applying their reflecting of reading comprehension strategies on teaching environment will provide more detailed and reliable data compared to surveys, which many of the similar studies in the related literature utilized. Accordingly, the purpose of the present study is defining the reading comprehension strategies considered applicable in the classroom by pre-service classroom teachers and their practical designs related to these strategies; in terms of selecting text appropriate strategy, and full and correct use of the strategies in reading process (pre-reading, during-reading, post-reading, whole reading process) within the conceptual framework defined in the literature.

The problem statement of the study is "Which reading comprehension strategies do pre-service classroom teachers reflect on teaching environment?" Answers to following questions are sought accordingly:

1. For which reading processes do pre-service classroom teachers prefer to use reading comprehension strategies?
2. Can pre-service classroom teachers reflect reading comprehension strategies on educational environment fully and correctly?
3. Which pre-reading comprehension strategies do pre-service classroom teachers prefer to use?
4. Which during-reading comprehension strategies do pre-service classroom teachers prefer to use?
5. Which post-reading comprehension strategies do pre-service classroom teachers prefer to use?
6. Which whole-reading process comprehension strategies do pre-service classroom teachers prefer to use?

Method

Research design

The present study on defining which reading comprehension strategies will pre-service classroom teachers use in reading environments is modelled as an illustrative case study. Case study can be defined as a research method that investigates phenomena in their own environment, with no distinct borders between the phenomena and their environment, based on "how" and "why" question, and enables the researchers to investigate in detail any phenomenon or event they cannot control (Yıldırım & Şimşek, 2005). What distinguishes case study from other methods is that it is based on 'how' and 'why', enables researchers to be included in a phenomenon or event they cannot control and investigate it in detail (Ekiz, 2009). The reasons for using this model in the present study are, that the reading comprehension strategies pre-service classroom teachers will use are accepted as a case with no distinct borders and that cannot be controlled by the researchers; and that this model enables researchers get involved in this case, investigate it in detail and find answers to "why-how" questions.

The present study is designed in accordance with "holistic single case study", which is one of the case study designs. Holistic single case studies involve one single analysis unit. It is used to confirm or reject a well-formulated hypothesis, to study unique or extreme cases, or for cases never studies or revealed before (Yıldırım & Şimşek, 2005). The single case studied in the present study is the reading comprehension strategies that pre-service teachers will use in their reading teaching designs they are planning to use. The present study takes pre-service teachers as an analysis unit.

Participants

The work group of the present study consists of the total of 140 (115 female, 25 male) senior (fourth) year students, who studied at Necmettin Erbakan University, Ahmet Kelesoglu Faculty of Education, Department of Classroom Teaching in the spring semester of 2015-2016 academic year. The sample was formed in accordance with criterion sampling, which is a purposive sampling method. Purposive sampling enables the studying of cases, which are thought to have rich information (Patton, 1997). The main principle of criterion sampling is studying of the all cases meeting a series of pre-determined criteria. The criterion or criteria can be formed by the researchers of they can use a prepared criterion list (Yıldırım & Şimşek, 2005). The criterion for the selection of the pre-service teachers to participate in the present study was that they were informed of Turkish language teaching technique in various courses (Turkish Teaching, Early Reading and Writing Teaching) and they had practice in these subjects, they had completed their teaching practice course and were last year students, who were ready to graduate.

Data collection tools

In order to collect data, the participants were provided with a narrative text (Turtle the Pottery Master) from the primary school 4th grade Turkish course book, and they were asked to explain which strategy or strategies they would use to provide the best reading comprehension among primary school 4th graders. Text has been identified by researchers. Then, in order to determine the suitability of the selected text, the opinions of the expert group consisting of three persons have taken. First, the experts are asked to evaluate the text literarily taking into account the student's level of development who will read the text. It has found out that all of the experts have the opinion that literary value of the text presented to them is suitable in terms of (1) containing a processed language and narrative; (2) waking up nice emotions, dreams and pleasures in the person; (3) nurturing human emotions, thoughts and dreams; (4) carrying the social and cultural characteristics of the community it belongs to; (5) putting human at the centre of the text; (6) having the purpose to reveal the goodness; (7) reflecting the characteristics of the societies in present and past; (8) using the life-related words, and the text is literarily appropriate for the 4th grade students. The selected text consists of 757 words, 42 paragraphs and 78 lines. There are five visuals in the text to support story fiction. The text has been presented to the teacher candidates in five pages along with the visuals, as shown in the course book mentioned above. In terms of the quantitative characteristics mentioned, the text has been also found suitable by the expert group for the 4th grade level. In addition, it has been confirmed by all the expert group that the selected text is also appropriate in terms of the text elements (Stage, Main characters and Supporting characters, the event that started the problem, Problem, Problem solving attempts, Result, Main idea, Response) (Akyol. 1999). The reason for selecting a narrative text or the present study was that narrative texts are designed to reflect many cases of communication, such as indicating a point, entertaining the audience, complaint and creating an environment of discussion especially among primary school children, who find these interesting since they encounter with these frequently, and also that they are considered as an important tool of thinking, explaining, comprehension and reminder (Akyol, 2011; Graesser, Golding, & Long, 1991).

After selecting an appropriate text, the course design development studies of the teacher candidates have been carried out in four sessions. 43, 41, 36, 40 participants have been found in each session respectively. In the sessions, primarily, purpose of research has been explained to the teacher candidates. Then, in terms of the purpose of the research the importance of creating the course designs in all details has been emphasized. Teacher candidates' questions have been answered and the sessions have been started. Sessions have been held at classrooms in the university building where prospective teachers always study. During the sessions, at least, two of the researchers have been provided to be observers. Pre-service teachers were asked to develop a lesson design, in which they could use the reading comprehension strategy they find appropriate for the text they were provided with. They were also provided with the "Reading Activity Form" presented in the Appendix to use while they develop their lesson design. No time limitation was place on the pre-service teacher for the designing process, yet they were observed to complete their activity design within an average of 30 minutes.

Data analysis

During the data analysis process of the present study, document analysis was conducted on the lesson designs developed by the pre-service teachers, in order to evaluate the appropriateness of the strategies with the selected text; whether their design reflected the strategies selected by them and the applicability of the selected strategy during reading process. Some of the most common data collection methods used in case studies are interview, observation and document analysis (Yıldırım & Şimşek, 2005). Document analysis involves the analysis of the written materials including information about the phenomenon or phenomena under study. Document analysis can be the single data collection method for qualitative studies, and it can also be combined with other methods of data collection. To provide the validity and reliability of the study, four elements were taken into consideration (Yin, 2003). These are presented in Table 1.

Table 1. *Validity and Reliability Studies*

Test	Case study tactic	Relevant phase of research
Construct validity	• Establish chain of events • Have key informants review draft case study report	• Data collection Reporting
Internal validity	• Do explanation building	• Data analysis
External validity	• Use theory in single case studies	• Research design
Reliability	• Use case study protocol	• All phases

Source: Yin (2003)

As presented in Table 1, to provide construct validity for the research, first a chain of events was established for the collected data. For this purpose, during the stage of associating the strategies used by the pre-service teachers in the designs they developed with the strategies defined in the literature, the researchers tried to refer to the literature by collecting as many proofs as possible. Pre-service teachers' expressions were also presented in the study with the same purpose. At this stage, pre-service teachers were coded. Such a code as M21M refers to a participant named Mustafa, who is 21st on the list and male. A pre-service teacher was asked to read the case study report prepared in addition to take her opinion. As presented in Table 1, we tried to present clearly how the findings were obtained during the data analysis stage and the proofs related to the inferences are presented in a way that others can access for internal validity (Yıldırım & Şimşek, 2008). For external validity, we tried to explain the research process and what was done during this process in a detailed way. At this context, research model, study group, data collection tool, data collection process, data analysis and interpretation were all defined in a detailed way (Table 1). Finally, for reliability, the steps followed for the present study were explained in detail so other researchers can follow the same steps and reach the same conclusions for further studies. With this purpose, eight major steps to follow for a case study, defined by Yıldırım and Şimşek (2008) were followed: (1) Developing research questions; (2) developing sub-problems of the research; (3) defining the analysis unit; (4) defining the case to study; (5) selection of the individuals to participate in the research; (6) data collection and associating the collected data with sub-problems; (7) data analysis and interpretation; (8) reporting the case study.

Findings

Evaluation of the reading comprehension strategies used by pre-service classroom teachers in terms of reading processes

First of all, we tried to analyse the place in the reading process of the reading comprehension strategies preferred by pre-service classroom teachers to teach the narrative text they were provided with. Findings obtained related to strategy-process context are presented in Table 2.

Table 2. *Reading Processes in Which Reading Strategies were Included*

Strategy	Process	*f*	%
Designs for the whole process	Pre-During-Post-Reading	71	50.71
Designs for a single process	Pre-reading	4	2.86
	During-reading	2	1.43
	Post-reading	17	12.14
Designs for two processes	Pre-Post-Reading	37	26.43
	During-Post-Reading	9	6.43
Total		140	100

As presented in Table 2, almost half of the pre-service teachers (50.71%) developed reading comprehension strategies for whole reading process. Additionally, participants whose designs included two processes mostly preferred pre-reading and post-reading strategies (26.43%). Only a few of these participants (6.43%) used strategies for during-reading and post-reading processes and didn't develop strategies for pre-reading (Table 2). Additionally, most of the pre-service teachers, who designed for a single process (12.14%) preferred post-reading strategies. A general evaluation of these findings show that a very small portion of the pre-service teachers developed strategies focused on one process of reading, and they mostly aim at providing reading comprehension for the selected narrative text using strategies in two or three processes of reading. Additionally, pre-service teachers used pre-reading and post-reading comprehension strategies more than during-reading strategies.

Evaluation of whether pre-service classroom teachers could reflect reading comprehension strategies on the education environment fully and correctly

The second focus of the present study was whether reading comprehension strategies presented in the distribution in Table 2 were used in the processes of reading fully and correctly as defined in the literature. Related findings are presented in Table 3.

Table 3. *Whether Strategies are Reflected on Reading Process Fully and Correctly*

Process-Strategy	Reflection level							
	Completely Reflects		Pretty much reflects		Partially reflects		Doesn't reflect	
	f	%	*f*	%	*f*	%	*f*	%
Pre-reading strategies	26	15.57	43	25.75	82	40.1	16	9.58
During-reading strategies	21	17.65	28	23.53	53	44.54	17	14.28
Post-reading strategies	31	17.71	45	25.71	86	49.14	13	7.43
Whole reading process strategies	1	11.11	2	22.22	5	55.55	1	11.11

As presented in Table 3, pre-service teachers could mostly partially reflect the strategies they designed on the all of the reading process parts they targeted at. More clearly, pre-reading strategies developed by 40.1%, during-reading strategies developed by 44.54%, post-reading strategies developed by 49.14% and whole reading process strategies developed by 55.55% of the pre-service teachers could be partially reflected on the teaching environment, compared to the definitions of these strategies provided in the literature. Additionally, in terms of pre-service teachers' ability to reflect the strategies on all reading process parts, the least observed case was that pre-service teachers could select an appropriate strategy for the reading process part yet they couldn't handle those strategies fully and correctly in terms of the literature. This was presented on "doesn't reflect" column in Table 3.

Evaluation of the pre-reading comprehension strategies used by pre-service classroom teachers

Other questions of the present study are related to the definition of the pre-during-post-reading strategies used by pre-service teachers. In this context, findings related to the analyses of pre-reading comprehension strategies used by pre-service teachers are presented in Table 4.

As presented in Table 4, pre-service teachers used only 7 of the 15 pre-reading comprehension strategy presented in the literature, and designed the total of 167 teaching environments for these 7 strategies. The most repeated pre-reading strategy by pre-service teachers was guessing. In the teaching designs planned for this strategy, the most commonly preferred activity was the use of visuals (27.54%). Other teaching designs for guessing strategy were by title (17.96%), scanning the text (1.79%) and by watching videos (0.59%) respectively. The second most preferred strategy by pre-service teachers was stimulating prior knowledge (Table 3). Pre-service teachers planned asking questions (14.38%), explaining (8.38%), watching videos (1.2%), watching documentaries (0.59%) and brainstorming (0.59%) activities for this strategy.

Other pre-reading strategies used by pre-service teachers were: Forming questions (5.99%), pre-teaching vocabulary formation (4.79%), forming reading objective (3.59%), cooperative reading (0.59%) and teaching concepts in advance (0.59%).

The proof chain formed with the statements of pre-service teacher A37F, who used most preferred strategy, guessing is as follows.

> *Statement 3: Before starting reading, I would ask my students to look at the pictures of the text and think on what the text could be about. Then, I would ask my students to share their opinions by letting as many of them as possible.*

Table 4. *Reading Comprehension Strategies Used For Pre-Reading*

Strategy	Environment	*f*	%
Guessing	By Visuals	56	27.54
	By title	30	17.96
	By scanning the text	3	1.79
	By watching a video	1	0.59
Stimulation prior knowledge	By asking questions	24	14.38
	By explaining	14	8.38
	By visuals	9	5.39
	By watching video	2	1.2
	By watching documentaries	1	0.59
	By brainstorming	1	0.59
Forming questions	Question-answer	10	5.99
Pre- teaching vocabulary	Question-answer	8	4.79
Forming reading objective	Question-answer	6	3.59
Cooperative reading	Heterogeneous groups	1	0.59
Teaching concepts in advance	Concept maps	1	0.59
TOTAL		167	100

Statement 5: Before reading text, I would ask them to have a look at it first. I would expect them to see some bold parts or dialogues that could provide information about the text. I would ask them to re-think by combining what they thought by looking at the pictures and by scanning.

Statement 6: I would ask them if they knew the author of the text and they had read other texts by the same author before. If they had, I would remind them those texts. If they hadn't, I would remind one story they knew. Then based on that story, I would ask them to think about what kind of stories the author could write.

According to the statements provided above, that pre-service teacher planned to use pre-reading guessing strategy by visuals first, then scanning and finally stimulating the prior knowledge on the author.

Evaluation of the during-reading comprehension strategies used by pre-service classroom teachers

The findings related to the during-reading comprehension strategies used by pre-service teachers are presented in Table 5.

Table 5. *Reading Comprehension Strategies Used For During-Reading*

Strategy	*f*	%
Oral reading by an effective reader	27	22.69
Defining vocabulary items	26	21.85
Answering questions, forming new questions	24	20.17
Underlining the text	17	14.29
Providing fluent and absorbing reading	14	11.76
Taking story map into consideration for narrative texts	6	5.04
Note taking	2	1.68
Using visuals for narrative texts	2	1.68
Defining complicated points	1	0.84
TOTAL	119	100

As presented in Table 5, pre-service teachers used only 9 of the 26 during-reading strategies presented in the literature and they designed 119 teaching environment for these 9 strategies. The most repeated during-reading strategy by the pre-service teachers was oral reading of the text by an effective reader (22.69%). Additionally, other most preferred during-reading strategies by the pre-service teachers were: "Defining vocabulary items" (21.85%), "Answering questions and forming new questions" (20.17%), "underlining the text" (14.29%) and providing fluent and absorbing reading" (11.76%).

The least used during-reading strategies were: "Taking story map into consideration for narrative texts" (5.04%), "note taking" (1.68%), "using visuals for narrative texts" (1.68%) and "defining complicated points" (0.84%).

The proof chain formed with the statements of pre-service teacher H67M, who used most preferred during-reading strategy, oral reading of the text by an effective reader is as follows:

Statement 13: After students read the text silently on their own, I would read the text or ask someone who is good to read it orally.

Statement 14: I would pay attention to intonation, punctuation, pausing when necessary.

Statement 16: If needed, I would ask several students to read the text orally again.

Evaluation of the post-reading comprehension strategies used by pre-service classroom teachers

The findings related to the post-reading comprehension strategies used by pre-service teachers are presented in Table 6.

Table 6. *Reading Comprehension Strategies Used For Post-Reading*

Strategy	Sub-strategy	*f*	%
Finding the main idea	-	54	30.86
Visualizing the text	-	49	28
Summarizing	-	40	22.86
Answering text related questions	-	16	9.14
Drawing	-	4	2.29
Synthesizing	Writing a follow-up for the story	3	1.71
	Writing stories	4	2.29
	Writing fables	1	0.57
Evaluation	-	2	1.14
Forming charts for the text	-	1	0.57
Comparing with the guesses	-	1	0.57
TOTAL		175	100

As presented in Table 6, pre-service teachers used only 10 of the 15 post-reading strategies presented in the literature and they designed the total of 175 teaching environment for these 10 strategies. The most repeated post-reading strategy by the pre-service teachers was finding the main idea (30.86%). Additionally, other most preferred post-reading strategies by the pre-service teachers were: "visualizing the text" (28%), "summarizing" (22.86%), "answering questions formed pre/post-reading" (20.57%), "finding the main idea" (10.29%) and "answering text related questions" (11.76%).

The least used post-reading strategies were: "forming charts for the text" (0.57%), and "comparing with the guesses" (0.57%).

The proof chain formed with the statements of pre-service teacher K48M, who used most preferred post-reading strategy, finding the main ideas is as follows:

Statement 4: After reading the text, I would ask the students to find the main idea.

Statement 5: I would ask them to combine all topics and developments within the text, while they find the main idea.

Statement 6: I would ask almost every student in the class to tell the main idea they found.

Which whole-reading process comprehension strategies do pre-service classroom teachers prefer to use?

The findings related to the whole-reading process comprehension strategies used by pre-service teachers are presented in Table 7.

Table 7. *Reading Comprehension Strategies Used for Whole-Reading Process*

Strategy	*f*	%
Asking question/questions	7	77.78
Note taking	2	22.22
TOTAL	9	100

As presented in Table 7, pre-service teachers used only 2 of the 11 whole reading process strategies presented in the literature and they designed the total of 9 teaching environment for these 2 strategies. The most repeated whole reading process comprehension strategy by the pre-service teachers was asking question/questions (77.78%). Additionally, the least used whole reading process strategies was: "note taking" (22.22%).

The proof chain formed with the statements of pre-service teacher E21F, who used most preferred whole-reading process strategy, asking question/questions is as follows:

> *Statement 2: Before reading, I would ask what some of the key concepts that can enable students to understand the text are.*
>
> *Statement 3: I would ask questions about the topic of the text. I would ask them to think about these questions as they read the text.*
>
> *Statement 4: I would ask them to answer these questions after they read the text.*

Results and Discussion

The present study conducted with the purpose of defining the reading comprehension strategies considered applicable in the classroom by pre-service classroom teachers and their practical designs related to these strategies; in terms of selecting text appropriate strategy, and full and correct use of the strategies in reading process (pre-reading, during-reading, post-reading, whole reading process) within the conceptual framework defined in the literature analysed reading activity plans designed by 140 pre-service classroom teachers and obtained the following findings.

Almost half of the pre-service teachers (50.71%) developed reading comprehension strategies for whole reading process. Almost one third of the pre-service teachers (32.86%) designed activities only for two of the reading processes. Most of these pre-service teachers preferred pre-reading and post-reading strategies in their plans. Most of the pre-service teachers, who designed for a single process preferred post-reading strategies. Accordingly, we can claim that pre-service teachers reflected post-reading strategies the most and during-reading strategies the least on their designs. These findings of the present study are partially in agreement with the findings of the similar studies in the related literature. Firstly, that designs of the pre-service teachers included all reading processes supports the findings in the literature that pre-service teachers will use these strategies frequently (Supancic, 1995; Çöğmen, 2008; Çöğmen & Saracaoğlu, 2009; Karasakaloğlu, 2012; İnce, 2012; Taraban et al., 2004). However, the findings related to the reading processes that pre-service teachers used most strategies respectively at post-reading, pre-reading then during-reading processes differ partially from findings of the studies conducted by Yurdaışık (2007), Karatay (2007) and Topuzkanamış (2009), who reported this order as pre-reading strategies the most and post-reading strategies the least. However, this finding is in agreement with the findings of the studies conducted by Supancic (1995) and İnce (2012).

Comparison of pre-service teachers' statements related to the content of the strategies they designed to use with the conceptual framework provided in the literature for the related strategy showed that pre-service teachers could use the strategy they preferred to use in all stages of reading partially fully and correctly. This finding of the present research is agreement with the findings reported in similar studies in the related literature. Similarly, Ünal (2006), Karatay (2007) and Topuzkanamış's (2009) findings indicated that students' levels of using reading comprehension strategies were medium level.

It has been found that, pre-service teachers used almost half of strategies defined as pre-reading strategies in the literature. Among the used strategies, the most repeated ones were guessing by visuals and stimulating prior knowledge. This finding is in agreement with the literature. Supancic's (1995) research findings indicate similar pre-reading strategy use frequencies. Moreover, according to related literature, stimulating prior knowledge and guessing strategies are among the most commonly used strategies (İnce, 2012; Baydık, 2011).

According to the findings of the study, pre-service teachers used only a few of the during-reading strategies defined in the literature. Among these, most repeated strategies were oral reading of the text by an effective reader, defining vocabulary items and seeking answers to the questions. This finding can be claimed to be consistent with the study itself. That pre-service teacher preferred to use very few during-reading strategies is consistent with the finding that the strategies used reflected the very few of during-reading strategies defined in the literature. In other words, pre-service teachers used during-reading strategies less than the strategies defined for other stages of reading. Additionally, the finding that the most used during-reading strategies were seeking answer to questions and defining vocabulary items is in agreement with the findings reported by the similar studies in the literature (İnce, 2012; Supancic, 1995; Blachowicz & Fisher, 2000).

It was found that, pre-service teachers used most of the post-reading strategies defined in the literature. The most repeated post-reading strategy by the pre-service teacher was finding the main idea strategy. This finding is also in agreement with the study itself. Pre-service designed post-reading strategies the most, and the strategy variation was accordingly the most for post-reading. This finding is also in agreement with the literature. Taraban et al. (2004) reported that analytical strategies were frequently used by pre-service teachers. Finding the main idea strategy is an analytical strategy, which indicates agreement between the findings of two studies.

The findings of the present study showed that pre-service teachers used very few of the strategies covering whole reading process. The most repeated of these was asking question/questions strategy. In other words, very few of the pre-service teachers preferred to use strategies that can be applied to whole reading process.

The following suggestions were developed in accordance with the findings reported above: (1) Pre-service classroom teachers should be made to have theoretical and practical information about the reading comprehension strategies that they can use in every stage of reading process. Pre-service teachers should be able to use different strategies; (2) Pre-service teachers should be provided with sources on the strategies that can be applied to whole reading process; (3) Further qualitative studies can be conducted to evaluate teachers' and/or pre-service teachers' use of reading comprehension strategies.

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Appendix

Reading Activity Form

Dear pre-service teacher, design a reading activity for 3rd or 4th graders for the narrative text "Turtle-The Pottery Master" you are provided with. Use the table below. You can use one, several or all lesson parts listed below.

Lesson Part	Teaching-Learning Activity and the Reason for Using it	Role of the Teacher	Role of the Students	Teaching Tools
Introduction				
Pre-reading				
During-reading				
Post-reading				
Assessment				

Other cases you would like to add: .....
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March 2018, Volume **10**, Issue **4**, **407-412**

Learning Environment Affecting Primary School Student's Mental Development and Interest

Received: **13 December 2017**
Revised: **9 January 2018**
Accepted: **11 January 2018**
ISSN: 1307-9298

www.iejee.com

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DOI: **10.26822/iejee.2018438130**

Abstract

Education is the main tool of social development, a process of systematic teaching to transfer some knowledge and skills. The choice of teaching methods influences the level of information perception by students. The article deals with the influence of studying environment on mental development level and students` interest. For cognitive development, diagnostic and academic interest to subjects testing and questioning of 736 primary school children was conducted. The respondents were divided into three groups depending on the technologies (systems) of teaching Mathematics and Russian language. The study shows that while teaching Russian using IDU technology more positive dynamics of educational effects is revealed.

Keywords: Primary school children teaching; intellectual development; academic interest in subjects; technology of integrated didactic units (IDU)

Introduction

Education and upbringing play a leading role in child's mental development (Spodek & Saracho, 2014; Galassi, 2017; Davies et al., 2016; Fauth et al., 2014; Chareka, 2010). Upbringing carries not only immediate, but also long-term consequences when it comes to personality development (Vygotsky, 1996); education can not only follow this process, but also be ahead pushing it further (Herasymenko & Sabadyr, 2016; Meyer, Kamens & Benavot, 2017).

There are two main theories regarding the problem of balance between education and development:
1. Education and development are unrelated (Piaget, 1997). This independence is expressed, in particular, in the fact that child's mind goes through all known stages, irrespective of whether a child is studying or not. According to this theory, child1s development is a result of intrinsic and spontaneous self-change, which is not affected by education.
2. Education and development are related (Tatuum & Tatuum, 2017). This theory considers development to be a dual process: maturity and education. This theory differentiates education and development, but at the same time establishes their interconnection (development prepares education, while education stimulates development).

In ontogenesis, mental development is a result of gaining social and historical experience transmitted imparted through education (Corno & Anderman, 2015). Education plays a key role in mental development, and therefore, one can control it [mental development] by changing the learning environment (Fraser, 2015). Social science and technology advance make high demands for independent, creative thinking of people. To meet them you need to improve the system of education in order to increase its influence on the development rate of pupils' thinking and their interests` development.

Mind development considers following fundamental problems of educational and age psychology:

1. Thinking is determined by studying.
2. Human thinking development in ontogenesis occurs as one stage, with known patterns of primary school students` thinking as transition from non-generic (empirical) method of solving tasks to generalized (theoretical) and further to its developed form-abstract thinking.
3. For effective theoretical thinking teaching of primary school children, special programs are needed.

When thought operates only within particular situations, it does not have sufficient control points to break up essential connections and coincidences, relations based on common homogeneous properties and associative links contiguity, common in essence and belong to the same situation (Davydov, 1996).

Operating with diverse concepts of things, phenomena, processes, child`s thinking is prepared, therefore, to realization of conception through their properties and relationship. Thus, in this stage of thinking there are prerequisites for transition to the next stage. These features are implemented in a child while, in the course of study, he masters theoretical knowledge system. The study of theoretical thinking development of primary school children can be seen with two approaches (Kalmykova, 1981).

Traditional approach: theoretical thinking development in process of knowledge system mastering. Empirical in terms of content thinking of mentioned above step can be characterized by its form as rational (in dialectical sense), distinguishing rational mental activity and actually reasonable «dialectical» idea, which involves "study of the nature of concept." Assimilating in studying process a system of theoretical knowledge,

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a child at this higher stage of developmentlearns to «investigate the nature of the concept itself», revealing through their relationship their more abstract properties; empirical in its content, rational in its form, thinking goes into theoretical thinking in abstract forms (Mikerova, 2011).

V.V. Davydov`s approach was to create special programs. Turning in the process of learning to master the system of theoretical knowledge, which is already «the study of concepts themselves» the child's thinking comes to more sophisticated understanding of his own operations laws. In this direction to seek solutions to the problem information indicating the dependence of theoretical thinking development in primary school age on the content of teaching programs was obtained. Studying using experimental programs developed by D.B. Elkonin (Elkonin, 1989) and V.V. Davydov, development is more intensive and integrated: children learn the ways of theoretical thinking in solving problems one year earlier, or in more abstract form than when studying using standard programs.

The main characteristic of integrated didactic units among modern scientific concepts is that integrated didactic units (IDU) is a didactic system of self-expansion of students' knowledge due to activation of subconscious mechanisms of accelerated information processing by means of bringing closer the interacting components of holistic idea in mental space and time.

The basic of concept`s integration was modern knowledge in epistemology (Meyer & Land, 2005; Sukhotina, 1983), principles of opposition, anticipatory reflection of reality, cyclic (reverse) connection of thoughts, combination of analysis and synthesis (induction and deduction), reliance on contrasts and analogies in thinking. Combined application of IDU methods is more efficient, compared to "excessive breakdown" of studying material, because they create conditions for displaying fundamental regularities of thinking, namely: (1) law of unity and opposition of opposites; (2) intermittent opposition of contrasting stimuli; (3) principle of reverse connections, systemic and cyclic nature of processes (Anokhin, 1998); (4) reversibility of operations (Piaget, 1997); (5) move to super symbols, i.e. usage of longer sequences of symbols (cybernetic aspect).

Enlargement of didactic units uses the hidden reserves of thinking that significantly improve the studying process efficiency in general, because human mind inherited from nervous system of evolutionary predecessors certain mechanisms of simultaneous thinking and accelerated information processing, which are subconscious. This is confirmed by the studies of scholars who considered the issues of language and speech theory.

IDU technology originates from intersection of many sciences: philosophy, logic, physiology, psychology, pedagogy, didactics, cybernetics, and computer science.

Methodological bases of these technologies consist in the fact that (1) transformation of factual information into structural information (or information of connections) occurs due to opposition of opposing and complementary concepts; (2) during knowledge assimilation a student, on the one hand, has to see and feel the objective problem, the product of solution whereof is a given task and, on the other hand, has to reproduce the "deposited" therein logic of human thought that created it; (3) substantiation of IDU technology is achieved by using paired categories of dialectics; (4) thinking is aimed at combining and identifying contradictions, which results in its solution; (5) technology uses enlarged didactic units of assimilation that contain all basic elements that form a certain holism; (6) IDU technology facilitates self-expansion of information and radically reconstructs all aspects of ordinary logic and usual thinking of a schoolchild; (7) core of studying the truth is bifurcation of entirety and understanding of opposing elements in their unity, their interconnections and transformations of one into another.

The essence of IDU technology comes down to incorporation of knowledge in space or time. Knowledge elements traditionally separated into different sections and years of study, unite and form a holistic composition of structurally new knowledge.

The analysis of IDU essence allowed formulating the definition of this studying technology: "IDU technology is a model of modern pedagogic activity that realizes substantial generalization that consists of integrative units of assimilation, which include interrelated and sometimes mutually exclusive parts and form integrity". In IDU technology definition the authors proceed from the fact that enlargement of didactic units is a variant of generalization. If educational technology already provides a substantial generalization, students will also strive to expand their knowledge, i.e. to generalize. This will develop thinking, its specific properties, and, consequently, the system of concepts, knowledge, skills and abilities, because thinking during studying by IDU technology is expanding of comprehended elements of a specific studying subject.

It is of great interest to identify the changes in development of students` thinking, which occurred with changing technology of education in primary school. In particular, there was an opportunity to compare the results of studying, designed for more or less uniform development of concrete and abstract theoretical thinking, carried out in regular school, with more intensive, in our opinion, influence which is realized in the process of studying by means of developing studying technologies by D.B. Elkonin – V.V. Davydov and IDU technology.

Z.I. Kalmikova after conducting a diagnostic experiment comparing the level of students' thinking of three groups (Group 1 – trained upon the old program – «C», Group 2 – upon the new program of mass elementary school – «H», Group 3 – Programme of V.V. Elkonin, B.V. Davydova – «E»), which aims to identify the changes in thinking development under the influence of a new studying environment, makes optimistic conclusion that these conditions have a significant impact on development of independent productive thinking of students, particularly on their verbal-logical way.

Cognitive orientation of subject interests dynamics shows a decrease from grade to grade of students' interest in Russian language (Shchukina, 1984). The reason for this phenomenon can be explained by the appearance of new subjects, which allegedly switch the attention of students to them, as well as the fact that Russian language knowledge in educational process framework of a comprehensive school is being exhausted and there is not anything new in high school. G.I. Shchukina says that, in fact, everything is much more complicated. The problem of modern school is attention to word, to its semantic meaningful basics to its communicative functions.

Objectives

The study of this aspect of the problem is to identify the influence of the learning environment on the level of mental development and interest of younger leaners.

Methods

Participants

Experimental basis of the study was secondary schools of Krasnodar, including No. 69, 67, 47, 96, 20, 37 and secondary schools of Maykop and Armavir. 736 pupils participated in the study in total. The experimental work was focused on 2-4 grade elementary school students aged 8-10. Students` selection was conducted by groups: the 1st group studied according to traditional educational system, the 2nd group studied according to D.B. Elkonin's and V.V. Davydov's developmental learning system, the 3rd group studied according to IDU technology. In addition, the authors conducted express polls of more than 1000 elementary school teachers from Krasnodar, Krasnodar Krai, Maykop, Armavir, Volgograd, Elista, and Moscow.

Measures and covariates

The methodological basis for the study served as a psychological, pedagogical researches on the development of thinking, theoretical issues of the leading role in the development of the activities of a child's personality; the concept of mental development, the activity of pupils and the development of cognitive interest in teaching pupils.

In order to achieve reliability in consideration of the problem, the following methods have been applied: theoretical analysis of psychological and pedagogical literature on the research topic; study of teaching experience; theoretical generalization, synthesis of data, questionnaires, testing.

Procedure and scientific structure

Experimental work included three stages. The first stage is preparatory stage. It includes analysis of scientific literature on pedagogy, philosophy, psychology. This analysis gives foundation for main hypotheses of study determination, level of the problem development and selection of theoretical and methodological basis of the study. It also includes the search for the conditions that affect the level of mental development and interest of junior schoolchildren. The second stage is experimental stage. It includes the plan of experimental concept, and selection and development of diagnostic methods. The stage also included the study of practical aspects of the problem, determination of conditions that facilitate effective influence of studying on the level of mental development and interest of junior schoolchildren, and determination of levels of mental development and interest in studying subjects in junior schoolchildren.

The present research used mental development method of T.A. Ratanova (Ratanova, 1995) and N.I. Chuprikova (Chuprikova, 1995), based on R. Amthauer's (Amthauer, 1953) intelligence structure test, to assess the level of intellectual development of junior schoolchildren.

The test consists of subtests, each of which is aimed at measuring different functions of intelligence. Four subtests were developed for junior schoolchildren, which include 40 verbal tasks, selected with account for programs of elementary grades. The test is provided in annex.

The first subtest consists of tasks that are a verbal variant of "find the odd one out" among five options. The data obtained from this method allow judging the mastery of generalization and abstraction, and ability of a tested to distinguish significant attributes of objects and phenomena.
The second subtest consists of tasks of conclusion by analogy. The tested has to be capable of establishing logical connections and relations between concepts.

The third subtest is aimed at finding skills of generalization (the tested has to name a concept that unites two words that are part of each task of a subtest).

The fourth subtest includes tasks that require tested to differentiate between essential attributes of objects or phenomena and inessential and secondary ones. The results of performance of certain subtest tasks allow judging the tested`s knowledge base. Each task is assigned with a score. The total result for each subtest is determined by adding scores of all ten tasks.

Assessment of students' tests

The score for each task is obtained by adding all correct answers in a given subtest. Each correct answer is worth one point. Thus, the total maximum score for all four subtests is 40 points.

Interpretation of schoolchild's results is performed as following:
40-32 points – high level of intellectual development;
31-26 points – average level;
25-20 points – insufficient (below average) level of development;
19 points or less – low level of development.

Four subtests which included 40 verbal tasks were offered to control and experimental grades.

In the first subtest, the students found the odd one out among five options. In the second subtest, the students made conclusions by analogy. In the third subtest, the students had to name a concept that united two words that were part of each task of the subtest. In the fourth subtest, the students differentiated between essential attributes of objects or phenomena or inessential and secondary ones.

The process

All 3 experimental conditions, those are, the training programs had been developed for the subject "Russian language". The teachers who worked with children on the IDU technology, had received additional training. The teachers of the other two groups confirmed their qualification using traditional teaching method and the developing method by Elkonin and Davydov.

Students testing was conducted at the end of a school year, that was, after finishing the annual program of Russian language teaching using one of the three approaches method.

The teachers survey was via email. The questionnaire consisted of 10 open-ended questions. The survey was used as an additional method to complement the data with teachers' point of view: if it is easy to teach using the technique of one of the approaches, what difficulties they met, what difficulties children met according to the teachers.

Also, the study revealed unexpected data, and as a result some specific questions about students' motivation were included in the questionnaire. A rapid survey to identify preferred subjects was conducted among all three groups students. Pooled data are presented graphically in the Figure 1.

In general, both Elkonin and Davydov's developing training and IDU technology training promote more intellectual development raising of junior schoolchildren than traditional

training. Developing training is good at the task to get middle level development but if we talk about high – IDU technology is better, and the effectiveness of the last approach is above almost two times more often, than when teaching on the system of Elkonin and Davydov.

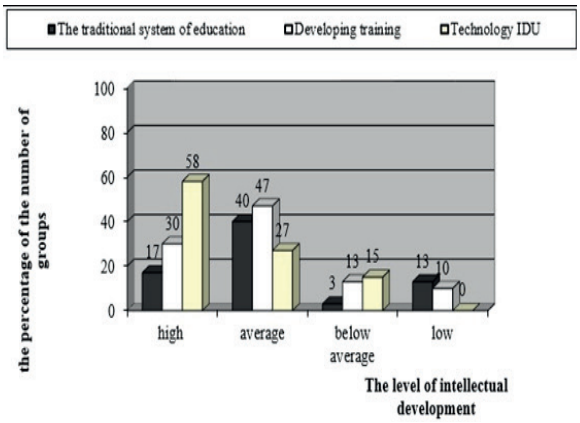

Figure1. Results of diagnostics of intellectual development level of students, depending on conditions of studying

Through the survey research of primary school teachers we found that every year at Russian lessons students learn the rules of spelling words, punctuation, but don`t work on word, on development of pupils` speech. Meanwhile, for students literature can become a school of thinking, school of creativity, school of knowledge of the most profound and subtle processes. A teacher, forming an inexhaustible interest to Russian speech, native language, remain in memory of students for a lifetime.

We also found a downward trend in interest in Russian language subject, even with primary school students. And elementary school gives foundation for future learning. Of all those surveyed, primary school teachers (sampling more than 1,000 people), only 3% of teachers notice the interest of elementary school- students in Russian language. It should be noted that this phenomenon receives a logical coloring, and of course, negative.

In the course of our research of studying using IDU technology it was determined that teaching Russian language with IDU technology increases interest in Russian language subject. Usually (what elementary school teachers confirm), students do not like school subject Russian language and prefer school subject mathematics. To determine the change in interests of primary school students in the direction of Russian language subject a questionnaire was held. Students (more than 360 students) were asked to put down their attitude in points to mathematics and Russian language school subjects (Figure 2) (Anokhin, 1998).

The third stage is conclusive one. Research materials were implemented in practical work of educational organization and educational process of Krasnodar schools.

Results and Discussion

The research showed that teaching Russian language with IDU technology junior schoolchildren was underdeveloped in modern pedagogical and methodical theory. In pedagogical theory, the author of IDU technology P.M. Erdniyev (Erdniyev, 1995) and his followers substantiated the idea of enlarging didactic units, studied didactic necessity of studying by this technology from elementary school, and suggested a methodical system of teaching mathematics and other subjects of natural sciences. Teachers are searching for possibilities of implementing IDU ideas at practical level, when teaching Russian language. However, so far, effective IDU ideas failed to become part of basis for teaching Russian language at elementary schools. This necessitated distinguishing and substantiation of bases of teaching Russian language by IDU technology at elementary schools.

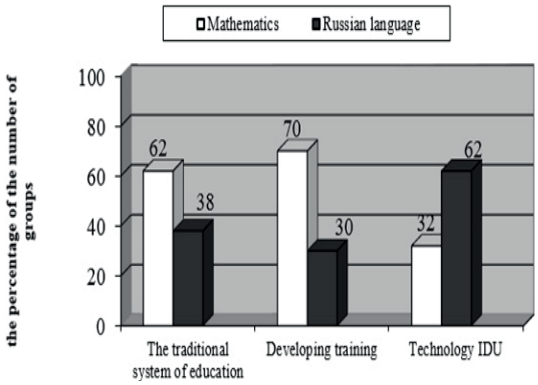

Figure 2. Results of the survey «My favorite subject»

Usage of IDU technology when teaching Russian language integrates the content of learning material that students have to master, diverse and multifaceted process of students' learning activity, and generalization among participants of studying process, in which various relationships are established.

When teaching Russian language by IDU technology, "informative weight" of each medium message (sign, symbol, word, phrase, or section) increases, because while emergence of reverse connections is simplified and, perhaps, a greater diversity of these connections is achieved (which is what occurs during the teaching by IDU technology), the overall amount of information in the system is not lost (not reduced), but is capable of accumulation (enlargement). At that, "appropriate" information becomes "cohesive" information, which transfers into long-term memory. Furthermore, additional information is extracted, because a student has to work with family of concepts and tasks, as opposed to a single exercise in ordinary studying. A student has to choose actions, signs, concepts, judgments, and trains of thought out of several possible variants. The nature of information is such that it is extracted when a person faces a choice. The more often this choice is made, the more information is extracted. Therefore, most IDU exercises are tasks with missing signs, letters, words, etc., models, matrices, certain material and ideal educational means.

Russian language classes, based on IDU technology, are knowingly based on need for enlarging knowledge, and are aimed at surrounding the main concept, at accumulating knowledge around the logical core of a lesson, at repeating the material through its development, and at transforming, which allows expanding the boundaries of Russian language studying program of elementary classes without overloading students with information.

IDU technology combines analytical process of solving ready packages with synthetic process of their compilation. Analytical processes includes analysis of word by its composition, analysis of sentence, selection of various parts of speech for models, orthographic pronunciation during writing, etc., which are combined with synthetic processes – word formation, sentence building according to schemes, proofreading during the correction of written

texts. This combines analysis and synthesis, which is a crucial feature of dialectic cognition.

Teaching Russian language by IDU technology in elementary grades ensures development and simultaneously gives junior schoolchildren knowledge, skills, and abilities.

The study allowed distinguishing junior schoolchildren with a formed mathematical, natural scientific and literature-linguistic selectivity. The study statistically proved the continuity in orientation of these students at distinguishing attributes and connections of content that they consider important and success of their processing in methods that diagnose subject selectivity of junior schoolchildren. The dynamics of selectivity in this educational and age stage was studied. The range of individual differences in nature of subject-selective activity of these pupils was found to increase from the first to the third grade. Qualitative differences in nature of subject-selective activity of junior schoolchildren with different levels of mental development were discovered. The founder of increased didactic units (IDU) technology, P.M. Erdniyev, substantiated theoretical bases of this technology from perspective of didactics and methods of teaching mathematics. His followers expanded the possibility of using IDU technology in natural sciences. In particular, they suggested methods for implementing it in teaching physics (Karyakin, 2010; Munchinova, 2013) and chemistry (Vasilyeva, 2009). There are no researches of IDU in teaching Russian language, which makes the study of bases Russian language teaching in elementary grades according to IDU technology relevant. The relevance is also determined by the need for substantiating the effectiveness of technology of Russian language teaching at elementary schools, which is aimed at developing the pupils' personality, in particular, its main component – linguistic creativity, and forming a system of linguistic concepts, knowledge, skills and abilities of junior schoolchildren.

Conclusion

These results clearly identify seen increasing interest in academic subject « Russian language» while studying on IDU technology. It is worth noting that interest in the subject during studying process plays a dual role. On the one hand, it functions as a result of studying, on the other - as an incentive to support the assimilation of subject`s content.

Thus, the article shows one of the ways of solving the problem of intellectual development level and interest in academic subjects while teaching younger students. It is based on conditions implemented in a variety of systems and technologies of teaching students - traditional system, technology of developing education of D.B. Elkonin – V.V. Davydov, technology of integrated didactic units (IDU).

Applying results of this research at practice allows forming knowledge and skills in students, developing their cognitive processes (in particular, thinking) and interest in Russian language. This will make teaching and learning more efficient, and stimulate junior's personality development. This paper will also enrich teaching methodology expert's knowledge regarding the essence and efficiency of teaching Russian language in lower grades by IDU technology.

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March 2018, Volume **10**, Issue **4**, **413-419**

A Comparison of 60-72 Month Old Children's Environmental Awareness and Attitudes: TEMA Kids Program

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Received: **12 November 2017**
Revised: **03 January 2018**
Accepted: **07 January 2018**
ISSN: 1307-9298

www.**iejee**.com

DOI: **10.26822/iejee.2018438131**

Abstract

The purpose of this study was to compare children's environmental awareness and attitudes in the classes where TEMA Kids was implemented and where it was not. This study which used pre-test post-test control group quasi-experimental research design was carried out in 2016-2017 academic year. The study group was composed of 60-72 month old 138 children (69 experimental, 69 control) who continued their preschool education. Environmental awareness and attitude scale for preschool education children was used as data collection tool. The t-test for dependent and independent samples was used to compare children's environmental awareness and attitudes in experimental and control groups. When the findings were examined, it was identified that when compared to the control group, there is a significant difference in favour of children in the classes where TEMA Kids program was implemented in all sub-dimension and total scores of the scale except for the environmental attitude sub-scale protecting creatures sub-dimension.

Keywords: Environmental awareness, environmental attitude, TEMA kids educational program, pre-school education

Introduction

Environmental issues which are fundamental problems of many countries in the world and know no boundaries and ideologies (Kışlalıoğlu, & Berkes, 2009; Laza, Lotrean, Pintea, & Zeic, 2009) have reached to important dimensions due to their structural features. The main environmental problems in Turkey are water pollution, air pollution, wastes, noise pollution, and erosion, respectively (Environmental Inspection Report of Turkey, 2017). It is not possible to solve these problems with only technology or regulations because the main source of environmental problems are people with their habits, lifestyles, ideas, beliefs and values and political, economic, and cultural structures created by people. Thus, people's environmental knowledge, their individual attitudes and behaviours towards environment have to change via environmental education (Erten, 2005; Karataş, 2011; Miser, 2010).

Environmental education is defined as the process of understanding of the interrelatedness among people, their culture and their biophysical surroundings, clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate and recognizing values (Palmer, Grodzinska-Jurczak, & Suggate, 2003). Environmental education implemented with systematic and scientific ways involves environmental knowledge, attitudes towards environment, and good behaviours towards environment (Erten, 2004; Külköylüoğlu, 2000). Individuals gain environmental awareness necessary for making a decision about the subjects related to the environment's quality and developing individual behaviour principles with environmental education. Although environmental awareness is a dynamic structure which develops throughout life, laying the foundation of environmental awareness during the childhood is quite important to display positive attitudes and behaviours towards environment (Türküm, 1998; Wilson, 1996). Thanks to these experiences, children will gain behaviours, skills and values for the natural environment which will continue for a life time (Wilson, 1996).

Environmental education refers to covering a variety of different topics related to the environment in an educational setting (Heimlich, 2002). Environmental education designed for the children aims at providing cultural accumulation and giving information about environment, environmental issues, their solutions, and individual responsibilities (Morgil, Yılmaz, & Cingör, 2002). Environmental education begins within a family and continues in school. If this training is not provided in the family, the importance of school for this topic increases more (Morgil, Yılmaz, & Cingör, 2002). Because many families in Turkey are not qualified to train their children about environmental issues, environmental education curricula must be developed beginning from the first stages of basic education (Aktepe, 2005; Şimşekli, 2004; Yücel, & Morgil, 1998). It is viewed that environmental education programs implemented in the research studies carried out during the early childhood were effective for developing environmental awareness among the children (Ahi, & Alisinanoğlu, 2016; Carter, 2016; Cevher Kalburan, 2009; Chu et al., 2007; Dilli, & Bapoğlu Dümenci, 2015; Edwards, & Cutter-MacKenzie, 2011; Erol, 2016; Gambino, Davis, & Rowntree, 2009; Hadzigeorgiou, Prevezanou, Kabouropoulou, & Konsolas, 2011; Inoue, 2015; Kellert, 2005; McClain, & Vandermaas-Peeler, 2016; Pringle, Hakverdi, Cronin-Jones, & Johnson, 2003; Shin, 2008; Somerville & Williams, 2015; Stuhmcke, 2015; Witt, & Kimple, 2008). Moreover, the research studies reveal that environmental awareness acquired during the pre-school education was effective for developing positive attitudes towards the environment (Eliason, & Jenkins, 2008; Smith, 2001; Taşkın, & Şahin, 2008; Wilson, 1996).

In addition to families and educational institutions respon-

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sible for developing environmental awareness, mass media and non-governmental organizations have important roles (Selanik Ay, 2010). It is known that the programs about environment in Western societies are generally successful with the efforts of non-governmental organizations (Tont, 2000). TEMA (The Turkish Foundation for Combating Erosion, Reforestation and the Protection of Natural Habitats) has been carrying out important missions to increase awareness of environmental problems since 1992. As stated in the report of Council for Environmental Education-CEE (2004) decision-makers about the management of the natural assets, non-governmental organizations and educators will play important roles for shaping environment in the future. Educators are responsible for equipping the learners with necessary skills and knowledge so that they can carry out a good assessment over the stimuli in the environment and decision-makers about the natural assets and non-governmental organizations are responsible for providing the necessary technology and knowledge for achieving goals (CEE, 2004). TEMA Kids is a program in which educators and non-governmental organizations come together for the learners in the early childhood period.

TEMA Kids Program developed collaboratively by Turkish Association for Developing Pre-School Education is an education program intended for early childhood period and started piloting in 2010. The aim of this program is to have children raise awareness and develop positive attitudes about topics such as environment, nature, soil, erosion, and sustainable living. The main goal of the TEMA Kids Program which has been carried out since 2010 is to raise environmental awareness with the pre-school children and to create awareness about erosion and soil, one of the aims of TEMA Foundation. The program involves some basic information for teachers about soil, water, and air and 42 activities which will help the program to achieve its goals. One of these activities is called "clean air clean breath". In this activity some pictures depicting air pollution are hung on the walls. Children are asked to examine these pictures and talk about them. A field trip close to highway is held and children make observation, if seasonal conditions are suitable chimney of the houses are also examined. When they come to the classroom they have conversation about their observation and children are asked to draw about their observation on one side of a paper and where they would like to live one the other side of paper. The activity is evaluated with evaluation questions and by giving every child a chance to talk about his picture in front of the group. The activities are implemented by the pre-school teachers/ elementary school teachers. The representatives of TEMA Foundation accept the applications of the schools that volunteer to implement the project and provide the necessary materials to the schools. The volunteer teachers in these schools implement the educational activities in their classes and also demand help from the representatives with such activities as planting saplings, inviting a guest expert and fieldtrip. Teachers choose at least 26 activities out of 42 activities considering the children's age group and adapt the activities considering the region's local characteristics and implement them. The activities were designed and developed regarding the goals and objectives stated in the programs of Ministry of National Education (MEB) Directorate General of Basic Education. The activity form consists of the anticipated outcomes, learning process, materials, new concepts and vocabulary, evaluation of the activity, points to consider when implementing the activities and the extra activities that families can do at home. Moreover, different kinds of activities were recommended to increase the effect of the activities and to achieve different goals. The activities provide opportunities for children to experience life in nature and also they are intended for developing their skills like creativity, observation, and critical thinking. After the teachers perform their activities, they can also materialise alternative nature activities according to the children's interests and levels in the groups. The evaluation form for evaluating anticipated outcomes of the children aim at measuring children's level of awareness about the themes studied in the education program. The teachers are expected to fill out this evaluation form for each child at the beginning and at the end of the implementation (TEMA, 2013).

When the literature is reviewed, there is not any research study which examines the effectiveness of TEMA Kids Program which has been implemented with thousands of children since 2010. Within this context, it is considered that the study will make contributions to bridge the gap in literature.

Purpose

The aim of the study is to examine the effect of TEMA Kids Education Program on 60-72 month old children's environmental awareness and attitudes. The study seeks to answer the following related research questions:

1. Do the pre-test-post-test scores of the children in the experimental and control groups differ at a significant level?

2. Is there a statistically significant difference between the post-test scores which the children in experimental and control groups get from the Environmental Attitude and Awareness Scale?

Method

The study is a quasi-experimental research that uses pretest post-test control group design. The independent variable of the research is TEMA Kids Education Program and children's environmental awareness and attitudes make up the dependent variable of the research study. Accordingly, experimental and control groups were determined by using purposeful sampling method. The activities prepared by the group teacher according to the outcomes included in the programs of MEB Directorate General of Basic Education were used in both groups but in addition to these activities, TEMA Kids Education Program was implemented with the children in the experimental group throughout the education year. The teachers were set free to choose the program activities. They chose 28 activities and implemented these activities on the day they identified as TEMA kids program day. Each activity lasted between 30 minutes to 95 minutes. Implementing these activities started in September and completed in May.

The study group

138 children studying in pre-school education institutions in 2016-2017 education year composed the study group. Out of 138 children, 69 children (female= 32, male= 37) made up the experimental group and 69 (female= 34, male= 35) of them composed the control group.

Four classes with five year old children in an independent preschool where TEMA kids program was being implemented were identified as experimental group using purposeful sampling method. In this intuition in all classes TEMA kids program was being implemented so another intuition which had at least four classes with five year old children was chosen as control group. Pre-test and post-test couldn't be implemented to all control group and

Table 1. *The pre-test results of the environmental awareness and attitudes scale for pre-school children*

Sub-Scale	Sub-Dimension	Experimental Group			Control Group			
		n	*M*	*sd*	*M*	*sd*	*t*	*p*
Awareness	Consumption	69	4.65	1.42	5.07	1.18	-1.889	.061
	Protecting Creatures	69	7.75	1.87	7.81	1.70	-.190	.849
	Environmental Pollution	69	4.65	1.19	4.16	1.98	1.772	.079
	Awareness Total	69	17.05	2.75	17.04	3.49	.027	.978
Attitude	Consumption	69	8.57	1.37	8.94	1.53	-1.524	.130
	Protecting Creatures	69	6.92	1.34	7.26	3.76	-.694	.489
	Environmental Pollution	69	8.32	1.60	8.51	1.24	-.771	.442
	Attitude Total	69	23.81	3.38	24.71	4.42	-1.341	.182
Total		69	40.86	5.05	41.75	6.44	.898	.371

experimental group children (*n*= 200), because of different reasons such as absenteeism on the day test were implemented leaving school, unwilling to participate etc., so 138 children were included in the study. The independent t-test (for unrelated groups) was used to examine whether or not there was a statistically significant difference between experimental and control group children's pre-test scores from the "the Environmental Attitude and Awareness Scale for Pre-School Children" and the analysis results were presented in Table 1.

Table 1 presents that there is not a significant difference between the pre-test scores of the children in experimental and control groups from the Environmental Awareness and Attitudes Scale. It can be stated in line with this finding that children in both groups exhibit similar qualities in terms of environmental awareness and attitudes.

Data collection tools

Environmental awareness and attitude scale for pre-school children. "Environmental Awareness and Attitudes Scale for Pre-school Children" developed by Büyüktaşkapu Soydan and Öztürk Samur to determine the children's environmental awareness and attitudes towards environment was used in the study. The scale consists of two sub-scales, Environmental Awareness (12 items) and Environmental Attitudes (14 items), and total 26 items with pictures. Both sub-scales are composed of sub-factors of consumption, protecting creatures, and environmental pollution. Environmental Awareness sub-scale explains 40.94% of the total variance and Environmental Attitudes sub-scale explains 44.02% of the total variance. The factor loadings of the items in the Environmental Awareness sub-scale change between .39-.74 and .42-.74 for Environmental Attitudes sub-scale. The correlation coefficient between factors related to the children's Environmental Awareness sub-scale (consumption, protecting creatures, and environmental pollution), are *r*= .80, .78 and .83 respectively. The correlation coefficient between factors related to the children's Environmental Attitudes sub-scale (consumption, protecting creatures, and environmental pollution), are *r*= .70, .79 and .72 respectively. The statistics performed for the reliability reveals that Sperman Brown reliability coefficient for Environmental Awareness sub-scale was calculated as .65 and Cronbach Alpha reliability coefficient was calculated as .66. Sperman Brown reliability coefficient was calculated as .75 and Cronbach Alpha reliability coefficient was calculated as .73 for Environmental Attitudes sub-scale. Sperman Brown reliability coefficient was calculated as .60 and Cronbach Alpha reliability coefficient as .67 for the whole scale. According to the t-test results which were carried out to determine the distinctiveness of the scale related to the significance of the difference between lower 27% and upper 27%, there was a significant difference in favour of upper group. The scale's item distinctiveness power change between .32 and .40 for Environmental Awareness sub-scale and between .34 and .47 for Environmental Attitudes sub-scale. The scale's mean item distinctiveness power is .38 (Büyüktaşkapu Soydan & Öztürk Samur, 2017).

Data collection and analysis

Before the data collection, the staff and the headmasters of the schools were informed about the aim of the study. Then, Environmental Awareness and Attitude Scale for Pre-school Children scale was administered to the children individually in a quiet place in their school by the researcher. It took about 15 minutes to administer the test to each child. After ensuring that the children understand the question type with a sample item, the rest of the items in the scale were asked one at a time.

The dependent t-test (for related groups) was used to compare the children's pre-test post-test average point scores in experimental and control groups. The independent t-test was (for unrelated groups) performed to compare average post-test scores of the children in experimental and control groups.

Findings

The t-test results for dependent samples related to the pre-test and post-test scores of the children in experimental and control groups were presented in Table 2.

When Table 2 was examined, it was found that there was not a significant difference with the average pre-test post-test scores of the children in the experimental group in terms of protecting creatures sub-dimension of environmental awareness sub-scale (*t*= .832, *p*> .05) and consumption sub- dimension of attitude scale (*t*= -1.805, *p*> .05) but there was a significant difference with all other sub-dimensions. When the average point scores of the children in the control group were examined, it was determined that there was not a significant difference considering the protecting creatures sub-dimension of environmental awareness sub-scale (*t*= -.199, *p*> .05), consumption (*t*= -4.414, *p*> .05) and protecting creatures (*t*= -1.035, *p*> .05) sub-dimensions of attitude scale but there was a significant difference with all other sub-dimensions.

The independent t-test related to post-test scores of the children in the experimental and control groups were presented in Table 3.

Table 2. *The t-test for dependent samples related to the Environmental Awareness and Attitude Scale for Preschool Children (EAASPC) scores of the children in experimental and control groups*

Sub-Scale	Sub-Dimension		Experimental Group					Control Group			
			n	*M*	*sd*	*t*	*p*	*M*	*sd*	*t*	*p*
Awareness	Consumption	Pretest	69	4.65	1.42	-19.367	.00*	5.07	1.18	-25.285	.00*
		Posttest	69	9.64	1.26			8.94	1.11		
	Protecting Creatures	Pretest	69	7.75	1.88	.832	.40	7.81	1.70	-.199	.84
		Posttest	69	7.86	1.15			7.52	.65		
	Environmental Pollution	Pretest	69	4.65	1.20	-19.290	.00*	4.16	1.98	-20.040	.00*
		Posttest	69	9.52	1.19			9.01	.81		
	Awareness Total	Pretest	69	17.05	2.75	-16.730	.00*	17.04	3.49	-22.071	.00*
		Posttest	69	27.02	2.78			25.47	1.94		
Attitude	Consumption	Pretest	69	8.57	1.37	-1.805	.07	8.94	1.53	-4.414	.08
		Posttest	69	9.58	1.27			8.96	1.19		
	Protecting Creatures	Pretest	69	6.92	1.34	-2.740	.00*	7.26	3.76	-1.035	.30
		Posttest	69	7.72	1.14			7.52	.75		
	Environmental Pollution	Pretest	69	8.32	1.62	-2.996	.00*	8.51	1.24	-7.285	.00*
		Posttest	69	9.52	1.20			9.01	.815		
	Attitude Total	Pretest	69	23.81	3.38	-3.335	.00*	24.71	4.42	-3.967	.00*
		Posttest	69	26.82	2.78			25.49	1.94		
Total		Pretest	69	40.86	5.05	-11.144	.00*	41.75	6.44	-14.850	.00*
		Posttest	69	53.84	5.56			50.96	3.88		

Table 3. *The independent t-test related to Environmental Awareness and Attitude Scale for Preschool Children (EAASPC) post-test scores of the children in the experimental and control groups*

Sub-Scale	Sub-Dimension	Experimental Group			Control Group			
		n	*M*	*sd*	*M*	*sd*	*t*	*p*
Awareness	Consumption	69	9.64	1.11	8.94	1.25	-3.442	.00*
	Protecting Creatures	69	7.86	.64	7.52	1.14	-2.104	.03*
	Environmental Pollution	69	9.52	.81	9.01	1.19	-2.914	.00*
	Awareness Total	69	27.02	1.93	25.47	2.78	-3.370	.00*
Attitude	Consumption	69	9.58	1.19	8.96	1.26	-2.976	.00*
	Protecting Creatures	69	7.72	.74	7.52	1.14	-1.233	.22
	Environmental Pollution	69	9.52	.81	9.01	1.20	-2.891	.00*
	Attitude Total	69	26.82	1.93	25.49	2.77	-3.339	.00*
Total		69	53.84	3.87	50.96	5.56	-3.355	.00*

As seen in Table 3, when the post-test point scores of the children in the experimental and control groups were examined, it was found that the experimental group's average sub-dimension scores, total average sub-scale scores, and total average scale scores were higher than the average control group scores. When compared statistically, it was found that except for the protecting creatures sub-dimension of attitude scale (t= -1.233, p> .05), this difference was meaningful for the other total average sub-dimension, sub-scale average point scores.

Results and Discussion

In this study which was conducted in order to find out the effect of TEMA Kids Education Program on 60-72 month old children's environmental awareness and attitudes, it was revealed that there was not a significant difference with the protecting creatures' sub-dimension of environmental awareness sub-scale and consumption sub-dimension of attitude sub-scale of the children in the experimental group but there was a significant difference with all of the other sub-dimensions in favour of post-test average scores. When the average point scores of the children in control groups were examined, it was determined that that there was not a significant difference with protecting creatures sub-dimension of environmental awareness and attitudes sub-scale and consumption sub-dimension of attitude sub-scale; however, there was a significant difference with all of the other sub-dimensions in favour of post-test average scores. Considering this result, it can be stated that both the activities included in pre-school education program and TEMA Kids Education Program had effects on children's environmental awareness environmental attitudes except for having children raise awareness regarding protecting creatures and increasing attitudes towards consumption.

In addition to this, when the post-test scores of the children in experimental and control groups were examined, it was revealed that there was a significant difference in favour of experimental group regarding all of the other total average sub-dimension, sub-scale average point scores

except for the protecting creatures sub-dimension of attitude sub-scale. This result exhibits that TEMA Kids Education Program was more effective on children's environmental awareness and attitudes. In accordance with the current study a number of studies carried out also revealed that environmental education programs implemented within the framework of specific education programs during the early childhood period were more effective (Ahi, & Alisinanoğlu, 2016; Carter, 2016; Cevher Kalburan, 2009; Chu et al., 2007; Dilli, & Bapoğlu Dümenci, 2015; Edwards, & Cutter-MacKenzie, 2011; Erol, 2016; Gambino, Davis, & Rowntree, 2009; Hadzigeorgiou, Prevezanou, Kabouropoulou, & Konsolas, 2011; Inoue, 2015; McClain, & Vandermaas-Peeler, 2016; Pringle, Hakverdi, Cronin-Jones, & Johnson, 2003; Shin, 2008; Somerville & Williams, 2015; Stuhmcke, 2015; Witt, & Kimple, 2008).

One of the interesting results in the research study is that there was not a significant difference between the post-test scores of the children in experimental and control groups regarding protecting creatures sub-dimension of attitude sub-scale. In addition, it was observed that there was not a significant difference with the pre-test scores of the children in control group regarding protecting creatures sub-dimension included in awareness and attitude sub-scales but there was a significant difference only with children's attitude sub-scale scores in experimental group. Moreover, pre-test post-test scores of the children in both groups regarding consumption in attitude sub-scale did not differ. These results reveal that there is need for implementation of much more effective programs about protecting creatures and consumption to raise environmental awareness and improve attitudes.

A good environmental education for early childhood period must include a content related to real-life experiences, interactions with different disciplines, and communication with the children (Basile & White, 2000). The teacher must focus on experience more than teaching, he must show children his interest in environment and he must be a role-model about protecting the environment (Wilson, 1996). Environmental education must begin with simple experiences and children should have positive experiences in open spaces. Although TEMA Kids Education Program involves activities performed in nature, the children's interaction with nature in this process include a short and controlled period of time. Nowadays, children in many countries have a problem that play less in a limited space and in limited time unfortunately. They do not have opportunities to manipulate the environment creatively. In place of this, they spend much more time at home and they are engaged in pre-programmed activities under the supervision of an adult (Louv, 2010; McCans, 2004; Memik, 2004; Prezza, Alparone, Cristallo, & Luigi, 2005; Witten, Kearns, Carrol, Asiasiga, & Tavae, 2013; Turgut, & Yılmaz, 2010). Because the natural environment where children can play freely diminish gradually and children have limited time to spend and play freely outdoors (McCans, 2004), they cause children to be condemned to indoor settings. The children who live in urban areas and have an opportunity to play outdoors usually spend their time in supervised outdoor spaces under the intensive supervision of adults against physical dangers and security (Harden, 2000; Backett-Milburn, & Harden, 2004). In this context, the reasons for the inefficiency of TEMA Kids Education Program regarding protecting creatures sub-dimension is that children spend less time in nature, they cannot form an interaction with nature, and the possibility of children's interaction with the creatures gradually decreases. In addition to that, it is required that young children must observe similar behaviours in their family settings and have an opportunity to practise them so that the attitudes and behaviours they acquire via education at school become permanent. Because of that, it is very important that families must be included in the environment education programs developed for the children in early childhood classes. Thus, children will acquire permanent and positive attitudes and behaviours towards environment and also the training of adults who have more effects on environmental problems will be realized (Soydan, & Öztürk Samur, 2014). The research studies reveal that the families who are actively engaged in studies related to the environment encourage their kids (Chawla, & Cushing, 2007) and the family involvement and participation in environmental education programs are considerably effective (Erol, 2016). Thus, students, families, or community members must actively participate in educational environment programs to experience and learn the environment (Ballantyne, Connell, & Fien, 1998). Educational environment carried out with the family involvement in a time period out of school time can enable children to create a bond with the environment and develop positive attitudes towards the environment. Effective environmental education programs are very much interested in children's and teenagers' daily life and what they do in their own backyards (Ballantyne, & Packer, 2009). The activities carried out in nature during the childhood (games, walking, camping, climbing and etc.) affect the families, teachers, and the other role models' attitudes as well as children's behaviours towards the environment (Chawla, & Cushing, 2007). TEMA Kids Education Program offers activities for parental involvement to carry out with their children as suggestions but they are not obliged to do them. The undifferentiated scores at pre-test post-test for consumption in attitude sub-scale of the children in both groups can be due to non-involvement of the parents in the education program. Previous studies in the literature have shown that family is the most important factor in identifying children's consumption attitudes (Ateşoğlu & Türkkahraman, 2009; Ersoy, & Sarıabdullaoğlu, 2010; Kocakurt, & Güven, 2005; Lueg & Finney, 2007; Madran & Bozyiğit, 2013).

Pre-school environmental education can be carried out anywhere in which a child interacts with nature. However, this education must continue in both family and school life without being interrupted and a child should often be offered opportunities to have positive experiences with nature. A child who grows up in the natural world and has a regular relationship with it is expected to develop positive attitudes towards creatures and change his consumption habits to promote the conservation of nature. Thus, while teachers design and plan their activities, they must involve parents in the education program and children's interaction with nature should be supported by including education that is given in nature.

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iejee INTERNATIONAL ELECTRONIC JOURNAL OF ELEMENTARY EDUCATION

March 2018, Volume **10**, Issue **4**, **421-430**

Mathematics Skills of Kosovar Primary School Children: A Special View on Children with Mathematical Learning Difficulties*

Received: **03 January 2018**
Revised: **12 February 2018**
Accepted: **21 February 2018**
ISSN: 1307-9298

www.iejee.com

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DOI: **10.26822/iejee.2018438132**

Abstract

The present study examined the development of mathematics skills of Kosovar primary school children in terms of their gender, living area, socio-economic status, and achievement level. A special emphasis was placed on longitudinal investigations of the development of mathematics skills in children with learning difficulties in mathematics over a 2-year and 4-month period. Participants were 553 fourth-graders, 85 of whom identified with mathematical learning difficulties were classified into two subgroups: children with low mathematics achievement and children with limited mathematics ability. Results have shown that there were no gender differences in mathematics achievement. Children's living areas as well as their socio-economic status were observed to have a substantial impact on math performance. The performance level of limited math ability children was lower as compared to low math achieving children on all of the measures assessing math outcomes and reading comprehension. Findings indicate that a majority of the limited math ability group members still met the cutoff criterion after more than 2 years of school attendance.

Keywords: Mathematics skills assessment, mathematical learning difficulties, limited math ability, low math achievement, socio-economic background

Introduction

It is well recognized that many school-age children experience major difficulties in learning mathematics. Although having mathematical learning difficulties is not a new condition, only in recent years the research emphasis has been placed more seriously on this phenomenon by illuminating its complexity from varying perspectives, such as in terms of neuroscience; cognitive, developmental, and educational psychology; mathematics education; and special education. As a result of these efforts, a foundational pathway has been built for the establishment of a new discipline: mathematical learning difficulties (Siegler, 2007).

Traditionally, math ability has been considered more as a gift in a limited number of individuals, and society in general seems to have accepted this situation. Moreover, this acceptance shows in the reluctance and reservation of the majority to deal with mathematics as a universal language for all cultures, and the difficulties that occur while learning quantities and relations appear to be both expected and normal. This gives a plausible explanation for the persistence of math difficulties even into adulthood, impacting negatively on the individuals' decision-making in everyday life (McCloskey, 2007; Patton, Cronin, Bassett, & Koppel, 1997; Curry, Schmitt, & Waldron, 1996). Searching retrospectively, the roots of the failure in learning mathematics with understanding can be found in the first grades of primary school when mathematics as a subject begins to be formally taught. Thus, the importance of school-age children learning foundational math skills with insight during the first grades has become an immediate imperative, both in the mathematics curriculum and in terms of the instructional approach or pedagogy. A failure to learn the cornerstones of math, such as foundational math skills, may place children at potential risk for later educational and societal marginalization. In a developing country, as in Kosovo, with economic and social welfare deprivation, this is even more likely to happen. That is why the assessment of children's mathematics skills in school should become the first necessary, essential step for preventing such negative outcomes and supporting children's further development.

Research on normal mathematical development provides a useful framework for analyzing, understanding, assessing, and developing means for improving the performance of children with mathematical learning difficulties (Jordan, Hanich, & Uberti, 2003). Several studies on the normal development of mathematics skills have demonstrated empirically that most children, regardless of their socio-economic or cultural backgrounds, develop key elements of informal mathematics knowledge before they enter primary school and receive any formal mathematics education (Jordan, Huttenlocher, & Levine, 1992; Jordan, Kaplan, & Hanich, 2002; Jordan, Kaplan, Ramineni, & Locuniak, 2009). It appears that the emergence of math ability in the early years is related to a child's overall cognitive development, which enables math skills to be acquired and developed gradually during the primary grades (Jordan, Levine, & Huttenlocher, 1994). First, children learn to calculate by counting their fingers or concrete physical objects, and later they develop faster and more efficient counting strategies (Jordan et al., 2003). A combination of these two techniques allows them to balance speed and accuracy while they experience difficulties doing a task, which in turn increases the likelihood of them finding a correct solution (Jordan & Montani, 1997). At this point, mathematical learning difficulties that emerge in children could be due to an inability to access mental representations of quantities when physical objects are not provided. As Jordan and colleagues

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(2003) have noted, at later stages of development, many primary school children might be competent in following rules and procedures, but they often follow the wrong ones. The authors (Jordan et al., 2003) stressed that memorizing a procedure without understanding its underlying principles can lead children to make consistent mistakes (e.g., adding instead of subtracting and vice versa, failing to borrow or carry, taking the smaller number away from the larger number regardless of its position, and so forth). Thus, it is obvious that internalizing and understanding math operations and principles require both of the fundamental prerequisites: conceptual and procedural knowledge (Gersten, Jordan, & Flojo, 2005). In other words, a child should know not only what procedure to use and how to carry out that procedure, but also why he or she chose to do so.

Over the last two decades, several researchers have reported that mathematical learning difficulties are characterized either by developmental delays in the ability to apply calculation principles and strategies (Jordan & Montani, 1997; Aunola, Leskinen, Lerkkanen, & Nurmi, 2004), or by specific cognitive deficits (e.g., working memory, visual-spatial processing, or attention) in number fact retrieval and the execution of relevant procedures (Geary, 2004; Geary & Hoard, 2001; Swanson & Beebe-Frankenberger, 2004; Fuchs et al., 2005). As such, these shortcomings among children with mathematical learning difficulties may persist throughout primary school (Geary, 2004; Jordan, Hanich, & Kaplan, 2003a, 2003b; Jordan et al., 2002; Hanich, Jordan, Kaplan, & Dick, 2001; Ostad, 1998). Consequently, poor mastery of basic math skills further impedes the child's ability to focus on higher mathematical thinking (e.g., math word or story problems, algebra, geometry, etc.), as there are few or no cognitive resources left for recognizing and understanding the true meaning of the math task they are trying laboriously to perform. In addition, findings from previous research have shown that while the poor mathematics performance of primary school children was mediated by their weak number competence in kindergarten (Jordan et al., 2009; Jordan et al., 2003a), early understanding of number relations and operations provides support for learning complex calculation procedures involving thinking, reasoning and problem solving in varied contexts (Jordan et al., 2009; Booth & Siegler, 2006; Rittle-Johnson, Siegler, & Alibali, 2001; Geary, Hoard, Byrd-Craven, Nugent, & Numtee, 2007). Studies also suggest that children's mathematical thinking should be assessed on tasks that are directly related to the teaching of mathematics in primary school (Jordan et al., 2009; Jordan et al., 2003a; Rittle-Johnson et al., 2001; Baroody, 1996). This is because the nonverbal number and arithmetic concepts, as a basis for formal mathematical knowledge, seem to provide useful information about children's understandings of mathematics principles in terms of counting, arithmetic, place value, and so forth.

From this point of view, conducting such an assessment in Kosovo has been a challenge, since there has been no standardized assessment instruments for measuring children's mathematics skills and there has been a lack of domestic research documenting students' mathematics performance that would add to a cross-cultural perspective for understanding mathematical difficulties (Mullis, Martin, Foy, & Arora, 2012; Sirin, 2005). The access to information provided by evidence-based research is of great importance and value for theoretical and practical purposes. To fill this gap, a Finnish test of math skills achievement for 9–12-year-olds (RMAT; Räsänen, 2004) has recently been translated and adapted to suit the Kosovo context. The main purpose of the RMAT is to identify children having difficulties with mathematics learning when placed under a time restriction for the completion of math tasks. Previous studies suggest that children with mathematical learning difficulties may perform as well as their typically achieving peers in untimed conditions (Jordan & Montani, 1997; Geary, 1990). Therefore, as a time-limited test of basic math skills, RMAT seems suitable for the detection and identification of children encountering difficulties in learning mathematics. To understand the developmental nature of mathematical learning difficulties, follow-up assessments are necessary. Researchers pointed out that for the reliable determination of children's growth patterns, it is crucial that the measurement encompasses not only more than just a single assessment time point, but that this must be extended over two consecutive years, in which sustained difficulties in mathematics are more likely to unfold (see Geary, 1990; Mazzocco, 2007, for a complete discussion). This would also reduce the risk of false positives in identification (Mazzocco & Myers, 2003). Despite these prerequisites, longitudinal studies are scarce and there is still a lack of consensus concerning the definition of mathematical learning difficulties (e.g., Jordan et al., 2002; Jordan et al., 2003a; Jordan et al., 2009; Mazzocco & Myers, 2003; Geary, Hamson, & Hoard, 2000; Geary et al., 2007; Geary, 2011; Geary, Hoard, Nugent, & Bailey, 2012; Morgan, Farkas, & Wu Qiong, 2009; Stock, Desoete, & Roeyers, 2010; Vukovic & Siegel, 2010), and thus our work was guided in that direction.

Additionally, the fact that all children are introduced to and familiarized with some aspects of basic math skills in their living environments long before they enter formal schooling also suggests the role of children's socio-economic backgrounds in this development, and thus, this needs to be considered when assessing their math skills. Several studies have acknowledged that more children from low socio-economic settings rather than those coming from middle socio-economic backgrounds meet the criteria for math difficulties (Royer & Walles, 2007; Jordan & Levine, 2009; Anders et al., 2012; Sirin, 2005; Davis-Kean, 2005; Jordan et al., 1994, 1992; Crane, 1996). With the publication of TIMSS 2011 International Results in Mathematics (Mullis et al., 2012), math results have been examined in the context of the major influences on student learning, including home support, school and learning climate, and teacher preparation for mathematics instruction, recognizing the complex interplay of societal, school, and home environmental factors. As the newest country in Europe, Kosovo has its specific context. It is worth to mention that Kosovo society has gone under the tremendous development during the last decades: from post-conflict and transitional struggle to effort for releasing from the troubled past and adjusting to a recent established democratic system. These positive and negative circumstances have directly influenced the students' and teachers' education in Kosovo as well.

Thus, our research efforts were focused on two key areas. First, the study aimed to examine mathematics skills development in fourth-grade children who have received formal mathematics education in primary school, taking into account their gender, living area, socio-economic status (SES), and achievement level. The reason for selecting fourth-graders for the study was based on the fact that most of the basic concepts and skills have been introduced to the children by that time in school, and because it is thought that mathematical learning difficulties may not be very stable in the earlier grades (Geary, 1990). As every child has his or her unique path in math skills development, it is assumed that this would reflect the differences even in the group of children identified with learning difficulties in mathematics. Thus, to assess the stability of the observed math problems, the study also focused on

the development of math skills with a subgroup of children. The second aim was to examine the lowest performing subgroup of children with limited mathematics ability in comparison to the rest of the children with low mathematics achievement. The main research questions of the study were:

1. Whether mathematical performance of fourth-grade children is affected by (a) gender, (b) living area, and (c) socio-economic background?
2. Whether children with limited math ability differ from children with low math achievement in their mathematical development?
3. Whether performance on math skill measures accurately predicted group membership over time (stability and/or change)?

Method

Participants

A total of 553 Kosovar fourth-grade children (*M*= 115 months, *SD*= 5.58 months) participated in the present study. Of these, 306 were boys and 247 were girls. The participating schools were randomly selected from five main regions of Kosovo. In each school, the children in two classes were tested. Altogether, 20 classes from 10 schools took part in the study. Within a subset of those classes, children with difficulties in learning mathematics were identified. Schools from urban and rural areas were included in this study so as to accurately represent the population. There were 314 children from urban areas and 239 children from rural areas.

Then, on the basis of poor performance on the RMAT mathematics achievement (a cutoff criterion at or below the 15th percentile for limited math ability and a cutoff criterion above the 15th percentile, but below the 35th percentile for low math achievement), a subsample of 85 children (48 boys and 37 girls) with learning difficulties in mathematics were selected from the main sample. They came from eight classes of two urban (*n*= 31) and two rural (*n*= 54) primary schools selected randomly in two municipalities of Kosovo with middle to low SES. Children with poor mathematics skills were identified by the use of the mathematics achievement RMAT test (Räsänen, 2004; Räsänen & Salihu, 2006). Based on the RMAT test score, all children who scored below the 35th percentile on national norms were included in the study. As suggested by prior research, there are two reasons for using this cutoff percentile. First, because it increases the possibility for picking up in the screening those children who have serious mathematical learning difficulties (Hanich et al., 2001; Jordan et al., 2003b; Geary et al., 2000; Jordan & Montani, 1997; Räsänen & Ahonen, 1995), and second, math achievement based on RMAT score may mask children's specific deficits because the test contains different types of items (see Mazzocco, 2007; Mazzocco & Myers, 2003; Gersten et al., 2005; Gersten, Clarke, Haymond, & Jordan, 2011, for a complete discussion). All children attended general education classes and none of them were receiving special educational services. During the follow-up, eight children moved to other schools and one, for personal reasons, discontinued participation in the study. All parents, except one, gave their written consent for participation in the study. As a result, 76 children (63 with low math achievement and 13 with limited math ability) were included in the analyses of the follow-up. Prior to its initiation, the study protocol was approved by the Kosovo Ministry of Education, Science and Technology Committee.

The children's background information that was related to their parents' occupations was collected from the school records. The data comprised of 95.3% for the fathers of the children and only 8.7% for the mothers of the children (mostly women-headed households). Specific data for the parents' educational level were not available. Based on occupational category, it was possible to distinguish each parent's occupation as belonging to one of the two categories: white-collar professions or blue-collar professions. A total of 27.1% of mothers and 20.5% of fathers were working in white-collar professions (such as doctors, attorneys, economists, engineers, teachers, etc.), and 16.7% of mothers and 69.1% of fathers were working in blue-collar professions (mostly part-time workers). In addition, 56.3% of mothers' and 10.4% of fathers' activities did not belong to either of the above-mentioned groups (e.g., housewives, students, pensioners, or unemployed).

Measures

Mathematics achievement. The children's mathematics achievement was assessed in a group classroom situation with RMAT - A Mathematical Achievement Test for 9–12-year-olds (Räsänen, 2004; Räsänen & Salihu, 2006). The RMAT was used for all participants in this study to determine which children had mathematical learning difficulties and required additional support (Salihu, Aro, & Räsänen, 2017). RMAT is a time-restricted group test enabling screening of many children in a short time. The RMAT test mainly consists of basic math skills, such as multi-digit calculations (e.g., 6000 – 627; 204 · 12), fractions and decimals (e.g., 3/10; 5 · 0.3), measurement (e.g., 9 l= __ dl), and algebra tasks (e.g., x: 20= 8). The original item selection for the RMAT was based on the idea of a restricted time for test completion to enable screening of many children in a short time. The test items were assessed first by conducting a pilot study with the Kosovo population. The Kosovo RMAT-test is a translation of the Finnish RMAT-test, and preliminary results showed that there was no need for major adaptation made to the items. This means that the original character of the Finnish RMAT-test items were not lost in the translation process. In Kosovo the test was used as a screening tool in order to identify children with mathematical difficulties a year and a half before the other data were collected. The time limit for the test was 10 minutes. Since RMAT was developed as a one-dimensional test (Räsänen, 2004), there is only one total score to interpret. One point is given for each correct answer. Consequently, the total maximum score for the test is 56 points. The reliability and validity of the RMAT test have been shown to be sufficiently high in Finnish population (Räsänen, 2004) and Swedish population of Finland (Räsänen, Linnanmäki, Haapamäki, & Skagersten, 2008), and it has proven to be suitable for measuring mathematics skills of Kosovar children. As reported by Räsänen (2004), the Cronbach alpha reliability was .92–.95 at ages 9–12; the correlation with the WRAT-R (Jastak & Wilkinson, 1984) was .547–.659. The Cronbach alpha coefficient on the Kosovo sample was .916. The RMAT test was used two more times with the group of children identified as having learning difficulties in mathematics with an interval of six months between the second and third assessments. The Cronbach alpha reliabilities on this sample at two measurement points were .892 and .912.

Calculation skills

The Mathematics Performance Test on Calculations (MPT-C; Salihu, 2008) comprised of 25 items with one- and two-digit number combinations (addition, subtraction, multiplication, and division operations) and with four response options presented horizontally. It was

administrated in a group classroom situation. Children had 20 minutes for task completion. The score was the number of correct answers. The Cronbach alpha reliability on this sample was .889.

Reading comprehension

The children's reading comprehension was assessed by a short passage with five questions and four response options presented beneath in a worksheet. The test was given in a group situation. Children had 5 minutes to respond. The score was the number of correct responses. The task was used three times within a year with an interval of 5 months in between. The correlations between the summed scores at three measurement points ranged from .491 to .678.

Nonverbal intelligence

Children's general IQ was assessed using the Raven's Standard Progressive Matrices (SPM) (1976) test. The SPM measures nonverbal reasoning with 60 items divided into five sets (A, B, C, D, and E), each made up of 12 problems which become progressively more difficult. The test was administered individually. The test administrator presented a series of patterns and the child selected the missing piece from 6 or 8 possible choices. The score is the number of correct responses. The test is considered to be an efficient instrument to measure cognitive ability of subjects from childhood until adulthood (Raven, Raven, & Court, 1998).

Procedure

The data collection was carried out in the middle of the school year among fourth-grade primary school children (see Table 1) in five main regions of Kosovo. The RMAT test was administered in groups of 12–15 children in the classroom. It was administered by the first author, with the help of the class teacher. Pencils and eraser were the only permissible equipment for the test, but children were allowed to count with their fingers or use a piece of paper for their workings. The children were allowed to count with their fingers or use a piece of paper for their workings. The children were instructed to solve as many of the problems as they could within the 10-minute time limit. After receiving the test instructions, the children were given the RMAT test booklets.

Table1. *Assessment Timeline During Three Consecutive School Years*

Grade Fourth	Grade Fifth	Grade Sixth
RMAT 1	MPT-C	RMAT 2
	Reading comprehension 1	Reading comprehension 2
	RPM	RMAT 3
		Reading comprehension 3

Note. RMAT= math achievement test, MPT-C= math performance test on calculations, RPM= Raven's progressive matrices, 1, 2, 3= assessment time point.

After the first assessment, the group of children identified by the RMAT test as low achievers in mathematics was assessed further, over the 2-year and 4-month follow-up period. In addition, since our main sample was spread out across the territory of Kosovo, we were only able to include 85 children in the follow-up. The second assessment, at the end of fifth grade, consisted of a math performance (MPT-Calculation) test, a reading comprehension task, and Raven's SPMs. Further, the RMAT and reading comprehension skills were assessed two more times at the beginning and in the middle of sixth grade (see Table 1).

Data analysis

Raw scores were used in the data analyses. All the analyses were performed at significance level .01. After checking the assumptions for parametric testing, univariate analyses of variance (ANOVAs) were carried out to examine the impact of gender, living area, and socio-economic background on children's mathematics skills. This allowed us to assess the main effects of gender, living area, and socio-economic background, as well as their possible interactions in the main sample and in the subsample.

Next, we examined the difference between children with low math achievement and children with limited math ability in terms of their performance on different scales using an ANOVA. The pattern of growth in children's math achievement was investigated using a repeated measures ANOVA. Finally, the percentages of changes in group membership were used to assess the stability of the classification over time.

Results

Results for the main sample

The results of the present study showed that the mean RMAT Kosovo score (M= 24.72, SD= 7.59, n= 553) was almost identical to that reported for the pilot sample (M= 24.03, SD= 7.45, n= 67).

ANOVAs revealed no statistically significant gender differences in children's math skills, $F(1, 549)= 4.43$, $p= .036$, $\eta^2= .008$ (see Table 2). A statistically significant difference in math performance was found between children from urban areas and those from rural areas, $F(1, 549)= 70.21$, $p<.001$, $\eta^2= .113$, the children from the rural areas scoring lower as compared to their peers from the urban areas (Table 2). The gender-by-living-area (urban, rural) interaction did not reach significance ($p= .128$).

An ANOVA showed that parents' professional category also had a significant effect on children's achievement score, indicating that children whose parents were in white-collar professions had better scores in math as compared to those whose parents were in blue-collar or other occupations: for both parents, $F(2, 550)= 15.16$, $p<.001$, $\eta^2= .05$; for mothers, $F(2, 45)= 5.69$, $p= .006$, $\eta^2= .20$; and for fathers, $F(2, 524)= 14.26$, $p<.001$, $\eta^2= .05$. No significant differences were found in the performance of children whose parents (mothers and fathers) belonged to blue-collar and other occupational categories (see Table 2). Tukey tests revealed that children whose parents were in white-collar professions achieved better scores than children whose parents were in blue-collar professions (mean difference= 4.30, $SE= 0.77$) and those whose parents were in the other occupational category (mean difference= 4.39, $SE= 1.05$). However, no differences were observed in terms of achievement in RMAT between children whose parents belonged to blue-collar and other occupational categories (mean difference= 0.08, $SE= 0.89$).

Overall, the omnibus result revealed that there was no significant interaction between parents' occupation and living area, $F(2, 541)= 1.29$, $p= .276$, or parents' occupation and gender, $F(2, 541)= 0.35$, $p= .705$. The interaction between gender and living area was also not significant, $F(1, 541)= 2.41$, $p= .121$. The same pattern was observed for 193 children identified with low achievement in mathematics (all $p> .205$).

Table 2. *Descriptive Information for Children's Math Skills Performance by Gender, Living Area, and Parental Occupation Category*

Parents Professional Category	All			Girls			Boys			Urban			Rural		
	n	*M*	*sd*	*n*	*M*	*sd*	*n*	*M*	*sd*	*n*	*M*	*sd*	*n*	*M*	*sd*
White collar	112	28.21	5.97	49	27.73	6.36	63	28.59	5.67	89	28.76	5.75	23	26.09	6.44
Blue collar	365	23.91	7.84	154	23.60	7.70	211	24.14	7.96	174	26.60	6.31	191	21.46	8.30
Other	76	23.83	7.18	44	23.80	6.91	32	23.88	7.64	51	24.80	6.81	25	21.84	7.62
Total	553	24.77	7.60	247	24.45	7.47	306	25.03	7.70	314	26.92	6.37	239	21.95	8.16

Findings showed that these children do not differ in math performance as a function of gender (p= .577), but they differ significantly as a function of living area, again with lower score for children from rural schools F(1, 189)= 8.30, p= .004, η^2= .04 (see Table 3).

Table 3. *Descriptive Information for Low Mathematics Achievement Subgroup by Gender and Living Area*

Variable	*n*	*Mean*	*SD*	*F*(1.189)	*p*
Girls	86	16.21	6.14	0.31	.577
Boys	107	16.67	5.76		
Urban	74	17.97	4.87	8.30	.004
Rural	119	15.53	6.33		

Results for the subsample

The results from the analyses further revealed that with the exception of their IQ level, which did not differ significantly (p> .100), children with limited math ability performed significantly worse than children with low math achievement on all the other measures (RMAT 1, RMAT 2, RMAT 3, Calculation, Reading comprehension 1, Reading comprehension 2, and Reading comprehension 3), with all p< .010 (see Table 4).

To investigate the pattern of growth in children's math skills and the changes that occur over time in more depth, a repeated measures ANOVA was undertaken with assessment (RMAT 1, 2, 3) as a within-subject factor, and subgroup (low achievement and limited ability) as a between-subject factor. The results showed that there was a significant improvement in children's math performance over the period of time, F(2, 146)= 47.77, p< .001, η^2= .39. The interaction between assessment and subgroup did not reach significance, F(2, 146)= 0.26, p= .770, revealing a similar pattern of development of math skills across the two groups. The same findings were observed for children's reading comprehension skills, with a significant main effect, F(2, 146)= 8.05, p< .001, η^2= .10, and no significant interaction effect between the factors, F(2, 146)= 0.80, p= .453. The significant main effect for the subgroup indicated that the difference in math performance remained across assessments between the groups, F(1, 73)= 75.47, p< .001, η^2= .51. A similar result was found for reading comprehension, F(1, 73)= 19.94, p< .001, η^2= .21.

The stability of the classification was determined by looking at the percentages of the changes in group membership over time. Based on the scores in RMAT, approximately 60% of the children (8 out of 13 children) were classified correctly into the limited math ability group, remaining consistently below the 15th percentile of the limited math ability criterion across three assessment points. Moreover, about 30% of the children still remained in the low math achievement group in the fifth and sixth grades, performing below the 35th percentile (as the cutoff criterion).

Discussion

This study was designed to examine the development of mathematics skills of Kosovar primary school children with respect to gender, living area, socio-economic status, and achievement level. A special emphasis was placed on, and thus increased attention was devoted to the longitudinal investigation of the development of mathematics skills in children with learning difficulties in mathematics over a 2-year and 4-month period.

The results of the study reveal that there are no significant differences in mathematics performance between boys and girls. This finding was expected, since it is in accordance with the most frequent findings from the other studies (Lachance & Mazzocco, 2006; Lindberg, Hyde, Petersen, & Linn, 2010; Royer & Walles, 2006; Tate, 1997; Marshall & Smith, 1987). Our findings expand upon previous studies and support the claim that gender differences

Table 4. *Performance Outcomes in Mathematics Skills, Reading Comprehension, and Nonverbal Reasoning by Low Achievement Subgroups*

Variable	Low Mathematics Acihievement		Limited Mathematics Ability			
	Mean	*SD*	Mean	*SD*	*F*(1.74)	*p*
RMAT 1	18.16	3.74	6.08	2.60	22.62	<.001
RMAT 2	25.54	5.50	13.46	5.14	53.10	<.001
RMAT 3	25.50	7.45	14.62	5.14	25.12	<.001
MPT-C	16.32	5.18	7.38	4.07	34.20	<.001
Reading comprehension 1	3.37	1.31	2.08	1.32	10.38	.002
Reading comprehension 2	3.89	1.18	2.15	1.73	19.69	<.001
Reading comprehension 3	4.15	1.13	2.77	1.74	13.03	.001
RPM	36.51	5.67	31.15	5.24	9.84	.002

Note. RMAT= math achievement test, MPT-C= math performance test on calculations, RPM= Raven's progressive matrices, 1, 2, 3= assessment time point.

in mathematics achievement for children from the third to sixth grades are minimal or nonexistent (Mullis et al., 2012; Marshall & Smith, 1987), and that girls and boys perform very similarly almost on all assessments of mathematics skills (Lachance & Mazzocco, 2006; Tate, 1997; Lindberg et al., 2010).

In contrast, the study results demonstrate that there is a huge gap in math skills achievement between the children as a function of their living area, indicating that those who live in urban areas performed significantly better and achieved higher scores than their rural counterparts did. One of the explanatory factors for the mathematics achievement gap between urban and rural children is inequality in learning opportunities and support. In fact, children from rural areas of Kosovo have less access to educational opportunities both at home and in the classroom, which in turn has had a major impact on their mathematics knowledge and skills from early childhood onward. More specifically, rural children typically come from a lower socio-economic background, which is associated with having a lower parental-education level, lower income, and consequently, limited resources for obtaining adequate nutrition, and for having stimulating didactic materials in their homes, as well as not being able to afford enrichment activities (sport, music, dance). Almost all of these disadvantage factors are considered to be associated with lower academic performance (Crane, 1996; LeFevre et al., 2009; Davis-Kean, 2005; Dooley, 2011, McNamara & Kendeou, 2011; Thornton, 2018). Consistent with this finding, Mullis and colleagues (Mullis et al., 2012) reported that a location of school (urban vs. rural) had a substantial impact on students' overall low mathematics achievement in the developing countries which are in close distance with Kosovo such as, Macedonia, Croatia, Romania, Turkey, etc. Moreover, findings from our study are in line with prior studies showing that children's math skills seem to be affected by parental occupation category, favoring children whose parents are in white-collar professions (Mullis et al., 2012; Anders et al., 2012; Kaşkaya, Calp, & Kuru, 2017; Sirin, 2005). As a result of the social and cultural variation in the children's home settings, it is likely that the input they receive may also vary qualitatively (Castro et al., 2015).

Indeed, since the children were fourth-graders, it might be quite plausible that the explanation for this disparity lies in inadequate and poor quality mathematics instruction, which is determined mostly by the teachers' insufficient educational background, qualification being achieved with only a 2-year associate's degree. The process of qualification of in-service teachers with a bachelor's degree has been finalized in the recent years. In line with this, Ertle, Ginsburg and colleagues (Ertle et al., 2008) also found that teachers of children with low SES tend to have lower levels of education and less teaching experience than teachers of children with middle SES, and the quality of math instruction is substantially related to the teachers' education and their professional development (Reid & Reid, 2017).

When the group of low mathematics achievers was divided into two subgroups, we found substantial differences between low math achieving children and limited math ability children in terms of their performance in reading comprehension and nonverbal reasoning. Findings show that children with limited math ability performed much worse than children with low math achievement on all of the scales, including measures for the math outcomes. This suggests that children with limited ability may have more pervasive academic deficits than children with low achievement. Similar findings with regard to reading-related skills and IQ that highlighted potential qualitative differences in the two groups of children with mathematical learning difficulties have been reported in other studies (see Hanich et al., 2001; Mazzocco & Myers, 2003; Jordan et al., 2003b; Murphy et al., 2007; Vukovic & Siegel, 2010).

Regardless of group membership, development was observed in the children of both groups over the follow-up period. A comparison of children in the two groups also showed that while the low math achieving children reached the fourth-grade performance level in the sixth grade, the limited math ability children still lagged far behind. It should also be noted that the groups were similar with respect to gender, living area, SES, and nonverbal reasoning.

Although most children with mathematical learning difficulties exhibit difficulties with fluent, accurate, and automatic retrieval of basic arithmetic combinations, the findings support the claim that children with limited math ability represent a distinct subgroup in comparison to the group of children with low math achievement (Jordan & Montani, 1997; Jordan et al., 2003b; Geary et al., 2007; Geary et al., 2012). In comparison to low achieving children, the limited ability children performed substantially worse in all of the math-related skill tasks. As has been found (Geary et al., 2007; Murphy et al., 2007; Stock et al., 2010; Vukovic & Siegel, 2010), while the use of a lenient criterion identifies children that may have more subtle deficits in a certain math domain, the use of a restrictive cutoff criterion identifies children with pervasive and often severe cognitive deficits as well as underlying deficits in working memory and processing speed.

The study showed that the confirmed status of children with limited math ability, since around 60% of them continually met the cutoff criterion below the 15th percentile on three assessment points more than 2 years after the original classification. Our finding is consistent with the study showing that approximately 66% of children with limited math ability continue to meet this criterion over time (Mazzocco & Räsänen, 2013). Taken together, although the data document the stability of mathematical difficulties that become a distinctive feature for limited math ability children over time, persistent mathematical difficulties were also observed in approximately 30% of children with low math achievement.

Limitations

It is worth noting, however, that the small number of children with limited math ability can be considered as a limitation of the study and should be taken into account in any attempts for generalizing the findings. In order to compensate for this, an adjusted alpha was used and effect sizes were provided which reveal the magnitude of differences for comparisons between groups. Furthermore, the measure we used for reading comprehension served as a brief control task for assessing children's reading comprehension and it is not a standardized one. To gain a deeper understanding of children reading ability perhaps a more sophisticated standardized measure for assessing reading fluency and comprehension is needed.

Conclusions and Future Directions

The findings of the present study suggest that mathematics instruction during the primary school grades in Kosovo is not at the level needed, since a considerable number of the fourth-grade children seem not to be educated adequately in mathematics. Thus, the major concern that arises here is not whether children are capable of learning mathematics skills (Ertle et al., 2008), but whether teachers are able to teach them to every individual child, includ-

ing those with mathematical learning difficulties,by showing enough sensitivity toward children's unique learning needs. Seen from this perspective, it is not surprising that in Kosovo, as in most Balkan countries, students with learning difficulties are not rarely considered as a burden in the classroom. Although this attitude has started to change (Thomas. 2013), creating opportunities for equal access to knowledge and skills for all children, as it is stressed earlier, still remains a challenge for today's teachers and to teacher education (Tarrou, 1996; Darling-Hammond & Baratz-Snowden, 2005; Hargreaves & Fullan, 2012).

In regard to this, a special emphasis should be put on identification and prevention of early math failure in the first primary grades, particularly in rural schools, since as the results suggest, it can have persistent negative consequences for later math learning. Furthermore, the interventions programs tailored to meet the learning needs of children in two subgroups should become an integrative part of math teaching. Our study documented that children with low math achievement and children with limited math ability represent two distinctive subgroups since they differ not only in math performance, but also in reading comprehension, and nonverbal reasoning. Attendance of more than two years of regular math instruction in school did not change the status of majority of children identified with limited math ability. If left untreated with special educational service most of the children with limited math ability, as well as a considerable number of the children with low math achievement, will remain in the same subgroup over time.

As mathematics is by nature cumulative and progressive, and because it has been shown that early mathematics skills are even more powerful predictors of later school success than reading skills are (Duncan et al., 2007), it is of critical importance to detect and identify problems as early as possible. In fact, the challenge of tackling inadequate mathematics learning and instruction, as well as students' low achievement in mathematics, has become a matter of national concern in many countries (Gersten et al., 2009). Thus, further research is necessary to examine and determine the long-term effectiveness of instructional math interventions that provide opportunities for math learning to directly connect from the classroom to the home, and consequently, have the potential to help children with mathematical learning difficulties improve their mathematics competency.

Acknowledgments

This study was supported by the Finnish Support to the Development of Education in Kosovo (FSDEK II) Project and in part by the University of Prishtina "Hasan Prishtina". We wish to express our appreciation to the children for their generosity in sharing their time to participate in the study.

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March 2018, Volume **10**, Issue **4**, **431-439**

Children's Perspective on the Right of Self-determination

Received: **26 October 2017**
Revised: **21 February 2018**
Accepted: **13 March 2018**
ISSN: 1307-9298

www.iejee.com

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DOI: **10.26822/iejee.2018438133**

Abstract

The present study was conducted to determine the thoughts of children, whose lives are governed by decisions taken by adults, on the right to self-determination. The study was conducted as a generic qualitative research, a qualitative research design. The study group included 16 children. The data were collected with semi-structured interviews conducted with children. Before the data collection process, the solo test game was played with children as ice breaker. After the solo test game, the modified version of the Cinderella fairy tale was read by the children and they were asked questions about the fairy tale. The objective of the modified Cinderella tale was to make children imagine a world where the decisions are taken by children. After the fairy tales, the semi-structured interview was conducted. The interviews were conducted upon the approval of the children to record the conversations, and the replies provided by children who did not provide approval for voice recordings were noted by the first author. The findings were analyzed with descriptive analysis. Based on the analysis results, the collected data was grouped in five categories that were organized under two themes. In conclusion, students stated that they were able to decide on daily matters such as selecting clothes, what to eat, however, they were presented with no choices in matters that could affect their lives such as school selection. Children stated that adults do not believe that children can make decisions on issues relevant to children's lives.

Keywords: Self-determination right, right to participate

Introduction

Concept of self-determination reflects the decisions made by individuals regarding processes related to themselves and their ability to execute these decisions (Deci, Connell, & Ryan, 1989). Although studies and documents on self-identification processes usually focus on adulthood, the foundations of the processes related to adulthood are laid during the childhood (Grolnick, Gurland, Jacob, & Decourcey, 2002). However, examination of the self-determination processes in childhood demonstrated that children do not have a say on issues related to their lives although this is their basic right. This suggests that children are passive individuals who respond to adults' demands and expectations in their lives (James, Jenks, & Prout, 1998).

The position of children in processes that related to their own lives is associated with the perspective of the society on childhood. Because the concept of childhood is a social construct created by the society (Archard, 2004; Elkind, 1999; Heywood, 2003; Onur, 2005; Postman, 1995; Sorin, 2005). This social construct determines whether the child would be the subject of her or his own life or a passive practitioner. According to Corsaro (1977), in social structures called the "constructivist model", the child plays an active role in his / her social world, however in the "deterministic model", the child has a passive role in his/her life.

The reason why the children are kept in a passive position is the perception of the adults that the children are not mature enough, do not know what is right for them, and cannot correctly perceive and assess the conditions (Edwards, 1996). Therefore, "strong" adults believe that "weak" children could not make sound decisions about their education and their future (Giroux, 2009). However, children's passive status about decisions about their own lives would also affect their adulthood. It is not possible to expect that children who are passive practitioners of decisions made by adults during childhood would be independent adults in the future (Hart, 2016, p. 16). Thus, the fact that children should have a right to speak on all issues that affect their lives, which is called the right to participate, is included in The United Nations Convention on the Rights of the Child (UN CRC, 1995). Due to the problems experienced in practice, the nature of the accession processes and the responsibilities and obligations of the party states on the issue are detailed in the General Comment No. 12 published in 2009. In particular, it was emphasized that children should be listened to and be active participants in all matters affecting their lives (UN CRC, 2009). Although the child's right to be listened to and self-determination is considered as a fundamental right in the Convention of the Rights of the Child, there are several problems in practice due to various factors that affect the enforcement of this right. For example, the right to self-determination can be influenced by factors such as the socio-economic structure or cultural characteristics that the child is exposed to. Thus, the participation processes determined by children's families and societies vary significantly by culture (Hart, 2016, p. 11). As a result, the environment in which the individuals live influences their competence in self-determination (Coleman, 2000).

The objective of the present study was to obtain the views of 10-13 age group children on the right to self-determination. At this stage of the study, the right to participate will be portrayed as the meanings that children ascribe to the concept of self-determination. The study is limited to children aged between 10 and 13 years during the 2016-2017 academic year. It was assumed that children provided sincere answers that reflected their thought to the questions.

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The following research questions were determined to investigate the views of children on self-determination:

1. What are their positions in decision making processes?
2. In which topic could they make their own decisions?
3. What are the views of children on their competence in decision making?

Methodology

Study design

This study was conducted as a generic qualitative research, a qualitative research design. In generic qualitative studies, the researcher attempts to understand the meaning of a phenomenon based on the perspective of the participants. Meanings are discovered by concentrating on how individuals build the truth in their interaction with their social environment (Merriam, 2015, p. 22). In the present study, it was attempted to find how the children interpreted the concept of self-determination based on their experiences and the transformation of their experiences into awareness.

Participants

Snowball sampling, a purposive sampling method, was used in the study. This method entails the inclusion of the participants who easily fit the study criteria. After accessing these participants, they are asked to access other participants to enlarge the snowball, thus creating new situations where information could be collected (Patton, 2014). The study participants included 16 children between the ages of 10 and 13.

Table 1. *Participants demographics*

Participant	Age	Gender
1. Dila	10	Female
2. Fatma	10	Female
3. Nazlı	10	Female
4. Buse	11	Female
5. Selen	11	Female
6. Dilek	12	Female
7. Kumsal	12	Female
8. Aleyna	13	Female
9. Bora	10	Male
10. Enes	10	Male
11. Kadir	11	Male
12. Altan	12	Male
13. Hakan	12	Male
14. Mehmet	12	Male
15. Metehan	13	Male
16. Murat	12	Male

Ethical considerations

Studies conducted in the past to understand childhood was in the form of research on children (Christensen & Prout, 2002; Darbyshire, 2000; Oakley, 1994). The experiences of the children, who were the objects of the studies, were attempted to be acquired via the adults in their environment. However, with the adoption of the idea that contemporary children are social actors shaping their own lives, this conventional perspective began to collapse and studies started to consider children as participants (Christensen & Prout, 2002; Alderson, 2005; Woodhead & Faulkner, 2000).

The recent studies on childhood emphasize that research techniques should be adapted to children or new methods specific to children should be used when conducting studies with children (Darbyshire, Schiller, & MacDougall, 2005; Punch, 2002). In studies that acknowledge that children are competent social actors, child-friendly methods should be preferred (Punch, 2002). Thus, child-specific manners and methods were attempted to be used in the present study. Based on the idea that all children love to play games, it was considered that an ice-breaking game should be played to increase the interaction with the children and to enforce the participation of the child. The solo test game was chosen among the games that could attract the interest of the study group. The solo test game is among the games where it is easy to share the rules and play the game in a short period of time when interaction with the children was possible. Also, the efforts to use child-specific ways and methods showed the way to select the data collection instrument and method. To initiate the chat, efforts were spent to find a story associated with the study topic. The modified version of the Cinderella tale found in the emphasizes gender equality. Based on this fairy tale, a new tale that emphasizes the concept of self-determination, which is the study topic, was written by the authors by writers and used in the study. The Cinderella tale was read to the children before the interview questions were asked.

During the interviews, information was provided to children that the interviews will be recorded on tape and if they did not want recordings, their responses could be written by the interviewer and their approval was received. The responses of the two participants, who did not want to be recorded during the interviews, were written by the interviewer. Informed verbal consent was obtained from the children who were recorded on tape and written informed consent was obtained from the participants whose responses were manually written. Based on the "informative" quality of participation, the objective of the study was explained to the children and the study was initiated with the children who volunteered to participate. Informed consent was obtained from children to include the characteristics of child participation (informative, volunteer, respectful, relevant, inclusive, safe and sensitive against risks). The names of children that participated in the study were changed and assigned nicknames were used. Interview records were analyzed by the first author and an independent field expert scholar separately and disagreements were resolved by consulting the second author and establishment of an agreement. The results of the evaluation were calculated using the Reliability= Agreement / Agreement + Disagreement formula (Miles & Huberman, 2015). The overall reliability of the study was determined as 89%.

Data collection

At the beginning of the study, the child was met, the solo test game was demonstrated, and the game was initiated after the consent of the child was obtained and the child volunteered. After the solo test game was played, it was explained to the child that a different version of the Cinderella fairy tale will be read and then, a chat would be conducted about the story. Interviewer asked the child; "Do you want to read the story or do you want me to read it to you?" The modified version of the Cinderella fairy tale emphasized the concept of self-determination, which was the subject of the present study. In this mod-

ified fairy tale, Cinderella is an adult and the original bad stepmother, Shila is a child. In this fairy tale, decisions are taken by children and adults have to adhere to those decisions. The fairy tale aimed the children to imagine a world where they could make the decisions and the adults need to obey these decisions through the substitution process in the tale. Thus, they were asked to observe their experiences from a different perspective. After reading the story, interview questions were asked. In the interview, seven questions were asked to the children on their views on decision-making, whether their opinions were asked when decisions concerning them were made, whether children could make decisions about themselves, what decisions they could make, which topics they should never make decisions on, and whether adults believed that children could make decisions about themselves.

The interviews were held between October and December 2016. Digital audio recorder was used during the interviews. The responses of the two children, who did not want their voices to be recorded, were written down by the interviewer. The talks lasted between 20 and 30 minutes and interviews were conducted by the first author. In the interview procedure, at first, the objective of the study was explained, the consents were obtained, the solo test game was played, then the Cinderella tale was read and interview questions were asked.

Data analysis

After the interviews were completed, the voice recordings are transcribed by the interviewer without any alterations and the interviews were enumerated in the order that the interviews were conducted. The transcript lines were enumerated starting from one. The transcriptions were examined, outlined and categorized under five topics.

The data obtained with the interviews were analyzed with "descriptive analysis" under two determined themes. In generic qualitative research, the meaning of a phenomenon "is created but not discovered". The primary objective of generic qualitative research is to expose and describe these meanings (Merriam, 2015, pp. 22-24). Descriptive and direct quotes that are the foundations of qualitative research provide a more facile interpretation and understanding of the thoughts, feelings and perspectives of the involved individuals (Patton, 2014, p. 503). In the present study, direct citations of the views of the children were presented and the data were constructed based on these quotes.

Research have a concern for producing and presenting valid and reliable information by adhering to ethical principles. In qualitative research, different approaches were proposed to determine internal validity or credibility. In the triangulation technique, which is one of the recommended techniques, an attempt is made to maintain consistency between the findings of the study and presented data (Merriam, 2013, p. 212-213). For this purpose, the study themes and categories were determined by the two authors and the categories and the subcategories were checked by an independent scholar. Concurrently, the analysis process was conducted by the first author and the abovementioned scholar separately for all 16 children. Disagreements were resolved by consulting the second author and establishment of an agreement.

Findings

Right to self-determination

Themes, categories, subcategories and codes on right to self-determination are presented below;

Table 2. *Themes*

Theme	Category	Subcategory	Code
Beliefs about decision-making	Who makes / should make decisions	*Adults for the child*	*Children should ask adults (2), adults make decisions (2), children cannot do it (1), parents could make better decisions than us (1), I do what I am told (1),*
		Children	*Children could make decisions as well (1),*
		Co-decision	*Everyone should be asked (4),*
	Self-efficacy perception of children on decision-making	*Children could make decisions*	*Children should decide to reach their goals (1), about homework (1), rational children could decide (1), children 12 years old and older could decide (1)*
		Children could decide on certain occasions	*They could decide on topics directly related to them such as clothing (3)*
		Children could not decide	*Adults are better in thinking (1), children cannot think clearly (1), children could make wrong decisions (1)"*
	Views of children on decision-making beliefs of adults	*They do not believe that children could make decisions*	*Adults are more intelligent (3), they underestimate us (3), because they have more experience (2), because we can select the wrong school (1), because we may not buy adequate clothes (1), because we do not know anything (1), because they believe that they could guide us (1), because they underestimate our mind (1), they know better (1), they consider themselves superior to children (1), because children could not think clearly (1)*
		They believe that children could make decisions	*They believe that children could make decisions on topics related to children (1)*

Table 2. *(Cont.) Themes*

Decision Topics	The subjects they think they could make / could not make decisions and reasons	The subjects they think they could make decisions	*clothing (9), homework (3), school items (3), sports (2), food (2), play (2), toys (2), issues related to children (2), fixing their room (2), places to go (2), doing the things they like (1), buying for themselves (1), in many topics associated with me (1)*
		The subjects they think they could not make decisions	*Topics related to my parents (4), nothing (2), whom I can or cannot meet (2), shopping (2), buying a house (2), school selection (2), places to go (2), health issues (2), buying a car (1), interior decoration (1), buying technological devices (1), course content (1), travel to other countries (1), going to the bathroom during class (1), to have my own room (1)*
		Reasons for not making decisions	*Because they are young (3), adults could make better school selection (2), because they cannot sign (1), one needs to be an adult to buy a home (1), because a child cannot distinguish individuals with bad intentions (1), adults know better (1), children could not make the calculations required for shopping (1), would not want to interfere with the teacher's business (1), a child cannot travel to another country and cannot get a passport (1)*
	The topics about which their views were asked / not asked	The topics about which their views were asked	*clothing (6), going out (2), school (2), haircuts (1), food (1), fixing their room (1)*
		The topics about which their views were not asked	*Clothing (2), places to go (2), courses (1), sports (1), health issues (1)*

Beliefs about decision-making theme

"Who makes / should make decisions" category. The views of the children on decision-making are grouped under the sub-categories of "adult instead of the child (8), co-decision (4) and child (1)". Children who think that adults make decisions expressed their views as follows: "Children should ask adults (2), adults decide (2), children cannot (1), parents can make better decisions than we do (1), I do whatever they say." Aleyna (age 13) stated her views on decision making as follows:

> *"I do not have many chances to make a decision. Sometimes I say that I will do my homework tomorrow, but my mom does not listen to me and makes me do all my homework that day."*

Buse (age 11) expressed her views on decision making as follows:

> *"For example, children always have to ask grown-ups, unfortunately. Then, for example, you are in a family, you are in a community it should be asked to everyone when making decisions."*

Kumsal (age 12) stated that adults do not allow children to make decisions because they underestimate children and expressed her views as follows:

> *"Of course our parents can make better decisions than we do, I do not oppose that, they are older than us, they grew up like us, they have walked the same path as we do now, but they ignore these issues as well, I mean, I could understand us a little, nut no, they do not think like that. Because adults look down on us, they scorn. "*

Metehan (age 13) stated that he thinks children cannot make decisions and said that *"They cannot think clearly because they are not settled yet. That is, they cannot."*

Mehmet (12 years old) stated that he always thought that decisions are taken by the adults, but that everyone should be asked:

> *"What is right should happen. Generally, the adults decide about it. I think everyone should have a say. What the majority of votes say, that is what should be. "*

"Self-Efficacy of Children about Decision-Making Category". The beliefs of children that they can make decisions about themselves included the subcategories of "children can decide (7), children can decide sometimes (3), children cannot decide (4)". The responses of children who thought that they can decide were as follows: "children should decide to reach their goals (1), children could decide about homework (1), reasonable children can decide (1), and 12 years old and older children can decide (1)." Children, who thought they can make decisions from time to time, stated that they could decide on matters that concern themselves such as clothing. Children, who thought that they could not make decisions, stated that "adults are better in thinking (1), children cannot think clearly (1), children can make wrong decisions (1)." For example, Bora (age 10) stated that he thinks children cannot make decisions about health:

> *"I do not think they can. For example, I cannot tell the doctor that there is such a pain in my stomach. If we are not with adults, the doctor cannot decide as well."*

Selen (age 11) argued that children can make decisions as follows:

> *"They can decide. For example, I just imagine, you want to buy this thing, and you have enough money, why should you ask someone? You want it. Why do you have to get permission from someone? But we have to ask the adults, unfortunately. Sometimes they approve, sometimes they do not."*

Kadir (age 11) stated that he thinks children cannot decide because they are not good in thinking like adults:

> *"I do not think they can. Because adults are better at thinking. For example, which school I should go, you know those peo-*

ple who work at the factory publish textbooks, if the children did it, the textbooks would no longer be text books."

Metehan (age 13) thought that children cannot make their own decisions: *"No they cannot. They cannot think clearly, that is, it is a child's mind. They make the wrong decisions.*"

Hakan (age 12), who was one of the seven children who thought that children can make decisions about themselves, expressed their thoughts as follows:

> *"Of course, especially about the classes... One can always make decisions because one is always free about one's self, nobody can oppose him, everyone can make one's own decision; as long as man remains equal to man."*

"Views of children on the adult beliefs about decision making" category. The children answered the question "Do adults believe that children can make their own decisions about the issues that concern them?" with the following answers: "They do not believe that (15), They believe that (1)". They explained their reasons as "Adults are more intelligent (3), they underestimate us (3), they are more experienced (2), they think that we may select the wrong school (1), they think that we may select the inappropriate clothing (1) (1), because they believe we do not know anything (1), because they think they can guide us (1), because they know better (1), because they consider themselves superior to children (1), because they believe that children cannot think clearly (1)." For example, Buse stated that adults belittle children and this hurts children's feelings:

> *"No. They think that we cannot make our own decisions because we are children, and they look down on us. We, as children, are so bored with it, they can hurt our feelings."*

Mahmut (age 12) stated that adults do not believe that children can decide on matters that concern them:

> *"They do not believe that. Because they think they are more experienced in their own..."*

Nazlı (age 10) stated that adults believe that children are not smart enough and can only decide on matters such as what to wear at school:

> *"They do not believe that. Because they think that children are not smart enough. I think we are. Adults grow up because their minds are more intelligent, because they are smarter. I think adults are more smart than children. They believe we can only decide on matters such as school clothing."*

Selen (age 11) expressed her opinions as follows:

> *"No. Because we are younger, we do not know anything, they would guide us, we will take our first steps or something... I think this is not right. In fact, parents should do this; I think they should leave their children be first, then ask what did you decide, the child should respond, did you really liked it, they should really go and ask, but they should do it, only on matters that concern the children. It is different in real life, just the opposite."*

Kumsal (age 12) stated that adults think that children cannot make decisions because adults think they are not smart:

> *"They do not believe that. They think they are so much older than us. They are in fact, but they belittle us, they think our minds are inapt, but I do not think so."*

Similar to the views of Kumsal, Altan (age 12) stated that he thinks adults belittle children:

> *"They do not believe that. They do not give their children what it is due, they try to decide themselves. I do not know why they do it, just because they are smarter? They probably underestimate their own children."*

Hakan commented as follows:

> *"Most adults do not believe that... Because adults think they are superior to children. They think, you do not know it, but we do."*

However, besides the abovementioned answers, Metehan expressed his ideas that children take everything as a game and thus, the adults are right as follows:

> *"They do not believe that. Children are not exactly clear, or most children are different. Their minds work differently. Children cannot think clearly, they perceive all as a game. Those at my age cannot make all decisions by themselves, that is, we are still young. "*

Decision Topics Theme

"The topic they think they could make / could not make decisions and reasons" category. The responses given by the children in the subcategory of the topics that children think they can make decisions were as follows: "clothing (9), homework (3), school items (3), sports (2), food (2), play (2), toys (2), issues related to children (2), fixing their room (2), places to go (2), doing the things they like (1), buying for themselves (1), in many topics associated with me (1)." For example, Selen (age 11) stated that children think that they can decide on matters of interest to them:

> *"In matters that are related to me. For example, I study piano and I should decide where and how. I mean, not so much, my mother makes the research and tells me what is available. And then I got to choose. That is how it happens."*

Aleyna (age 13) expressed her thoughts on the issues that children could make decisions as follows:

> *"On topics such as playing, toys, children can make their own decisions. Then kids can make their own decisions about clothes. They can make their own decisions about doing things they like. Nothing else more or less."*

Buse (age 11) expressed her thoughts about the topics they can decide as follows: *"They can arrange their rooms as they please. They can choose their clothes. I think they can get what they want if their financial situation is good.*
"

There were also children who said that children should get their parents' permission in all matters, as well as children who thought that they can make their own decisions. Dila's (age 10) following response that *"For example, I ask my mother even if I want to jump rope, or I ask my mother when I want to watch TV,"* demonstrated the fact that certain children had to get their patents' permission for everything.

Dilek (age 12) stated that only children could make decisions about their own goals:

> *"Children can make their own decisions about education, because it is the child's goal, they can make decisions on that, it is up to the child, not up to her family. She can do it, his family would only support his education, would pay for it. For example, if she needs a pen, they would buy the pen for her. But they cannot attain our goals. Because it is not up to them, because it is our goal."*

The responses of the children in the subcategory of the topics that children think they cannot make decisions were as follows: "topics related to my parents (4), nothing (2), whom I can or cannot meet (2), shopping (2), buying a house (2), school selection (2), places to go (2), health

issues (2), buying a car (1), interior decoration(1), buying technological devices (1), course content (1), getting a tattoo (1), traveling to other countries (1), going to the bathroom during class (1)." For example, Nazlı (age 10) expressed her thoughts on the issues that children cannot decide as follows:

> *"For example, when my father and mother are discussing about an issue, I say in my opinion it should be like this, but they do not listen."*

Buse (age 11) stated that she thought she could not decide about the people she could meet:

> *"Whom I should meet or I should not. For example, people who have bad intentions that approach me, others could observe, but I might not notice. As such."*

Aleyna (age 13) stated that she believed that she could not decide about the choice of school and the purchase of technological equipment:

> *"School selection. Buying a big thing such as getting a phone, tablet, computer..."*

Kumsal (age 12) stated that she could not decide about whom to befriend since her mother does not allow her to meet the children she does not approve.

Hakan (age 12) stated that he thinks that he cannot decide what to do in the classroom:

> *"For example, in class, I would not want to decide about it anyway. Whether the teacher would instruct, would check the homework, or something else, I think I cannot decide about these things. Because I would not want to interfere with the teacher's business."*

The answers of the children in the subcategory "why children cannot decide" were as follows: "because they are young (3), adults could make better school selection (2), because they cannot sign (1), one needs to be an adult to buy a home (1), because a child cannot distinguish individuals with bad intentions (1), adults know better (1), children could not make the calculations required for shopping (1), would not want to interfere with the teacher's business (1), a child cannot travel to another country and cannot get a passport (1)". Most of the reasons they considered were related to "being a child". For example, Bora (age 10) expressed the reason why he did not think he could decide as follows:

> *"For example, you must be an adult to buy a house, an adult must sign for it, I cannot sign."*

Nazlı (age 10) stated the reasons why she thought she cannot decide as follows:

> *"Because we are minors, adults are not, so they always make the decisions. Because they think they can do it. For example, they do not ask their children when they consider about something because they want to think by themselves, they never want to ask the children."*

Kumsal (age 12) stated that she thought adults could be right. Her thoughts were as follows:

> *"They were like us, too, they traveled the same path, they might know better than we do. They must know something, so they tell us what to do."*

Hakan (age 12) stated that he thought he could not decide which topic the teacher would instruct in the class or whether a topic would be instructed or the homework would be checked.

Metehan (age 13) stated that he could not travel to foreign countries since he could not get a passport:

> *"I cannot travel to another country due to my age. I am still a child. One cannot get a passport by one's self."*

"The topics that their opinions were asked / not asked" category. In the subcategory of the topics where children's ideas were asked, the following answers were recorded: "clothing (6), going out (2), school (2), haircuts (1), food (1), fixing their room (1)" and in the subcategory of the topics where children's ideas were not asked, the following answers were recorded: "clothing (2), places to go (2), courses (1), sports (1), health issues (1)." For example, when Murat (age 12) stated the following topics that his opinion was asked / not asked when decisions were made about him:

> *"In some, they ask. For example, when I have a haircut, they ask my opinion, but when they decide about which course I would attend, or which sports I would be registered, they do not ask my opinion. I always want other things, but they always register me for swimming. They rarely ask me about the things that concern me. Sometimes they ask about personal things. Things like haircut, but for example, I do not end up getting any outfits that I show to my mom, how old she thinks I am?"*

Buse (age 11) stated that when big decisions are made about her, they ask her:

> *"For example, my mother tells me that I will go to the school. But when I get up one morning, he tells me that you will not go to school. She makes my decisions. In such unimportant things. For example, they ask me about things like when they want to change my school."*

Kumsal (age 12) stated that there were times when her parents did not ask her opinion when deciding about matters that were related to her:

> *"She asks me what to cook, what do I want to eat. But then, there are times she would not, for example, let us say she is going out for fun, she makes decisions for you. I do not want to go to my mom's friend, but she would tell her okay, we will visit you with Kumsal this afternoon. But I do not want to visit her, but no one asks me."*

As there were children whose opinions were not asked when making decisions, there were also children whose ideas were asked. Hakan (age 12), for example, expressed that his opinions were asked when decisions were made on issues that concerned him:

> *"They ask about my decisions yes, but it is a little dependent on the environment. For example, in a good environment you can really reflect your decision to people and if there is no obstacle to prevent you to reflect it freely, you can reflect it. For example, if a person considers himself as superior but not equal, it would make you feel about making a decision about him."*

Conclusions

There are several authors who considered childhood as a restricted period in life and indicated that fact in their works (Holt, 2000; Firestone, 1979; Pavese, 2012). One of the most important reasons behind this is the fact that in childhood, children are not active in decision-making processes associated with themselves and have to live a life based on the decisions made by adults. Thus, children who are forced to become the objects of their own lives experience a restricted lifestyle. However, for children to recognize themselves as an individual, they should make their own choices and to experience the consequences of these choices. However, when the children are not given the choice to make decisions about themselves, the

chance of the children getting to know themselves is also taken from them (Perry & Szalavitz, 2013, p. 93).

While the decision-making process of children about their own lives is examined, it was observed that certain children were active in this process and certain others were passive practitioners of the decisions that adults made for them. Children, who think they do not have a say in the decision-making process, often stated that their parents make the decisions. In a study by Akyol (2011), although an approach where the views of children are obtained during the decision-making processes concerning matters pertaining the children has developed, due to the prevalence of the conventional perspective, the decisions of children on topics related to their lives were still not allowed. However, as a result of the lack of opportunities for children to participate in their lives, children would not be able to recognize their autonomy and would continue their lives as passive individuals (SC, 2010).

During the decision-making processes, the children who are aware of the idea that "everybody is entitled to their views" stated that the current situation was exactly the opposite. In a study conducted by Oktay and Kumbaroğlu (2011), children stated that they had no right to speak about their decisions. They considered that this was due to the fact that they were 'underestimated' by adults. There were participants who stated that the adults should understand the children since they traveled the same path. Punch (2002) explained this phenomenon by stating that although all adults experience the childhood period, since they could not make sense of childhood with their present minds and adult perspective, it would not be possible for them to understand children.

There were children who considered that they should be active in the process of making decisions about themselves, there were other children who thought that adults should make the decisions for them. Children considered themselves as inadequate, and they expressed that they considered that adults could make better decisions. This could be due to the fact that children remained in a continuous passive position while decisions were made about them. It is expected that children who have no experience in the decision-making process would consider themselves inadequate in decision-making. It is not possible for individuals, who do not make choices and experience the consequences of these choices, to believe that they could make decisions about themselves (Perry & Szalavitz, 2013).

Self-efficacy perceptions of the participants on decision-making of the children reflect the perspective of the children on childhood. For example, statements such as 'children cannot think clearly, this is mind of a child' or 'adults are better at thinking' suggest that children considered children as inadequate. The view that adults were 'smarter' than children and that adults can make the right decision about the children was rather dangerous because it would negatively affect children's development, emotions and capacities (SC, 2010). However, participants who considered that 'children should make their own decisions to achieve their goals', though that children were entitled to make decisions. Whether the individuals considered the children are entitled to make their own decisions or not is directly related to their own experiences.
Although there were participants who considered children adequate for decision-making, it is regrettable that there were children who stated that they asked their mothers even when they wanted to jump rope and were not able to choose their friends or clothes. The participants who thought that children should make decisions only on "trivial(!)" matters such as clothing, playing games and fixing their rooms were the majority. In similar studies, it was observed that families were involved in the selection of children's friends and had low level of beliefs about the decision making abilities of their children (Dönertaş & Aksel, 2011; SC, 2010; Spielhofer et al., 2010). In a study conducted by Madge (2006), children stated that they wanted to decide on trivial matters related to their lives such as "bedtime or bath time" and did not expect to have more say in others. It was regrettable that only one participant in our study though that he can decide on several issues that concern him and lived such a life.

When they were asked whether they thought that adults believed children could make own decisions, almost all children stated that they thought adults did not believe it. They stated the reasons for the disbelief of adults as "they consider that children are not smart enough, they think that children should be guided, and they underestimate the children". Giroux (2009) explained this situation by stating that "strong and knowledgeable" adults do not believe that "weak and ignorant" children can make sound decisions about their education and their future. Children's statements in the present study supported the ideas of Giroux (2009).

When the topics that the children could/could not decide were examined, it was observed that they considered that they could decide on trivial matters such as "clothing, games, toys and food." It was a pity that there was only one child, who indicated that he can decide on almost any aspect of his life. However, Article 12 of the CRC states that children's ideas must be obtained when making decisions about children.

Participants stated the topics on which they would never decide as "the choice of school, who to meet and who not to meet with, shopping for the house, and the instruction content in the classroom". The participant, who thought that he could not decide what should be instructed in the class, said that "this business should be decided by someone with a college degree". The reason could be explained by the prevalent approach that includes a perception and distrust that entails the incompetency of children in the management of their own learning processes (Bäckman & Trafford, 2007). When asked "why do you think children cannot decide?" the children replied "because we are young and adults are grown up, thus they make all the decisions', 'there should be a reason why they always decide', 'because the children roam between dreams and reality', thus, it could be argued that the abovementioned distrust that encompasses several areas in life affects the children as well and results in negative judgments about themselves.

Although there were children who stated their ideas on issues that would "not affect their lives" such as buying clothes or what they would want to eat were asked, it was upsetting to find children who thought that their ideas were not asked even in the same issues. Unfortunately, the right to participate is not considered as the participation of the child in her or his life, in decisions that would affect her or his life (Kjorholt, 2008). The presence of participants who argued that whether their ideas were asked or not depended on people considering them as equals, suggested that children were aware of the current situation.

These negative thoughts on participation cause children to question their competence and to make negative judgments about this competence. However, for children to be able to manage their own lives as a free individual, it

is necessary to have these experiences starting from an early age. In support of these processes, children need to take an active role in domestic and educational processes that are related to their lives. Otherwise, individuals who could only implement the decisions made by adults and lack the ability to make their own decisions throughout life would be raised.

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iejee | INTERNATIONAL ELECTRONIC JOURNAL OF ELEMENTARY EDUCATION

March 2018, Volume **10**, Issue **4**, **441-447**

Effects of Early Morning Physical Activity on Elementary School Students' Physical Fitness and Sociality

Received: **21 January 2018**
Revised: **05 March 2018**
Accepted: **13 March 2018**
ISSN: 1307-9298

www.iejee.com

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DOI: **10.26822/iejee.2018438134**

Abstract

As part of the Comprehensive School Physical Activity Program, we investigated how early morning physical activity affects elementary school students' physical fitness and sociality. Seventy-five boys in 6th grade of one elementary school located in G Metropolitan City, Korea comprised the experimental group that participated in early morning physical activity for 6 months. The control group did not perform said activities. Experimental design for this study adopted pre- and post-measurement and comparison methods between groups. Collected data were analyzed with analyses of covariance and Bonferroni post-hoc tests. The experimental group showed significant differences in the improvement of cardiorespiratory endurance and muscle strength among the sub-elements of physical fitness compared to controls. They also showed significant differences in the development of sociability, activity, autonomy, stability, and dominance among the sub-factors of sociality compared to controls. We elucidated the importance of early morning physical activity performed before school, which has implications for schools' physical education programs.

Keywords: Comprehensive school physical activity program, early morning physical activity, physical activity before school, physical fitness, sociality

Introduction

Physical activity in childhood is closely associated with health. Physical activity refers to all movement of the body caused by the contraction of the skeletal muscles (World Health Organization, 2015) and plays a vital role in energy consumption. However, despite many positive effects provided by physical activity, there is an increasingly decline in physical activity opportunities for students in school (Brusseau, Tudor-Locke, & Kulinna, 2013). In addition, due to the characteristics of modern society and the way science and technology has increased individuals' sedentary lifestyle, opportunities for physical fitness have been reduced, which contributes to health problems such as obesity, chronic diseases (Mavrovouniotis, 2012). Recent research data shows that about one-third of adults are obese, which is associated with chronic diseases such as hypertension, diabetes, hyperlipidemia, and metabolic syndrome (i.e., "hypo-physical activity disease") (Flegal, Carroll, Ogden, & Curtin, 2010; Kohl & Cook, 2013). Since this phenomenon also occurs increasingly in younger age groups (Kann et al., 2015; NPAPA, 2016), it is necessary to recognize the importance of life-long physical activity and examine its effects during specific periods (Centers for Disease Control, 2011). Furthermore, 65–80% of adolescents who are obese will be obese as adults (Guo, Chumlea, & Roche, 2002; Wright, Parker, Lamont, & Craft, 2001). In addition, adolescent obesity is associated with depression, low self-esteem, helplessness, isolation from peer groups, and mental and psychosocial problems (Baker, Beckstead, Mangelsdorf, & Thummel, 2007). Therefore, additional physical activity opportunities are needed at school to improve the overall health and well-being of children (Dinkel, Lee, & Schaffer, 2016).

To develop sociality, it is essential that sociality education is intentionally and deliberately performed, including socializing children from their families to community and school peer groups (Kim, 1996). Jang (2010) suggested that in addition to improving students' physical fitness, physical activity can help social development to solve social problems such as the formation of good friendships and school maladjustment problems. Appropriate physical activity plays a positive role in developing sociality through sportsmanship, improved human relations, and stress relief. In addition, Lee & Kim (2003) reported that students participating in physical play or sports activities are healthy, physically strong, socially adaptable, and can cope with stress. However, opportunities for participating in specifically planned and organized physical activity programs are few (Brusseau et al., 2013).

Efforts should be preceded to increase the physical activity time spent by elementary school students to solve these problems. Recently, the Comprehensive School Physical Activity Program (CSPAP) was presented internationally to address the lack of physical activity among children (Brusseau & Hannon, 2015). The CSPAP includes five components: 1) quality physical education, 2) physical activity before and after school, 3) physical activity during school (both recess and classroom activity), 4) staff involvement, and 5) family and community engagement (CDC, 2013; NASPE, 2008). It is recommended that students get about 60 minutes of physical activity per day (U.S. Department of health and human services, 2008) since physical activity has a positive effect on students' knowledge, skills, and their confidence in being physically active throughout their lifetime (CDC, 2013).

Many countries recognize the importance of physical activity and are trying to solve health problems of children and adolescents through policies or projects using the CSPAP. The United States is reported to maintain health and prevent chronic illnesses in students through programs such as "Let's Move! Active Schools" program (CDC, 2015). They are placing a priority on physical education and physical activity in school education. In Europe, Ireland has implemented the "Active School Flag" program to form a school community with physically active habits. Finland has implemented the

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"Finnish Schools on the Move" program to promote students' physical activity. In addition, Germany employs a "Moving Schools" program to enhance its citizens' physical activity levels (Tannehil, van der Mars & MacPhail, 2015). In sum, the CSPAP is being utilized internationally to ensure students' physical activity opportunities; however, many prior studies only focused on designing programs to simply increase students' participation time in physical activity rather than physical activity programs to achieve meaningful educational goals. In addition, there are many cases where programs for each country (Tannehill, Mars, & MacPhil, 2015) and communities are not suitable to their own reality, resulting in application difficulties. This study, therefore, as a part of CSPAP, tried to make the goal clear that before school physical activity programs offer students an opportunity to be physically active and achieve meaningful educational goals.

Early morning physical activity was introduced through the success stories of Naperville high school students in Illinois, USA, which indicated that physical activity programs conducted in school before formal classes were shown to activate the brains of the participating students and helped them improve their concentration and accomplishment (Ratey, 2008) Since the program was introduced, it has increasingly been conducted in schools across many countries; however, there are few detailed studies addressing the effects on the participating students other than those related to cognitive ability (Michael, Merlo, Basch, Wentzel, & Wechsler, 2015). Moreover, most physical activity programs focus notably on the effects on students through formal physical activity during school.

Therefore, a study that addresses students' health, physical strength, schoolmate relationship, and school adaptability after participating in a regular and periodic early morning physical activity program is needed. Consequently, we examined elementary school students' physical fitness and sociality. It is anticipated that specifically examining the educational effects of students' participation in early morning physical activity will play a vital role in influencing school physical education programs to implement physical activity before school and ensuring that students get the required amount of physical activity each day.

Method

Early morning physical activity program

Early morning physical activity program was conducted about 40 minutes before the start of regular class. The students exercised on the school grounds or in the auditorium everyday for 6 months. To promote students' active participation in physical activity and keep them motivated continuously, we planned a program including exercises that they were usually interested in. As a result of asking students about their favorite physical activity, soccer was dominant. Therefore, to encourage the voluntary motivation of the students, we organized a program for soccer activities, and constructed another group for physical activities other than soccer. As a result, we separated students into 3 groups: (1) participated in soccer activities, (2) participated in other sport activities, and (3) a control group that did not participate in early morning physical activity (i.e., reading). Students participating in physical activities were encouraged to take part in the program by adjusting their intensity according to their own physical strength with maximum autonomy. In addition, we organized various forms of participation such as pair/group activities that allowed students to interact with their friends as well as individual activities (Table 1).

Table 1. *Operating Program of Early Morning Physical Activities*

Operating program	Activity time	Activity details	
Warming up	5 min.	Preparatory gymnastics, 2 laps around a 150-meter playground	
Main exercises	30 min.	Soccer activities	Other sport activities
		-Basic skill practices (pass, kicking, dribble, shooting) -Formal soccer game	-jumping rope, table tennis, dodge ball, tee-ball, badminton, basketball, soft-ball, floor-ball
Cool-down exercises	5 min.	Stretching or cool-down gymnastics after running lightly	

Participants

The participants selected for this study were 75 male students who were in the 6th grade of elementary school, had not had a medical disease for 6 months, and had no difficulty exercising. We included only boys to control for developmental characteristics. The study purpose and design was explained in detail to parents in a school curriculum presentation session at the beginning of the semester. In addition, to control for differences in classroom culture and homeroom teachers, students were groups into the experimental or control group as a whole rather than by class. Participants' characteristics per group are shown in Tables 2.

Table 2. *Participants' Physical Characteristics*

			Height (cm)	Weight (kg)
Experimental group A	*n* (25)	Mean	152.65	45.81
		Standard deviation	8.15	10.20
Experimental group B	*n* (25)	Mean	151.15	44.42
		Standard deviation	5.37	7.51
Control group	*n* (25)	Mean	153.40	45.79
		Standard deviation	5.90	6.61

Data collection

Physical fitness. To investigate the effect of participation in early morning physical activity, cardiorespiratory endurance, muscle strength, and flexibility were established as sub-elements of health fitness. Caspersen, Powell, & Christenson (1985) defined the three components as measurable elements that reflect overall physical fitness. Also we have adopted example tests suggested by them as measurement of each three variables.

Cardiorespiratory endurance. We measured participants' ability to run as fast as possible using a 1000-m running or walking test. The running speed was recorded in seconds. The shorter the running time, the better participants' cardiorespiratory endurance.

Muscle strength. Participants were instructed to perform as many sit-ups as possible in 60 seconds. First they lied flat on their backs and bent their knees with putting their hands on their chest. And then repeatedly and as quickly as possible, they lifted their upper body in front of their

Table 3. *Mean and Standard Deviation of Pre-, Post-, Corrected-post-test Physical Fitness by Group*

Sub-group	Group	Pre-test		Post-test		Corrected post-test	
		M	*SD*	*M*	*SD*	*M*	*SD*
Cardiorespiratory endurance (seconds)	Experimental group A	333.50	69.54	315.30	65.39	341.06	3.53
	Experimental group B	352.73	42.47	316.07	31.66	327.38	3.91
	Control group	403.95	49.30	404.10	48.93	369.86	3.66
Muscle Strength (number)	Experimental group A	34.20	12.92	43.20	14.32	37.05	1.23
	Experimental group B	25.73	8.63	36.20	9.56	37.87	1.34
	Control group	22.25	10.98	22.60	9.56	27.49	1.20
Flexibility (cm)	Experimental group A	5.37	6.61	8.75	6.25	8.02	.75
	Experimental group B	6.48	7.65	9.04	7.60	7.31	.88
	Control group	2.32	7.51	3.64	8.05	5.66	.76

knees and lied back again. It was measured by the number of times the sit-up posture was performed, and the higher the number of sit-ups, the better participants' muscle strength.

Flexibility. Participants were instructed to get their shoes off on a flat surface and sit straight on their knees. Allowing both feet to reach the measuring instrument vertically, they bent their upper body slowly and stretched their hands as far as possible using their waist and shoulders. The length they could reach was measured; the longer they could reach, the better participants' flexibility.

Sociality

Sociality Questionnaire. To measure sociality, we prepared a 30-item questionnaire by employing the assistance of 3 experts (1 professor and 2 PhD in the major of physical education) and teachers in the same grade for the questionnaire, which Han (1998) prepared by amending and supplementing the personality test for elementary school developed by Jung (1971). The sociality sub-factors we measured were sociability (7 questions), activity (5 questions), autonomy (6 questions), stability (5 questions), and dominance (7 questions). Sociability means the degree of respecting others' opinions other than insisting on self-assertion, cooperating, exchanging with others, and interacting with them smoothly. Activity indicates the degree working hard and trying to accomplish tasks with enthusiasm. Autonomy implies being responsible for one's task, plan, and practice. Stability means the degree of being emotionally stable and calmly coping in demanding situations. Lastly, dominance refers to one's assertion with others and persuading others to change their behaviors.
Reliability of the Sociality Questionnaire: The validity of the sociality was verified by an expert that confirmed the accuracy, appropriateness of the contents, and terminology of the scale, and its reliability was measured using Cronbach's α. Cronbach's α is a reliability test that determines the measure's internal consistency, which is the degree of homogeneity between test questions. In this study, Cronbach's α values for the five sociality items ranged from .634 to .832, indicating that the questionnaire was reliable. Each question was measured on a 5-point Likert scale, and higher scores indicate higher sociality.

Data analysis

The collected data were statistically analyzed using SPSS, and the statistical significance level was set to .05. To examine the effect of participation in early morning physical activity on physical fitness and sociality, we utilized means and standard deviations for pre and post-test scores. Then, we compared the pure effects of such activity after eliminating the effects of pre-scores by group on post-scores. Specifically, we performed analyses of covariance (ANCOVA) by setting all variables related to pre-scores as covariates and deriving and analyzing the corrected post-measured values. Next, a main effects analysis was conducted by employing Bonferroni post-hoc tests for sub-factors that had showed significant differences between the three groups.

Results

Effects of early morning physical activity on physical fitness

The respective mean and standard deviation of the pre-, post-, and corrected post-test or all three groups is shown in Table 3.

To compare the differences of sub-factors in physical fitness between the experimental groups A and B and the control group, we conducted an ANCOVA with corrected post-measured values after setting pre-scores as covariates for each group. And then Bonferroni's method was used for post-test to further investigate the differences between the three groups of corrected strengths that were statistically significant.

Effect on Cardiorespiratory Endurance. There was a statistically significant difference between groups in corrected cardiovascular endurance (F= 30.92, p< .05). According to the post-test, the mean difference between experimental group A and experimental group B was not statistically significant. The mean difference between experiment group A and control group was statistically significant (F= -88.80, p< .05). In addition, the difference between the experimental group B and the control group was statistically significant (F= -88.03, p< .05).

Effect on Muscle Strength. There was a statistically significant difference between the groups in the corrected strength (F= 21.08, p< .001). According to the post-test, the mean difference between experimental group A and experimental group B was not statistically significant. The mean difference between experimental group A and control group was statistically significant (F= 9.57, p< .001). Also, the difference between the experimental group B and the control group was statistically significant (F= 10.39, p< .001).

Effect on flexibility. There was no statistically significant difference between the groups in the corrected flexibility (F= 2.48, p> .05).

Table 4. *Means and Standard Deviations of Pre-, Post-, Corrected Post-Sociality Test by Group*

Sub-group	Group	Pre-test		Post-test		Corrected post-test	
		M	*SD*	*M*	*SD*	*M*	*SD*
Sociability	Experimental group A	4.29	3.33	4.46	3.57	4.54	.93
	Experimental group B	3.62	4.48	3.84	4.26	3.80	1.00
	Control group	3.64	4.58	3.55	3.70	3.51	.87
Activity	Experimental group A	3.72	2.80	4.07	2.32	4.09	.60
	Experimental group B	3.43	3.36	3.76	3.43	3.75	.68
	Control group	3.45	2.83	3.40	2.18	3.39	.59
Autonomy	Experimental group A	3.76	3.12	4.01	4.29	4.06	.87
	Experimental group B	3.49	3.39	3.83	3.76	3.82	.97
	Control group	3.41	3.97	3.10	3.32	3.06	.86
Stability	Experimental group A	3.51	3.03	19.50	4.44	19.44	.89
	Experimental group B	3.23	4.22	16.27	4.09	16.29	1.02
	Control group	3.18	3.99	15.20	3.09	15.24	.88
Dominance	Experimental group A	3.54	3.18	4.15	4.24	4.17	1.02
	Experimental group B	3.45	4.58	3.69	4.99	3.68	1.18
	Control group	3.37	5.62	3.14	4.92	3.12	1.02

Effects of participation in early morning physical activity on students' sociality

The means and standard deviations for sociality in the pre-, post-, and corrected post-test between the three groups are shown in Table 4.

To compare the differences of sub-factors in sociality between experimental groups A and B and the control group, we conducted an ANCOVA with corrected post-measured values after setting pre-scores as covariates for each group. And Bonferroni's method was used for post-test to further investigate the differences between the three groups of corrected strengths that were statistically significant.

Effect on sociability. There was a statistically significant difference between the groups in the corrected sociability (F= 14.81, p<.001). As a result of post-test, the mean difference between experimental group A and experimental group B was statistically significant (F= 5.18, p< .01). The mean difference between the experimental group A and the control group was statistically significant (F= 7.17, p< .001). The difference between the experimental group B and the control group was not statistically significant.

Effect on activity. There was a statistically significant difference between the groups in the corrected activities (F= 8.66, p< .01). As a result of post-test, the mean difference between experimental group A and control group was statistically significant (F= 3.51, p< .001). Also, the mean difference between experimental group A and experimental group B, experimental group B and control group was not significant.

Effects on autonomy. There was a statistically significant difference between the groups in the corrected autonomy (F= 12.63, p< .001). As a result of post-test, the mean difference between experimental group A and experimental group B was not statistically significant. The mean difference between experimental group A and control group was statistically significant (F= 6.00, p< .001). Also, the mean difference between experimental group B and control group was statistically significant (F= 4.60, p< .01).

Effect on stability. There was a statistically significant difference between the groups in the corrected stability (F= 5.85, p< .01). As a result of post-test, the mean difference between experimental group A and control group was statistically significant (F= 4.20, p< .01). The mean difference between experimental group A and experimental group B, experimental group B and control group was not statistically significant.

Effect on dominance. There was a statistically significant difference between the groups in the corrected dominance (F= 12.93, p< .001). As a result of post-test, the difference between the experimental group A and the experimental group B was not statistically significant. The mean difference between experimental group A and control group was statistically significant (F= 7.38, p< .001). Also, the mean difference between experimental group B and control group was statistically significant (F= 3.95, p< .05).

Discussion and Conclusion

Effects of participation in early morning physical activity on physical fitness

Early morning physical activity had a positive effect on the change in physical fitness of the 6th grade male students who participated in this study. Experimental group A and B both improved significantly in overall physical fitness compared to the control group. Specifically, both experimental groups improved significantly in cardiorespiratory endurance and muscle strength excluding flexibility compared to the control group. The results are in agreement with Kim's (2012) study showing that the physical activity at the before class conducted for 12 weeks was effective in reducing the body fat percentage and increasing the muscle mass in middle school students, as well as demonstrating a positive effect on students' cardiorespiratory endurance. Further, Ha et al. (2013) reported that a exercise program conducted in the morning for 12 weeks with elementary school students induced positive effects on students' physical fitness and academic achievement, suggesting that early morning physical activity is positively associated with perceptive ability as well as physical fitness. Kim (2007) conducted rope-jump-

ing exercises while listening to music in the morning for 16 weeks with elementary school students. Kim revealed that this program positively affected students' running ability, quick adaptation, and cardiorespiratory endurance. These results are partially consistent with our study.

Most of the early morning physical activity programs that students participated in for six months were activities directly related to the improvement of physical fitness. Participation in regular and autonomous physical activities had a positive effect on training students' healthy body and mind. Through participating in the program, students felt their physical strength improve, and they felt healthier. Particularly, the students who intensively participated in soccer showed significant differences in sub-factors of physical fitness, perhaps because soccer requires aerobic exercise and muscle strength. In addition, the group participating in various events showed increased interest, confidence, and performance ability. We posit that both participating groups had improved overall physical fitness because of their daily, early morning physical activity. This should be implemented in schools' physical education programs to increase students' physical strength and decrease obesity.

Effects of participation in early morning physical activity on sociality

Early morning physical activity had a positive effect on the development of sociality in the participating students. Experimental group A and B improved significantly in sociality compared to the control group, including all five sub-factors (i.e., sociability, activity, autonomy, stability, dominance). Therefore, early morning physical activity is thought to have a positive effect on students' sociality and relationships with other students. These results are consistent with Lee and Kim (2013), who showed that soccer activities had various positive effects on participating students such as improvement of physical strength, stress relief, and formation of amicable social relations. Furthermore, they agree with the results of Ha (2002), who showed that participation in physical education activities by elementary school students was significantly related to independence, cooperation, and sociability as sub-factors of sociality. In addition, Cho (2001) revealed that participation in autonomous physical education activities had a positive effect on the development of accountability, stability, and dominance in higher-grade elementary school students. Lastly, the development of sociality such as sociability, independency, compliance, and cooperativeness in a group participating in regular sports activities was shown to be higher than the non-participating group (Choi, 2001), showing that sociability and cooperativeness among students who participate in group events develop better than among those who do not participate.

Students appeared to act friendly with their peers while participating in early morning physical activities. They were cooperative and had a sense of responsibility while performing several physical activities. In addition, there were students who, although usually liking exercises, passively participated in the program, or lacked confidence in certain school activities (e.g., the group participating in a variety of physical games and New Sports). However, steady participation in early morning physical activities was shown to lead such students to have time for communicating with their many friends, thus promoting peer relationships and improving adaptability to school life. Consequently, early morning physical activity had a positive effect on students' sense of affective stability and because it provides opportunities to not only cultivate joy in physical activity and cooperativeness (Ko, 2016), but also facilitates interactions with peers naturally. In other words, autonomous and regular participation in physical activities is effective in the development of sociality by increasing students' school life satisfaction.

In sum, the importance of physical activity before school and in formal physical education classes has been clearly noted. We revealed the positive effects of elementary school students' participation in early morning physical activities, especially regarding physical fitness and sociality. In addition, it suggests that systematic physical activity programs should be organized and effective coaching or teaching and strategies are needed. Teachers not only provide opportunities for students to participate in simple activities like running, but to provide them with opportunities to participate in various and systematic programs in order to achieve more meaningful outcomes educationally. However, our study had some limitations. First, the experimental group participants were all boys from the sixth grade in G region, Korea. Subsequent research should be conducted with more diverse samples (i.e., sex, age, and geographic location). Second, it seems there exists differences in their physical fitness baseline between the groups, which raise a problem regarding random sampling. Although the pre-program score was set as covariate variable for each group so that we tried to verify only the effectiveness of participating in the program, that baseline of health fitness could work as a confounding variable. Third, it is necessary to study in detail what aspects of the program influence students' physical fitness and sociality. Future research should seek to determine, for example, the correlations between various elements such as regular physical activity, peer relationships, activities, teachers' instruction style, and students' attitudes.

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iejee | INTERNATIONAL ELECTRONIC JOURNAL OF ELEMENTARY EDUCATION

March 2018, Volume **10**, Issue **4**, **449-456**

Effect of Recess on Fifth Grade Students' Time On-task in an Elementary Classroom

Received: **28 November 2017**
Revised: **20 February 2018**
Accepted: **28 February 2018**
ISSN: 1307-9298

www.**iejee**.com

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DOI: **10.26822/iejee.2018438135**

Abstract

Recess is an integral part of the school day where children are afforded the opportunity to create and organize games, socialize with their peers, and explore nature. When implemented effectively, recess has the potential to offer significant academic, physical, and social benefits (London, Westrich, Stokes-Guinan, & McGlaughlin, 2015). However, the amount of time allocated to recess in elementary schools across the United States has significantly declined over the past two decades. A reduction in play time can be attributed to increased educational mandates, which have lead to vigorous and ongoing debates about the important role recess plays in elementary schools. Thus, this quantitative study examined the effect of recess on fifth grade students' time on-task in an elementary classroom. Participants on- and off-task behaviors were observed and documented on a task frequency chart prior to and after recess. Findings from the study indicated that providing fifth-grade students with daily recess significantly increased on-task behaviors in the classroom.

Keywords: Recess, time on-task, elementary classroom, instructional time

Introduction

Expanding learning time policies is increasingly popular in educational reform across the United States. Subsequently, academic instruction occupies most of a child's school day with the underlying goal of increasing academic performance (Woods, 2015). This reallocation of time during the school day to address academic concerns is not fading; if anything, the trend is increasing. In the Pennsylvania State Education Association's (PSEA) 20/20 Vision for the Future (2010), authors note that increasing instructional time is critical to improving student achievement. However, critics argue that a change in instructional time does not have a significant impact on student achievement and can be a catalyst for behavior problems (Baker, Febrega, Galindo, & Mishook, 2004; Silva, 2007). To combat long periods of instruction, a number of countries embed unstructured recess breaks throughout the school day with the understanding that providing physical activity improves attentiveness in the classroom (Pelligrini & Bohn, 2005). This strategy is scarcely practiced in the United States, as the foci remains steadfast on increasing academic achievement. Therefore, breaks from academic instruction, such as recess, remain at a high risk of being diminished or eliminated altogether (Ramstetter, Murray, & Garner, 2010).

Decrease in recess time

The Center on Education Policy (2008) examined the impact of the No Child Left Behind (NCLB) Act on recess and found that 20% of school districts decreased recess time, with an average decrease of 50 minutes per week (Center on Education Policy, 2008). Burriss and Burriss (2011) examined the effect of policy and practice on outdoor play and learning via questionnaires. The surveys completed by representatives from 173 randomly selected school districts in the United States indicated that 32.3% of respondents believed that there had been a decrease in time for outdoor play and only 5.3% believed there had been an increase (Burriss & Burriss, 2011). These reductions allocate more time for English and math instruction (Brusseau & Hannon, 2015).

Although the Every Student Succeeds Act (ESSA) of 2015 requires that Health and Physical Education curricula be included as part of a child's well-rounded education, it does not mandate time for recess or outdoor play. Ultimately, the decision to implement or remove recess is at the discretion of each state, school district, or individual school. Without daily recess, students find themselves in sedentary environments a majority of the school day. The effects of such sedentary behaviors can be detrimental to students' physical activity levels, social development, and academic achievement (McManus et al., 2015).

Time on-task

An extensive body of research has examined how recess affects students' social (Barros, Silver, & Stein, 2009; Jarrett, 2002; Ramstetter et al., 2010), physical (Erwin, Ickes, Ahn, & Fedewa, 2014; Ling, King, Speck, Kim, & Wu, 2014; Springer, Tanguturi, Ranjit, Skala, & Kelder, 2013), and academic abilities (Brusseau & Hannon, 2015; Chang & Coward, 2015; Pelligrini & Bohn, 2005). However, few studies have examined the effect recess has on students' time on-task in the classroom, prior to and following a period of recess. According to Karweit and Slavin (1981), the amount of time that students spend on-task, or engaged in learning, is an important factor contributing to academic achievement. In classrooms where students spend limited amounts of time on-task, a vast amount of instructional time is lost. Conversely, a greater amount of instructional time is displayed in classrooms where students spend a majority of time on-task (Karweit & Slavin, 1981). Furthermore, a beginning teacher evaluation study indicated that students who spend more time engaged in the learning process have higher levels of academic achievement (Berliner & Tukinoff, 1976). Thus, it is imperative for elementary classroom teachers to utilize methods and strategies such as physical breaks from the classroom that may help increase time on-task.

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Effect of recess on social development

While the academic and physical benefits of recess are perhaps the most documented factors that can be used to advocate for increased recess time for children, recess has the multifaceted potential to affect the whole child in ways that exceed academic and physical benefits (Ramstetter et al., 2010). In direct contrast to classroom activities where children cannot make the choice to withdraw from an activity, at recess, children are free to join in or leave play situations according to their own discretion. This "open setting" that children encounter at recess enables them to engage in diverse and abundant social interactions that they may not experience otherwise (Jarrett, 2002, p. 3). Additionally, this open and unstructured recess period provides time for children to acquire social skills that may not be developed within a structured classroom environment (Ramstetter et al., 2010).

Effect of recess on academic achievement

Research suggests that social interactions have important cognitive implications. However, the opportunity for communication with peers is not the only aspect of recess that benefits students' academic achievement (Pellegrini & Smith, 1993). Elementary students in Shanghai, China receive daily recess time that amounts to almost 40% of an entire school day. Even though these students spend more time away from academic work every day, their ability to perform well on academic tasks has not declined. In fact, these are some of the world's highest achieving students, and they repeatedly receive top honors in multiple areas on the Program for International Student Assessment, the "most-watched international comparison exam" (Chang & Coward, 2015, p. 15).

Donnelly and Lambourne (2011) examined the effect of providing "90 min/week of moderate to vigorous physically active academic lessons intermittently throughout the school day" (p. S38) on the academic achievement of students in 24 elementary schools in northeast Kansas. A third party of trained psychologists measured academic achievement by administering The Wechler Individual Achievement Test. This test assesses reading, writing, mathematics, spelling, and oral language skills. Performance on this standardized test indicated an improvement of 6% among students involved in physically active academic lessons compared to a 1% decrease for students in control classrooms. Thus, concluding that physical activity can have a positive impact on academic achievement (Donnelly & Lambourne, 2011).

Effect of recess on childhood obesity

Increasing elementary children's physical activity levels at school is also an essential element to reducing childhood obesity (Chin & Ludwig, 2013). Obesity is an increasingly present issue among elementary school age children across the globe. A national report, Prevalence of Obesity Among Children and Adolescents: United States, Trends 1963-1965 Through 2007-2008, indicated that the prevalence of childhood obesity has tripled since 1976, when only 6.5% of children ages 6-11 were classified as obese (Ogden & Carroll, 2010). Recent statistics indicate that approximately 17% of all children and adolescents in the United States are affected by obesity (Centers for Disease Control and Prevention [CDC], 2016). Globally, the trajectory of childhood obesity is steadily increasing and is cited as one of the most "serious public health challenges of the 21st century" (World Health Organization [WHO], 2017). DeOnis, Blossner, and Borghi (2010) noted that if the obesity epidemic continues, nearly 9% of all preschool aged children around the world will be considered obese by 2020 (DeOnis, Blossner, & Borghi, 2010).

One of the causes of obesity can be attributed to a child's lack of energy expenditure during the day. The average child sits for approximately 8.5 hrs each day (McManus et al., 2015). When a child's energy expenditure is not equal to energy intake, weight gain is inevitable. The energy balance can only be recovered through increased physical activity and healthy eating behaviors (Ling et al., 2014). Fernandes and Sturm (2011) examined the effect of physical activity at school on obesity prevention among 8,246 elementary students in 970 schools. Initially, body mass index (BMI) was calculated using each participant's height and weight. Each participant's teacher reported the frequency of physical education classes and recess. The amount of time each student participated in physical activity at school was then calculated. Data was collected periodically throughout the study, and results indicated that meeting the National Association of Sport and Physical Education's (NASPE) recommended time for recess "was associated with a decrease of 0.74 BMI percentile units" (Fernandes& Sturm, 2011, p. 178). Thus, providing evidence to suggest that reducing physical activity at school can have a detrimental effect on elementary students' overall health.

Recess as a mental break

In addition to the social, academic, and physical reasons for providing elementary students with daily recess, people of all ages and in all professions benefit from breaks in their daily routine. According to Jarrett (2002), breaks are necessary for "satisfaction and alertness" (p. 2). Studies have also shown that short, structured breaks throughout the school day can improve physical activity levels, academic achievement, and concentration (Pelligrinini, Huberty, & Jones, 1995; Caterino & Polak, 1999; Barr-Anderson et al., 2011). One of the most critical aspects of recess is that it provides a break for elementary students in the day's routine. This break in routine can also be described as a "period of interruption" (Ramstetter et al., 2010, p. 522). A period of interruption followed by a period of concentrated instruction is necessary for optimal cognitive processing in children (Ramstetter et al., 2010). When recess is provided as an unstructured break during the school day, the stresses and distractions that normally interfere with cognitive processes are diminished.

It is important to note that transitioning from one academic subject to another does not provide a cognitive or physical break (Barros et al., 2009). Only the unstructured free time that recess can provide, affords elementary students the opportunity for mental change and physical release. The benefits that come from this energy release reach far beyond a break from rigorous academic work and cognitive processing, as they have the potential to improve many aspects of the classroom (Barros et al., 2009).

As aforementioned, research continually indicates that physical activity has a positive impact on the academic, social and physical development of children. Taking this into account, the researchers' anecdotal observations in the field revealed that elementary students became increasingly off-task as recess drew closer and increasingly on-task after recess breaks. This evidence led the researchers to believe that studying the effects of recess on fifth grade students' time on-task in the classroom would be relevant and beneficial to elementary educators, administrators, policymakers, parents, and students. The present study aimed to address the following research questions:

1. Do on-task behaviors in the classroom increase or

decrease after a 25-minute period of recess?

2. Are the average minutes of on-task behaviors higher before or after recess?

3. Are the average minutes of off-task behaviors higher before or after recess?

Method

Participants and setting

This quantitative study examined the effect of recess on fifth grade students' time on-task in an elementary classroom. The present study took place in a fifth grade general education classroom in Northwest Mississippi. Participants were selected through non-probability purposive sampling and were inclusive of six female students and six male students, ages 10-12. Ethnicities of the participants were 66.7% Caucasian, 25% African American, and 8.3% biracial. Participants involved in this study exhibited a wide range of ability levels as determined by their academic achievement. Academic achievement is representative of performance-based outcomes that identify the extent to which a student has met specific learning goals within the context of the learning environment. For the present study, academic achievement levels were determined by analyzing data from a formal standardized test entitled STAR that assessed both reading and mathematics skills. According to the criterion for the STAR assessments, 37.5% of the participants tested above grade level, 30.8% of the participants tested at grade level, and 31.7% of the participants tested below grade level. Prior to the study, consent was obtained from the classroom teacher, librarian, and art teacher to conduct observations in their classrooms. Parental consent and children's assent was not required, as there were no interactions with the participants during observations and no interventions were implemented.

Instrument and observations

An on-task and off-task frequency chart was utilized to document observations of participants' on- and/or off-task behaviors in the classroom prior to and following a 25-minute recess period (See Appendix A). The whole interval recording (WIR) protocol was utilized within the on- and off-task frequency chart to collect data, wherein the behavior that occurred during each time interval was recorded (Fisk & Delmolino, 2012). This type of data collection system is known as discontinuous, as it divides the observation into equal duration intervals and notes the occurence or nonoccurence of a behavior within a given interval (Mudford, Taylor, & Martin, 2009). The reserachers chose WIR by utilizing a guide Fisk and Delmolino (2012) developed to aid reserachers in selecting valid and reliable measurement systems based on the current body of research and the context of their study. Space was allocated in the task frequency chart for participant observations, six male and six female. Twelve observations were completed over a six week period from September 12, 2016 - October 19, 2016 on Mondays and Wednesdays for 30 minutes during the morning. The observations took place prior to recess in a fifth grade classroom and after recess in the school library or with the art teacher in the regular academic classroom. This type of observation is known as a controlled structured observation, as the observations were completed under the same conditions during each session and could be easily replicated. The observer did not have contact or interaction with the subject, as the sole intent was to observe behaviors in the most natural environment possible. Systematic time sampling was utilized during observations to acquire different samples of behavior at predetermined time intervals over the course of the observations. Sytematic time sampling, as opposed to random time sampling, enables observations to be generalized during the time in which the observation occurred (Bakeman, 1997).. Observations were divided into 5-minute intervals, wherein each 5-minute time interval included two codes that represented on-task or off-task behaviors. These behaviors were documented during the 5-minute time intervals for each participant. The list of on- and off-task behaviors observed for during this study were derived from the literatüre, wherein the most common recurring on- and off-task behaviors in the classroom setting were identified. Moreover, behaviors on the on- and off-task lists were based on both quantitiative and qualitative studies noted in the literatüre that addressed actively engaged behaviors (on-task) which were correlated with student productivity and disruptive classroom behaviors (off-task) which were connected to less productive students (Dalton, Martella, & Marchand-Martella, Rathvon, 1990; Sun & Shek, 2012). The behaviors observed for included, but were not limited to the following:

ON (on-task)

- answering questions asked by teacher;
- looking at or writing on academic materials;
- receiving assistance from teacher or teacher's assistant;
- raising a hand and waiting to be called on;
- reading a book when finished with work; and
- looking at teacher or speaker.

OFF (off-task)

- playing with materials;
- staring into space/looking around class/stretching;
- laying head down;
- scribbling on paper;
- talking to a classmate about non-academic matter;
- talking to the teacher when not asked a question
- singing or talking aloud to oneself; and
- out of seat or walking around class without permission.

Analyses

During each observational period, the code that correlated with the participant's behavior for each 5-minute interval was circled. The code was determined by analyzing the behavior that was exhibited a majority of the 5-minute time interval. Upon final data collection, descriptive and inferential statistics were utilized to summarize the data sets. Two double bar graphs were created to display the average number of minutes each participant spent on-task and off-task prior to and after recess. The average number of minutes each participant spent on-task before recess and after recess was also converted to percentages and used to create a table that identified each participant's average percentage of time on-task before recess, average percentage of time on-task after recess, and average increase in time on-task from before to after recess. The double bar graphs and table were then compared to determine the overall increase or decrease that recess had on fifth grade students' time on-task in the classroom. Additionally, a paired samples t-test was completed to determine if the difference in increase of time on-task prior to and following recess were statistically significant. One of the assumptions of the paired t-test is that the two groups are normally distributed. Thus, the Shapiro-wilk test was utilized to test for normality.

Results

Even though time allocated for recess in elementary schools has decreased across the United States (Hausenblas & Rhodes, 2016), the justification for educational policy may rest on the assumption that reducing recess time increases instructional time, therefore improving academic performance. On the contrary, the present study's findings indicate that including recess in a school day's allocated time schedule in fact, increases time on-task. What is known from research is that time on-task is a strong indicator of academic engagement and achievement. Thus, this study adds to the breadth of research that argues recess should be included as a vital component of an elementary child's school day.

Results for research question 1

Results revealed that each of the 12 participant's average time on-task increased from before recess to after recess (See Table 1). Student 5 had the greatest increase in time on-task, from 20.8% time on-task prior to recess to 60.4% time on-task after recess. Student 2 showed the lowest percentage of time on-task before recess (18.7%) and remained at the lowest percentage of time on-task after recess (56.2%). However, this student showed great improvement in time on-task following recess (37.5%). Student 3 displayed the smallest amount of increase in time on-task, from 64.5% before recess to 75% after recess. Though there was not a large increase in time on-task, this participant had the highest percentage of time on-task before recess and still showed an improvement in time on-task behaviors immediately following a period of recess. The overall average increase for all participants in time on-task from before recess to after recess was 33.7%.

Results for research question 2

During the 30 minute period following recess, 100% of the participants spent more time on-task than off-task (See Figure 1). Only one participant (Student 3) had a less difference between the average amount of time spent on-task and off-task during the period of time immediately following recess. Student 3 spent 19.375 minutes on-task before recess and 22.5 minutes on-task following recess. This is a 3.125 minute increase in time on-task from before recess to after recess.

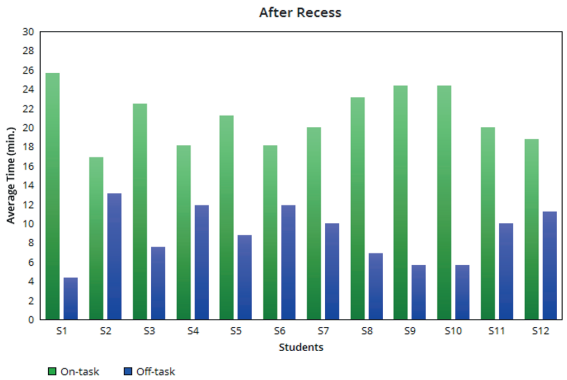

Figure 1. Participants' average time on-task and average time off-task after a period of recess.

Results for research question 3

Results also indicated that only two of the twelve participants observed, Student 3 and Student 9, spent more time on-task than off-task during the period of observation before recess (See Figure 2). Only two more of the twelve participants observed, Student 1 and Student 10, spent near equal amounts of time on-task and off-task. Student 1 spent 47.9% of time on-task and 52.1% of time off-task, and Student 10 spent 45.8% of time on-task and 54.2% of time off-task. Even though the amounts of time these two participants spent on-and off-task were similar, Student 1 spent 1.25 more minutes off-task than on-task, and Student 10 spent 2.5 more minutes off-task than on-task. The remainder of the twelve participants spent more time off-task than on-task on average during the period of observation before recess. In summary, 83.3% of the participants observed in the fifth grade classroom spent more time off-task than on-task during the 30 minutes prior to recess.

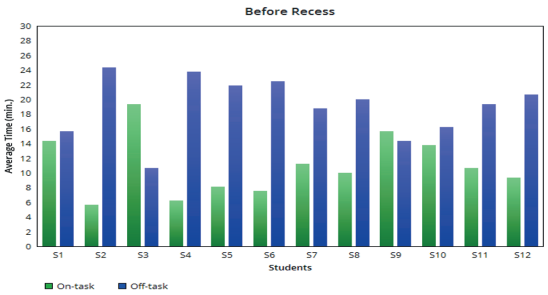

Figure 2. Participants' average time on-task and average time off-task before a period of recess.

Paired t-test

A paried samples t-test was completed to compare the means of time on-task before and after recess for a single group. Prior to completing the paired t-test, a Shapiro-wilk test was conducted to test for normality of the data. Results indicated that p> .05, indicating that the data was normal. Results of the paired-samples t-test revealed that the mean time on-task before recess (*M*= 36.59, *SD*= 13.70) varied from after recess (*M*= 70.27, *SD*= 9.61) at the .05 significance level (*t*= 13.17, *df*= 11, *n*= 12) (See Table 1).

Table 1. *Participants' average time on-task before recess, average time on-task after recess, and average increase in time on-task.*

	Before Recess Average time on-task	After Recess Average time on-task	Average increase in time on-task
S1	47.9%	85.4%	37.5%
S2	18.7%	56.2%	37.5%
S3	64.5%	75%	10.5%
S4	20.8%	60.4%	39.6%
S5	27%	70.8%	43.8%
S6	25%	60.4%	35.4%
S7	37.5%	66.6%	29.1%
S8	33.3%	77%	43.7%
S9	52%	81.2%	29.2%
S10	45.8%	81.2%	35.4%
S11	35.4%	66.6%	31.2%
S12	31.2%	62.5%	31.3%

Note: Data analysis showed that when the difference in mean time on-task prior to and following recess were compared (*p*= .00001), the results were statistically significant, *p*< .05.

To conclude, when the behaviors of participants were observed prior to a period of recess 100% of the participants

displayed an increase in time on-task. Participants spent, on average, between 3.125 and 13.125 more minutes on-task in the classroom after a period of recess. Therefore, the findings from this study indicate that a 25-minute period of recess significantly increased fifth-grade students' average time on-task in the classroom.

Discussion

Similar to results of previous quantitative studies (Jarrett, 2002; Pellegrini & Bohn, 2005; Ramstetter et al., 2010), this study supports the theory that short breaks which include physical activity during the school day enable students to remain on-task for longer periods of time. A study by Foran, Manion, & Rutherford (2017) also found that teachers perceived students to be more focused after participating in physical activity. While numerous studies have been conducted that indicate students who are physcially active during the school day earn higher grades, are more focused, and perform better on achievement tests (Hillman, Erickson, & Kramer, 2008; Rasberry et al., 2011), much less is known about why this actually occurs. To address the "why," researchers have recently begun to examine the changes in the overall physiology of the brain that occurs when children participate in physical activity. Recent brain imaging technology has enabled reserachers to examine children's brain malleations during physical activity and correlate them to a child's learning and development (Hillman, Erickson, & Kramer, 2008). Ploughman (2008) also noted that changes in the brain, such as increased neurotransmitters identified through EEG tests, oxygen saturation, and growth in the brain-derived neurotropic factor are all correlated to cognitive development for children. Thus, this provides evidence to suggest that the changes in brain physiology that occur when students participate in physical activity at school, such as recess, have the ability to improve cognitive functions needed for success, such as attention and focusing on tasks in the classroom. Therefore, recess needs be considered an essential element of the school day and should be taken into consideration when daily schedules are developed in elementary schools. Future research should take this into consideration when addressing the connections between children's physical activity, changes in brain physiology and performance in the classroom. Contrary to arguments utilized by those who eliminate recess time, findings of this study indicate that recess positively affected the on-task behaviors of fifth grade students in the classroom.

Limitations

The effect of recess on each participant's time on-task indicated statistically significant outcomes, however, there are a number of limitations that may have factored into the results. One of the limitations was the location of the school at which participants were observed and the time of year when the research was conducted. The research was conducted in the state of Mississippi, during the months of September and October. These months are particularly warm, which may have had an effect on the findings by altering participants' activity levels at recess. Another limitation of this study was the subject matter participants learned during observational periods, both before and after recess. On Mondays, participants attended a library class following recess, and on Wednesdays, participants attended an art class following recess. Studying different subjects could have influenced participants to demonstrate more on-task or off-task behaviors depending on interest level of the subject. A third limitation of this study is the time of day in which students participated in a period of recess. If recess had been offered earlier or later in the school day, the findings of this study could have been different. Furthermore, this study only examined the on-task and off-task behaviors of twelve fifth grade students. A larger sample size of fifth grade students may aid in further validating the findings of the present study.

Observational data was collected while the researcher stood in the back of the classroom to provide the least amount of distraction possible. The purpose of being minimally distracting was to guarantee that participants' on-task or off-task behaviors were genuinely reflective of their typical classroom behavior and were not affected by the observations that took place. If the observations did produce distractions, they would be considered a limitation of the research study. The amount of recess time participants were provided is another limitation of this research study. Participants' daily schedule allocated 25 minutes of recess, but on occasion participants would receive less than or more than 25 minutes of recess depending on when assignments were completed, weather conditions, and other varying circumstances.

Lastly, the variety of assignments that participants completed during each observation period before and after recess could be considered a limitation. Some tasks could be considered much more engaging and interactive, which could cause participants to demonstrate more on-task behaviors. These engaging or interactive tasks included cooperative learning activities or timed multiplication tests. Conversely, some tasks that participants were assigned could be considered more mundane and required a higher level of self-discipline from participants to complete, such as listening to the teacher read texts aloud or completing worksheets. This could have caused participants to demonstrate more off-task behaviors.

Conclusion and recommendations

Findings from this study indicated a positive association between allocating time for recess and on-task classroom behaviors. However, future research might include a larger sample size with a similar design. It would also be advantageous to include a group of more varied participants to provide further validation of this study. Other opportunities for future research may examine the effects of recess when provided to students at different times throughout the school day, the effects that longer or shorter recess periods have on time on-task, how recess affects students in different grade levels, and/or how the effects of recess may differ between gender.

In summary, this study provides a small, albeit significant insight into the behavioral and subsequently academic advantages of providing elementary students with a recess break during the school day. Findings demonstrated that recess significantly increased on-task behaviors of fifth grade students in an elementary classroom. While it is recommended that children receive at least 60 minutes of physical activity each day, the stark reality is that many students in countries across the world, including the United States, receive short recess breaks or no breaks at all due to educational policies that have increased instructional time. Thus, it is critical that administrators, educators, and policymakers find the intricate balance between allocating time for recess and academics to ensure that all elementary school children are afforded the opportunity to succeed at their highest potential.

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Appendix

On-Task and Off-Task Behaviors On-Task (ON) Off-Task (OFF)							
Student	**Minute 0**	**Minute 5**	**Minute 10**	**Minute 15**	**Minute 20**	**Minute 25**	**Minute 30**
S1	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S2	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S3	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S4	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S5	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S6	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S7	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S8	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S9	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S10	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S11	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF
S12	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF

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March 2018, Volume **10**, Issue **4**, **457-461**

How Do Specialist Teachers Practice Safety Lessons? Exploring the Aspects of Physical Education Safety Lessons in Elementary Schools

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Received: **06 January 2018**
Revised: **05 March 2018**
Accepted: **13 March 2018**
ISSN: 1307-9298

www.iejee.com

DOI: **10.26822/iejee.2018438136**

Abstract

The purpose of this study was to investigate elementary PE specialist teachers' assessments of safety risk factors in PE class, risk management, and difficulties in risk management. Five elementary PE specialist teachers who had at least five years of teaching experience participated in this study. Data were collected from non-participant class observations, in-depth interviews, and documents. Data were analyzed through the inductive categorical analysis. The results of this study are as follows: First, PE specialist teachers perceived that safe PE classes can be achieved by dealing with risks embedded within PE classes such as subject-innate, facility, environmental, and managerial components. Second, PE specialist teachers implemented safety classes by: (a) intentional class activities with detailed lesson plans, (b) reconstructing curriculum, and (c) making safety as a habit not as information acquisition. Third, participants had difficulty in teaching safety in PE classes due to: (a) outcome-oriented safety-first policy, (b) breach of safety codes between teacher and administrator, (c) limited contact with students, and (d) different level of sensitivity to safety issues. The findings suggest that teaching safety in PE classes are complex pedagogical activities that goes beyond teaching CPR or first aids and teacher education program should conceptualize safety issues from a pedagogical perspective.

Keywords: Physical education, specialist teacher, safety, safety classes

Introduction

Physical education (PE) teachers teaching physical activities and sports traditionally face the double-edged sword of "safety." Safety risk factors are embedded in all physical activities and sports. The goal of the PE curriculum is to educate students on the values of physical activities and sports while minimizing the risk of safety accidents (Bailey, 2002; Capel, 2000). A statement like the following can be found in PE curricula or teacher's guides in almost all countries: "PE teachers should encourage students to learn to take challenges and adventure and to compete through physical activities and sports." In fact, this statement is highly contradictory because safety and the values inherent in sports such as challenges, competition, and adventure are concepts completely opposed to each other.

In this regard, the PE curriculum in Korea, also called "the curriculum of the value of physical activities," is unique. It is an educational curriculum based on a new paradigm whereby in PE class students learn, not high jump and soccer, but the value of challenges through high jump and the value of competition through soccer. Interestingly, the PE curriculum presents "safety" as a core value for students to learn in addition to "health," "challenge," "competition," and "expression" (MEST, 2012). While safety is a critical educational issue in any country, the Korean PE curriculum emphasizes its importance more directly. While it is not explicitly stated in the curriculum, teaching safely as well as safety is a responsibility of PE teachers (Chappell, 2015; Robert, Danuta, & Danuta, 2015).

In addition, elementary school students are more likely to be exposed to the risk of safety accidents than adults or middle and high school students (Caine, Maffulli, & Caine, 2007). Because of the nature of the developmental process of elementary school students, they have great curiosity about their surroundings and their urge to explore their environment is strong. Due to these tendencies, their low level of judgment, self-regulation, and situational awareness place them at a higher risk of safety accidents than adults or adolescents (Micheli, Glassman, & Klein, 2000).

There has been much research conducted investigating the injuries that can occur in PE class or analyzing safety risk factors (Kelly, 1997; Lariosa et al., 2017; Severs, 2003). However, little research has been conducted to explore the perception and practice of safe PE classes from the perspective of PE teachers who teach students. There has also been insufficient research conducted on safety risk factors in PE classes for elementary school students, who are still undergoing physical development. Accordingly, the present study aimed to investigate elementary school PE teachers' assessments of safety risk factors in PE class, risk management, and difficulties in risk management. The following specific research questions were addressed in the study:

1. What safety risks in PE classes do specialist teachers assess?
2. How do specialist teachers teach safely and safety in PE classes?
3. What are the difficulties in teaching safely and safety in PE classes?

Material & Methods

Participants

First, an initial pool of participants was chosen of ten PE specialist teachers who were attending graduate schools and the PE specialist teachers they recommended. Then, in following the purposeful sampling method (Creswell, 2009), teachers from the initial pool who met certain criteria were chosen as study participants: full-time elementary school teacher, specialist PE teacher with five years of experience or more, and currently teaching PE class as a specialist PE teacher. Five teachers were chosen, and their specific backgrounds are given in Table 1. Five study participants belonged to a

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Table 1. *Background information on participants*

Pseudonym	Age / Gender	Teaching career	Experience as PE specialist	Region	Total students	Number of students per class	Grade level
Kyeongho	34 / M	8 years	7 years	Rural	64	About 20	4-6th
Chansik	37 / M	11 years	8 years	City	143	About 20	6th
Jina	38 / F	12 years	5 years	City	134	About 20	6th
Myeongho	34 / M	8 years	6 years	Rural	86	About 20	5-6th
Nari	30 / F	8 years	5 years	City	125	About 20	5-6th

to a rural elementary school of a small city in Gyeongnam province located in the south of Korea, where summer temperatures are typically high and rainfall is abundant. All participants were asked to make efforts as teachers to enhance safety in PE class according to the Korean government's currently reinforced safety measures in school education.

Data collection and analysis

Data were collected through individual interviews, non-participant observation, and document review. In-depth interviews were conducted with individual participants using a semi-structured questionnaire for a total of two sessions of 40 minutes each. The semi-structured questionnaire consisted of items regarding participants' risk management strategies and positive experiences they had had while utilizing the strategies. Non-participant observation was conducted two to three times for each participant. Observations and field notes were made on the safety-related speeches and behaviors of each participant and their interactions with students before and during a PE class; additionally, pictures and videos were taken of the participant and students with their consent, which were analyzed later. Lastly, data useful for understanding the participants' strategies to manage safety-related issues during PE class were collected from the field documents (including the PE class lesson plans, PE safety manual, and teacher's guide developed by the Office of Education).

Inductive categorical analysis was performed on the collected data (Patton, 2002). First, significant content was underlined and analytic memos were compiled, while interviews were transcribed and field documents were transformed to research text. Initial coding was then performed on the transcribed data and research text for each participant in order to derive meaningful topics relevant to the issues of the present study. Subsequently, focused coding was performed to generate higher-level categories by grouping lower-level ones derived during early coding. To increase the trustworthiness of the research, early results of the analysis were shared with the study participants and member checks were performed to ensure that the data were not distorted. Additionally, to check for any errors in the research process, the entire research process was peer-debriefed with a university professor in sports pedagogy and three in-service teachers (Creswell, 2009).

Results

The results of this study are presented according to the three research questions on specialist teachers' risk assessments, strategies, and difficulties in risk management in PE classes

Specialist teachers' risk assessment in PE classes

PE specialists thought that skillful management of risk factors embedded in PE is the right way to lead safe PE classes, and that it is also part of teacher expertise. Factors threatening safety in PE class revealed in participants' narratives were generally classified into subject-innate components (e.g., sport performance risks), facility components (e.g., crowded gyms and old facilities), environmental components (e.g., inclement weather), and managerial components (e.g., lack of time and cursory safety inspection).

Safety risk factors in PE class perceived by participants were largely similar to what had been reported in earlier publications on risk factors for PE class safety (Chappell, 2015; Whitlam, 2003). The most interesting finding regarded participants' perceptions of environmental components. The examination of interviews and field documents showed that in addition to conventional factors threatening environmental safety such as temperature, rain, and snow (Chan & Ryan, 2009; Edwards, et al., 2015; Goodman, Paskins, & Mackett, 2012), participants focused on environmentally contaminants like fine dust and yellow sand storms. Since yellow sand storms blowing to Korea from the deserts in China contain various heavy metals such as magnesium and aluminum, the participants avoided PE classes for students' health during severe yellow dust storms. Moreover, In the PE safety manual used by participants, it is recommended not to hold an outdoor PE class if the air quality forecast is a "bad level of fine dust" (a forecast level of 121-200 μg/m^3) or "very bad level" (a forecast level of 201 μg/m^3 or higher). When asked about how to handle weather with high levels of fine dust or yellow dust storms, one of the participants, Myeongho, said:

> *"if it is about other risk factors, I can conduct a PE class either by preventing them or paying attention to them. But on days when there is fine dust or a yellow dust storm is severe, I cannot hold a PE class in the outdoor field at all. It's not too hard to imagine why the term 'classroom PE' was created."*

Specialist teachers' risk management in PE classes

All teachers have rights and responsibilities for the class they teach. Safety legislation and regulations in every country specify the responsibilities of a teacher as those of a supervisor, and thus it is widely accepted that maintaining safety in the classroom is a "duty" of a teacher (Raymond, 1999; Whitlam, 2005). Based on the analysis of the data collected in the present study, PE specialists' risk management strategies were categorized into the following types: (a) intentional class activities with detailed lesson plans, (b) reconstructing the curriculum, and (c) making safety a habit, not a process of information acquisition.

Intentional class activities with detailed lesson plans

> *"To prevent safety accidents, everything must be planned before the class: Whether or not there are any risk factors in the facility and the equipment, which of the activities during the class have a risk of accidents, whether there are any students in poor physical condition today. The teacher should be*

> *aware of all these things and prepare for alternatives before beginning the class. So far, there has never been a serious safety accident in my PE class."*

As shown in the interview with Jina, participants thought that it is important for a teacher to be preemptively aware of the expected safety accident types for a given physical activity. A review of participants' lesson plans revealed that they identify students' physical features, examine the facility and the equipment, and prepare warm-up and cool-down exercises to prevent exercise injury at a highly detailed level.

Reconstructing the curriculum

Participants did not blindly trust the physical activities introduced in the textbooks. They exercised skepticism regarding safety and, if a certain exercise had risks that were excessive or difficult to prevent, either modified it or replaced it with a safer alternative. In relation to this, Nari reported the following:

> *"When I first started out as a teacher, I used the physical activities introduced in the textbook as-is. As I accumulated experience in school after school, however, I understood that the same physical activity could have different risk levels depending on the PE class environment. Since then, I show students the activities I reconstruct to teach safely in my class environment."*

A teacher should teach an education curriculum, not a textbook (Jewett, Bain, & Ennis, 1995). From this perspective, participants deserve to receive support for their proactive attempts to reconstruct the curriculum to teach PE classes safely. However, they had the idea of reconstructing the curriculum to ensure safe PE classes based only on their own experience. In this respect, Chansik stated the following:

> *"It seems that I acquired the idea of reconstructing the curriculum little by little, as I failed to conduct safe PE classes. After some students were injured or put in a dangerous situation, I figured it out by myself. I have participated in PE teacher training programs for PE class safety, but every one of them taught only CPR or emergency protocols. Such programs are not really helpful to teachers in increasing their expertise in the reconstruction of the curriculum."*

Making safety as a habit not as information acquisition

According to the PE class observation, at the beginning of a PE class the participants provided detailed explanations of safety accidents that could occur during the class to make students aware of safety risk factors before participating in activities. However, participants believed that rather than such a cognition-focused strategy, it is more effective for students to form the habit of maintaining a sensitive attitude toward safety, not only in PE class but in school life overall. Indeed, such mottos as "safety is a habit for students to have" and "my safety is others' safety" were posted in the corridors of the school building where Kyeongho and Nari worked. That is, the habituation strategy is to the general context of students' everyday lives as the cognitive strategy is to the specific content of PE curriculum. To the question why the viewpoint of safety as a habit is important, Kyeongho responded as follows:

> *"Especially in elementary school, safety is closely tied to everyday lifestyle habits. Teaching safety should be done in the context of everyday activities. Emphasizing safety just in the subject classes has no effect."*

Specialist teachers' difficulties in risk management in PE class

The analysis of the difficulties in PE class risk management experienced by the participants showed that the following three contradictory perceptions of PE class safety were present in the school community: (a) an outcome-oriented safety-first policy (process vs. outcome), (b) breaches of safety codes between teachers and administrators (prevention vs. responsibility), (c) limited contact with students (classroom teachers vs. specialist teachers), and (d) different levels of sensitivity to safety issues (sensitive teachers vs. insensitive students).

Outcome-oriented safety-first policy: process vs. outcome
The PE class safety manual the participants used specifies that safety accidents occurring in PE class must be reported to the School Safety and Insurance Federation, which are then reflected in the assessment of the school. In other words, a school with a high proportion of safety accidents in PE class is highly likely to receive a lower score in school assessments and may be put at a disadvantage in securing the next year's budget. Consequently, participants were implicitly forced by the principals to make safety a top priority when conducting PE class. In an extreme case, the schools where some participants were working had cultivated the atmosphere of not reporting a safety accident if the injury was not serious. In such a situation, participants were reluctant to teach physical activities or sports with the risk of safety accidents. Jina expressed her concern over the outcome-oriented safety-first policy as follows:

> *"Once an accident occurs in a PE class, the teacher's efforts for safe PE classes are just useless. If the policy stressing safety over education continues, teachers cannot help but decide not to teach an activity with even a slight risk."*

Breaches of safety codes between teacher and administrator: prevention vs. responsibility

The most serious difficulty experienced by participants when trying to conduct safe PE classes was the reality that they (specialist PE teachers) and the school administrator have completely different orientations with respect to safety. Participants pointed out that specialist PE teachers are committed to the "prevention of safety accidents" in PE class, whereas the school administrator is interested in "safety accident liability." Also, they emphasized that the prevention of and liability for safety accidents fall on everyone, but that the school organization is bureaucratic, where each member fulfills his or her role and takes responsibility for that role. On this point, Nari said the following:

> *"Administrators are only interested in whose PE class the accident occurred in and whose fault it was, and just want to receive a process report on the safety accident. There are times when my efforts for students not to be injured are regarded as unimportant and they wouldn't even listen to me."*

Limited contact with students: Classroom teachers vs. specialist teachers

Subject specialist teachers in each country have long and complicated histories, but their profession has emerged to enhance the teacher professionalism frequently mentioned in elementary education (Barney & Deutsch, 2012; Brooks & Thompson, 2015). Although specialist teachers were introduced to provide quality subject classes to students, the research participants reported that specialist teachers play a minor role in the safety of students' PE classes.

> *Chansik: "Jione, why are you standing there doing nothing? What's going on? "*
>
> *Jione: ..... (silence)*

> *Unknown: "She had an argument with a classmate in the classroom this morning. She's in a bad mood, after that. "*
>
> *(field notes, Chansik's PE class)*
>
> *At the beginning of each lesson I ask students about their physical condition and pick out the students who cannot always attend classes. Since I am not a classroom teacher, unless students tell me, I have no idea what trouble a student is having and how and how much he/she is sick. Also, it is difficult for a specialist teacher to comprehend the tendencies, behavior, and habits of all students. (Myeongho, interview)*

The research participants point out the limits they face by not learning in detail about the situations, health, and psychological conditions of their students because they are not classroom teachers. In elementary education, it is very important for the teacher to observe and communicate with the student in close contact. For a safe PE class, the teacher's deep understanding of each student should be assumed. Specialist teachers have an advantage in forming subject matter knowledge or curricular knowledge, as proposed by Shulman (1987), in that they focus on one specific subject and prepare and run that class. Participants had expertise in "teaching PE well" with abundant subject knowledge and teaching techniques in practice. However, they showed weaknesses in their knowledge of learners and their characteristics, which is necessary for teaching activities, because they have less opportunity to come into contact with their students than classroom teachers. Lack of understanding of their students was a major factor in lowering confidence in the participants' expertise in "teaching PE safely."

Different levels of sensitivity to safety issues: sensitive teachers vs. insensitive students

Once again, from the field notes:

> *Jina: "Soo-Mi, bend more. If you don't stretch your back properly, you may hurt it later when you throw the ball."*
>
> *Soo-mi: [As if annoyed] "I have never been injured in a PE class."*
>
> *Myeongho: "Always make sure that there is no one in front of you before you throw a flying disk."*
>
> *Unknown: "Don't worry, teacher. Even if I get hit by one, it never hurts me."*

A gap in PE class safety also existed between students and teachers. As shown in the field notes made during non-participant oservation of the PE classes, students seemed oblivious to PE class safety, unlike teachers, who were sensitive to safety issues. Participants were sometimes observed to be upset or to caution students in a stern manner when they did not observe safety rules or talked as if those rules were nothing serious. Kyeongho said,

> *"even if I try to teach safe physical activities and sports, it is the students who own the moving bodies. Thus, those who should make the most efforts for safe PE classes are none other than students."*

Discussion

The present study was conducted with specialist PE teachers in elementary schools to explore their perceptions and practices of PE class safety. Specifically, their PE class risk assessments, risk management strategies, and difficulties in risk management were examined.

First, it was found that PE class risk assessment and the ability to perform risk management are an important expertise that teachers possess. Risk factors for PE class safety accidents differ vastly according to context, and thus a teacher should assess risk in a thoughtful manner and manage it according to the context (Chappell, 2015). If a teacher lacks such expertise, the dream of becoming a PE teacher may end up being a dream of "Killer Jobs." (Finn et al., 2017)

Second, the present study findings are a reminder that attention should be paid to thoughtless education hidden behind the widespread safety-first policy. As confirmed in the study, school management emphasizing outcome-oriented safety-first policies and prioritizing liability over prevention, despite teachers' efforts to practice teaching safely and safety in PE class, induces teachers to think that "if there is a risk, we don't teach." Many PE teachers decide whether or not to teach a certain physical activity by determining whether the benefits of the activity outweigh the risk or the risk outweighs the benefits (Beaumont, 2007, p. 31), and holding too tightly to a safety-first policy reduces teachers' desire for education and shrinks educational activities, the harms of which are passed onto the students. Thoughtless education is more dangerous than obliviousness to safety.

Third, the results suggest that safety assessments in PE classes are focused on prevention and quantitative methods. Of course, prevention is a keyword that should be given priority over anything else in safety. A series of tasks for teachers to assess and manage PE class risks serves to prevent safety accidents in PE classes. However, attention should not be focused on "how many safety accidents were prevented in PE classes?" The assessment items should include the school staff's efforts to prevent accidents and what actions they have taken in the event of an accident. In order to do so, it is necessary to implement methods of qualitative analysis of the safety manual and safety incident cases of the unit school while avoiding a quantitative evaluation that merely counts the incidents of safety accidents or the number of safety education activities.

Conclusions

The present study findings can contribute to increasing the understanding of specialist PE teachers' risk assessment, risk management, and difficulties in risk management in elementary school PE class. The results suggest that teaching safely and safety in PE classes involves complex pedagogical activities. Teachers should have an accurate understanding of sports facilities and equipment needed for class and the sport that is the content of PE class while perceiving students' physical condition and risk factors in terms of their teaching methods. Based on such risk assessment of PE class, teachers should be able to establish strategies to perform risk management. Teacher education programs should conceptualize safety issues from a pedagogical perspective so that safety classes can be a stepping stone rather than a stumbling block to other PE activities. Especially, expertise in assessing and managing the safety risk in PE class should be addressed seriously in both pre- and in-service teacher education programs. In addition, the lack of teachers' perceptions of the emotional and psychological aspects of safety shows that teachers conceptualized safety as a mere physical issue rather than a holistic issue encompassing both physical and psychological aspects.

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March 2018, Volume **10**, Issue **4**, **463-474**

Sixth Grade Students' Skills of Using Multiple Representations in Addition and Subtraction Operations in Fractions*

Received: **14 February 2018**
Revised: **20 March 2018**
Accepted: **20 March 2018**
ISSN: 1307-9298

www.iejee.com

DOI: **10.26822/iejee.2018438137**

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Abstract

The current study aims to show the transition skills of sixth grade students between the representations (numerical, model, number line and verbal) given in addition-subtraction operations in fractions and to analyse the ability of the students to construct each representation type. In this research, case study method was used in terms of the subject and process followed. The study group of the research is the sixth grade students of three middle schools in Kastamonu province placed in the northern part of Turkey. The research participants consisted of 59 students, 31 of which are male and 28 of which are female. Data collected through "Multiple Representations in Fraction Operations Test". According to research findings, it has been determined that the achievement of students in using different representations in operations with fractions is higher in addition operation compared to subtraction operation. In addition, it turns out that students are more successful in numerical-numerical, model-model, model-numerical, and numerical-model transitions compared to other transitions in both operation types. It was also found out that students fail in other representation types such as number line and verbal representation transition situations.

Keywords: Multiple representations; addition and subtraction of fractions; representation creation skill; transition among representations

Introduction

Most people define mathematics as a field consisting of abstract concepts, algorithms, and symbols without any connection with real world (e.g. Cramer, 2003). For this reason, researchers emphasize the necessity of teaching mathematics as an integrated concept and processing system based on certain patterns and associations that exist in the real world (Nair & Pool, 1991; Resnick & Ford, 1981). This necessity causes long debates in the need for using appropriate representations in teaching and learning of mathematics in terms of having complete understandings of mathematical concepts, expressing mathematical ideas and relationship between concepts (Duval, 2006; Goldin & Shteingold, 2001). Moreover, taking advantage of different representations in the teaching of a mathematical concept and making transitions between different forms of representations are critical in terms of a complete internalization of mathematics. (Kaput, Blanton, & Moreno, 2008; Lesh, 1999; National Council of Teachers of Mathematics [NCTM], 2000). Hence, the use of representations has been a crucial topic in learning of mathematics over the past three decades in standards of school mathematics for developing students' abilities to use appropriate representations and to make correct and robust translations among them (Ministry of National Education [MoNE, 2013]; National Council of Teachers of Mathematics [NCTM], 2000; Van de Walle, Karp, & Bay-Williams, 2010). However, studies focusing on students' abilities in use of representations indicate that middle school students have inadequate knowledge and ability to construct appropriate representations and to transform from one representation to the others (Gagatsis & Elia, 2004; Neria & Amit, 2004).

Multiple representations can be defined as a process of visualizing and concretizing abstract concepts or symbols in everyday life in general terms, as well as the definition of the relationship between objects or symbols in mathematics (Kaput, 1989). The theory of multiple representations in mathematics education has begun to gain importance with the studies of Dienes. Influenced by Piaget's theories and made studies with Bruner, Dienes called the concept of multiple representations as "Perceptual Diversity Principle." According to this principle, presenting a conceptual structure in multiple forms as perceptually identical as possible will make it easier for the student to have the mathematical significance of abstracting (Dienes, 1960). In this context, concepts should be able to be presented in different forms. Multiple representations and the learning relationship point to a learning environment with a particular focus on conceptual learning (Dufour-Janvier, Berdnarz, & Belanger, 1987). In this context, mathematics teachers need to consider and effectively use multiple representations of information in verbal, numerical, visual graphical or numerical forms, with the support of developing technology, rather than using only intensive verbal and mathematical language.

Research on multiple representations in mathematics teaching has shown that using multiple representations helps students better understand and improve their problem solving performances (Ainsworth, Bibby, & Wood, 1997; Akkuş-Çıkla, 2004; Moseley & Brenner, 1997; Sert, 2007). If it is not possible to switch between different representations, it can be said that the mathematics cannot be understood at the conceptual level (Ainsworth, 1999; Van der Meij & De Jong, 2006), When studies focusing on multiple representations are examined, it has been shown that the efforts of the students to determine the ability to switch between different representations are based on problem solving (Corter & Zahrer, 2004;

*This study has been produced from the master's thesis referenced as "Kara, F. (2017). An investigation of sixth grade students' skills of using multiple representations in addition and subtraction of fractions. Unpublished master's thesis, Kastamonu University, Graduate School of Science."

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İpek & Okumuş, 2012; Lesh, Landau, & Hamilton, 1983), algebraic expressions (Sert, 2007) and function (Baştürk, 2010). Moreover, some studies focused on the ability of students' and teachers' preferences for multiple representations (Ainsworth, 1999; Akkuş-Çıkla, 2004; Sert, 2007). However, there has not been a detailed examination of the addition and subtraction operation of fractions between multiple representations and multiple representations.

In mathematics education context, worldwide research on students' understanding about fractions and fraction operations indicates that learning fractions is a complex and difficult process. The impediments in students' reasoning of fractions included factors such as an early emphasis on whole-numbers (e.g. Behr, Harel, Post & Lesh, 1994) and insufficient abilities to transform between multiple representations (Tunç-Pekkan, 2015). On the other hand, it is claimed that even though students can easily carry out the algorithms with fractions, they do not understand the meanings of such algorithms (Mick & Snicrope, 1989; Wearne-Hiebert & Hiebert, 1983). Considering students' difficulties and misconceptions about addition of fractions, researchers suggest using multiple representations in teaching and learning of fractions meaningfully in order to overcome students' difficulties and to develop their conceptual understanding of fractions (e.g. Alacacı, 2010; Tunç-Pekkan, 2015).

Studies about fractions generally focus on the problems that students have experienced in operations with fractions (Orhun, 2007; Soylu & Soylu, 2005), the problems they have in creating different representations of fractions (Işık & Kar, 2012; Pesen, 2008), the representation preferences that students use in fractions (Kılıç & Özdaş, 2010), and the misconceptions they have about fractions (Biber, Tuna, & Aktaş, 2013). However, no studies have been found that examine the preferences of students, achievement situations in their preferences and representation creation situations. Developments in the way students think about representation in mathematical learning have revealed the need for the use of multiple representations (Pape & Tchoshanov, 2001). In this context, there are unanswered questions about the qualities of creating and using multiple representations, and the questions of this research are worth answering. Again, the results of this research are important for the review of classroom teaching. On the other hand, these research findings of this study are thought to contribute to the use of alternative pedagogical approaches to mathematics educators and researchers, and to investigate the effects of these approaches on classroom settings.

Purpose of the research

Among the purposes of this study are to show the transition skills of sixth grade students between the representations (numerical, model, number line and verbal) given in addition-subtraction operations in fractions and to analyze the ability of the students to construct each representation type.

Problems of the research

1) How are the transition skills of students between the multiple representations involved in the addition and subtraction operations in fractions?

2) How are the skills of the students to create different types of representations used in the addition and subtraction operations in fractions?

Methodology

In this research, case study method, which is one of the interactive patterns in the qualitative research approach, was used in terms of the subject and process followed. The case study is a method that allows the researcher to focus on a specific situation such as an event, a person or a group and investigate the situation in the cause-effect relation with the obtained data in more detail (Çepni, 2012). In the case study, in the questions of "How?" or/and "Why?" are included in the research design and the case is examined in depth (Yıldırım & Şimşek, 2013). In this study, the transitions of sixth graders were defined between the representations in the addition and subtraction of fractions according to the question of "How?". We also investigated the difficulties encountered in the process of creating each representation using the question "Why?".

Study group

The study group of the research is the sixth grade students of three middle schools in Kastamonu province placed in the northern part of Turkey. Purposeful (deliberate) sampling method was used to determine the participants (Yıldırım & Şimşek, 2013). Criteria for determining grade level included curriculum coverage of the objectives regarding operations in fractions, and in this context, sixth grade students have been used as the targeted population. In determining the schools to be worked with, the provincial general achievement average was taken into account and three schools with average level of achievement were included in the study.

Initially, a total of 73 sixth grade students, 38 males and 35 females, participated in the research. However, as a result of the pre-evaluation of the application, it was determined that 14 students did not answer the questions at all and they were excluded from the further examination. Finally, the research participants consisted of 59 students, 31 of which are male and 28 of which are female.

Data collection tools

Two data collection tools were used in this study. The first tool is a demographic questionnaire containing students' gender, age and mathematics class notes. As the second data collection tool, "Multiple Representations in Fraction Operations Test" was used (Appendix 1). In order to construct the test, firstly the curriculum objectives related to the concepts were examined. In accordance with the number of objectives and the course hours devoted to the addition and subtraction of fractions, a trial test was prepared with 30 test items consisting of 8 main questions and sub-questions. In order to determine the validity and reliability of the test, three expert opinions were taken from the mathematics education field. Coverage validity of the instrument achieved through the step that the experts indicate whether each test item is eligible by marking the "suitable," "not suitable" and "needs to be changed" options according to their intelligibility, quality and level criteria.

In order to determine the validity and reliability of the 30-question trial test, the pre-test was conducted on 59 students in two middle schools in Kastamonu (Turkey) province center. According to the results of the application, item difficulty index and item discrimination index were calculated for each question (Table 1). According to the item difficulty and discrimination analysis, it was found that the items with the item discrimination index between -1 and 0 were removed from the test,

the items between 0 and 0.30 were corrected and the items higher than 0.30 were used directly in the test.

Table 1. *Results of multiple representations in fraction operations test item analysis*

Item #	Difficulty	Distinctiveness	Item #	Difficulty	Distinctiveness
1	0.75	0.49	16	0.51	0.75
2	0.81	0.49	17	0.58	0.72
3	0.25	0.78	18	0.29	0.76
4	0.32	0.54	19	0.22	0.69
5	0.69	0.49	20	0.66	0.64
6	0.31	0.83	21	0.37	0.85
7	0.63	0.62	22	0.56	0.65
8	0.34	0.56	23	0.24	0.74
9	0.25	0.63	24	0.27	0.70
10	0.64	0.70	25	0.49	0.82
11	0.61	0.69	26	0.47	0.81
12	0.27	0.75	27	0.22	0.74
13	0.36	0.81	28	0.27	0.74
14	0.73	0.47	29	0.44	0.85
15	0.76	0.53	30	0.39	0.78

The KR-20 reliability coefficient of this test was calculated as 0.96. As a result, "Multiple Representations in Fraction Operations Test " prepared in line with item analysis and expert opinions was used as data collection tool. The final state of the test consists of 8 main questions and a total of 30 open ended questions including three inter-representative transitions under these questions. The distribution of the questions in the test is given in Table 2.

Coding procedures

At the beginning of the study, in order to create the coding list, the related literature was examined, the representation types determined in the addition-subtraction operations in fractions were developed and the representations to be used in the codes were decided. In Table 3, the criteria used to assess the skills of the students on the representation determined in the study are given. Two experts working independently were involved in the coding process of the data. Both experts have numerous studies regarding use of multiple representations in mathematics education. As a result of the first coding, the agreement rate (reliability coefficient) between coders was calculated as 88.7% according to the Miles and Huberman (1994) formula. The coders came together and discussed the items causing the dispute and reached an agreement on each item.

Table 2. *Multiple Representations in Fraction Operations Test question distributions*

The type of representation the problem is given	Question number		Type of representation required to transit
	Addition	Subtraction	
Model	1	5	Model
	1a	5a	Numerical
	1b	5b	Number line
	1c	5c	Verbal
Numerical	2	6	Numerical
	2a	6a	Number line
	2b	6b	Model
	2c	6c	Verbal
Number line	3	7	Number line
	3a	7a	Numerical
	3b	7b	Model
	3c	7c	Verbal
Verbal	4 a	8a	Number line
	4b	8b	Model
	4c	8c	Numerical

Data analysis

The achievement rate of the students related to transiting among the representations have calculated through correct answers given to the related questions. In this calculation, it is taken into account the expressions of the questions (in writing) and the representations which are used in the solution of the questions. By creating these two different categories, it is aimed to determine the direction of the transition. For example, if a question is given in a numerical form, and verbal explanations are sought in the solution, then a judgment has been reached that there is a transition from numerical representation to verbal representation in this question. Students' skills of creating each representation was analyzed by means of the criteria mentioned in Table 3.

Findings

Findings regarding the transition skills of sixth grade students in the addition and subtraction of fractions are given in Table 4. When the table is examined for addition operation, it has been determined that the students are more successful in situations where the numerical response to the question given in the form of model representation (transition from model to numerical mode) and the cases where the numerical expression of the verbal questions is requested (verbal to numerical transition). Again, it turns out that the majority of students are successful in tran-

Table 3. *Criteria for creating representations*

Numerical	Number line	Verbal	Model
1) Writing the mathematical expression of the representation 2) Denominator equalization if necessary 3) Expressing the given operation numerically 4) Performing the operation	1) Drawing the number line 2) Placing the integers 3) Separating by equal units (determining the denominator) 4) Expressing fractions (showing numerator with arrows) 5) Performing the given operation 6) Showing the result (arrowing out)	1) Expressing the given fractions (verbal) correctly 2) Identification of objects suitable for given fractions (wholes to be fragmented) 3) Performing the given operation in the text 4) To be able to express the process given at the root of the question.	1) Drawing a closed figure divided by the appropriate units for given fractions (Determining the denominator) 2) Screening the requested part according to the given fractions (determining the numerator) 3) Denominator equalization if necessary 4) Performing the given action on figures

sitions requiring to construct model and numerical representations in the addition operation. On the other hand, students' performance in the transition where the number line representation and the verbal representation are required have been relatively low (between 14% and 22%).

Table 4. *Students' achievement rate in transiting between representations (%)*

To:	Model		Numerical		Number line		Verbal	
From	+	-	+	-	+	-	+	-
Model	64	39	76	47	10	34	19	7
Numerical	54	47	64	59	15	24	20	8
Number line	51	34	54	36	10	15	14	7
Verbal	66	31	75	29	22	14	NR	NR

Note: NR: Transition not required

When the findings of subtraction operation are examined from table 4, it is seen that the achievement status of the students in general is lower than their achievement rates in the addition operation. Moreover, it was determined that the situation in which the students were most successful in transition between representations was determined as the transition which a numerical answer was required for the numerical question (59%). Again, it turns out that almost half of the students are successful in the questions requiring model-numerical and numerical-model transition in the subtraction operation. On the other hand, it is observed that in the case of the remaining representation transition pairs in the subtraction operation, the students show very low achievement, especially in transitions requiring verbal representation creation.

Issues encountered in forming representations

In this section, problems encountered about the representations are analyzed and presented according to previously determined criteria. The values given were obtained from the responses given to the questions to form each representation.

Issues in model representation forming

Table 5 lists the difficulties that students encounter in model representation during addition and subtraction in fractions. When the table is examined, students' difficulties were encountered in all the steps that should be followed during the model representation forming process. While adding fractions on a model, students have made more mistakes in the steps determining the denominator and fulfilling the operations. It has been observed that students left more unanswered questions in the subtraction operation. Moreover, it is seen that the mistakes that students make during the steps of fulfilling the operations and determining the numerator are also more prevalent in the subtraction operation.

Figure 1 provides an example of a mistake in the denominator determination stage in addition operation. According to the figure, the student was asked to add up the fractions 2/12 and 4/12 given on the model. The student has drawn a figure of 8 units (denominator) and marked 6 units (numerator) in the model created in the answer and expressed the solution as 6/8. When performing the addition operation on the model representation, student is seen to not focus on denominator on the final answer, but only added up the hatched areas.

Table 5. *Issues encountered in model representation forming (f)*

Steps	Addition	Subtraction	Total
Determining the denominator	55	48	103
Determining the numerator	43	55	98
Equalizing denominators if necessary	30	52	82
Fulfilling the operation	48	72	120
Unanswered	18	47	65

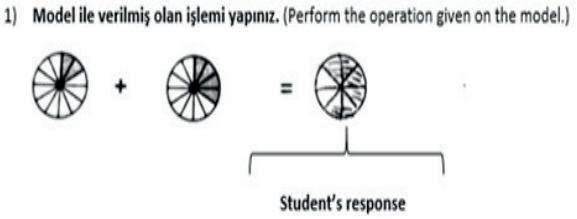

Figure 1. Denominator mistake in transition from model representation to model representation (S28)

An example of a mistake in performing operation is shown in figure 2. Here, the student identified fractions given verbally (three tenths and two tenths) on the model separately, but on the model formed in the answer while performing the addition operation, drew a 10-unit figure (denominator) and marked 4 unit (numerator) and expressed the answer as 4/10. While the student was performing the addition operation in the form of a model representation, he could divide the whole into equal parts but could not mark the required part (numerator).

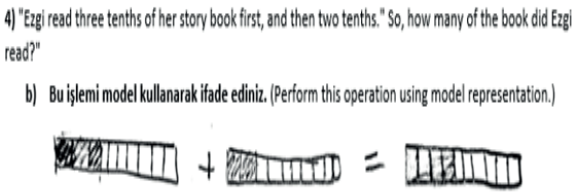

Figure 2. Mistake in performing operation transition from a verbal representation to model representation (S16)

Figure 3 shows an example of a mistake in denominator equalization and performing an operation in transition from model representation to model representation. When the fractions given in the model representation are examined, it is observed that the student cannot divide the second whole in the same way as the first whole in terms of procedural skill (to achieve equal denominators), and could not divide into suitable unit in the new fraction formed when subtracted the unequal denominators from each other.

Issues encountered in numerical representation forming

In Table 6, the problems that students encounter while forming numerical representation are presented in accordance with predetermined criteria. It is seen from that mistakes were encountered in each of the steps to be followed in the process of creating a numerical representation while the frequencies of the mistakes encountered in conducting numeric operations were less than those in model operations of fractions. However, there was more

unanswered questions in numerical representations (*f*= 84) than model ones (*f*= 65).

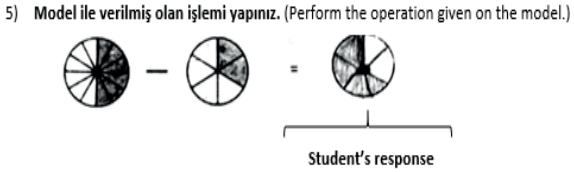

Figure 3. Mistake in denominator equalization and performing an operation in transition from model representation to model representation (S72)

While adding fractions by using numerical representations, students suffered from more mistakes in the steps of performing the operation and writing the numerical expression of the representation. It has been observed that students left the questions in the subtraction operation unanswered more, mistakes were encountered more in the performing operation stage in subtraction operation.

Table 6. *Issues encountered in numerical representation forming (f)*

Steps	Addition	Subtraction	Total
Writing the numerical expression of the representation	27	30	57
Expressing the operation numerically	17	30	47
Equalizing denominators if necessary	19	34	53
Performing the operation	39	56	95
Unanswered	27	57	84

When the mistakes frequently encountered by the students in the numerical representation are examined, it is seen in figure 4 that the student who correctly express the fractions given in model representation cannot numerically subtract the fractions. It is understood from the operation performed, (s)he subtracted first numerator from the second to find to the numerator, and subtracted denominator from denominator to calculate the denominator. He performed the subtraction operation by thinking denominator and numerator separately. In other words, it is seen that the result is obtained by subtracting numerators and denominators by themselves.

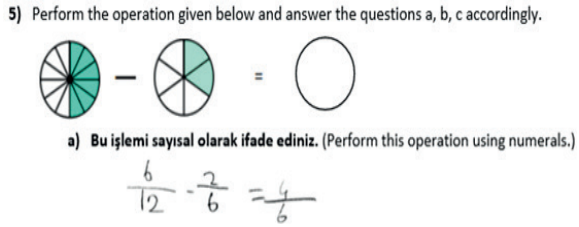

Figure 4. Performing operation mistake in transition to model representation to numerical representation (S68)

In Figure 5, an exemplary case of denominator equalization mistake is shown. In this question, it is required to numerically subtract fractions given in numerical representation. When the student performs the operation it appears that he knows that denominator equalization is necessary but he performs the operation without extending the numerator with regards to obtaining an equal fraction by extending the fraction to equalize the denominator.

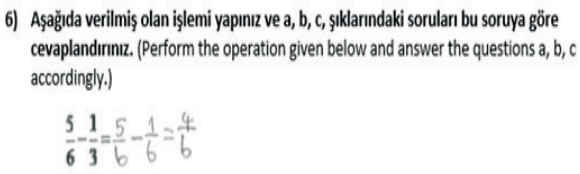

Figure 5. Denominator equalization mistake in forming a numerical representation (S12)

Issues encountered in number line representation forming

Table 7 presents the mistakes the students made when performing the addition and subtraction of fractions on the number line. It has been determined that students make numerous mistakes in the steps of expressing fractions on the number line (showing by arrows), determining the given operation on the number line and showing the result (by arrowing out), although the mistakes are encountered at each step in general. On the other hand, it has been observed that most students left these questions unanswered.

Table 7. *Issues encountered in number line modeling forming (f)*

Steps	Addition	Subtraction	Total
Drawing the number line	1	1	2
Placing the integers	22	14	36
Separating by equal units (determining the denominator)	55	45	100
Expressing fractions (showing numerator with arrows)	105	75	180
Determining the operation	88	88	176
Showing the result (arrowing out)	123	90	213
Unanswered	55	81	136

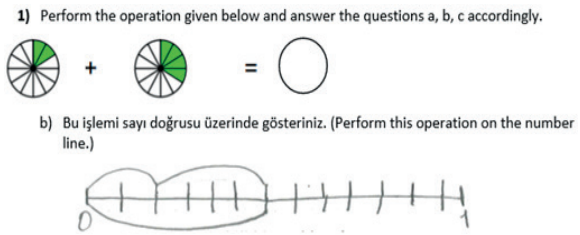

Figure 6. Separating into equal units (determining the denominator) (S64)

Figure 6 provides an example of one of the mistakes that students often make which is to divide the whole into equal parts and identify on the number line, i.e. placing the denominators. While the whole is required to be divided into twelve equal parts on the number line, it is seen that twelve lines were drawn on the whole and divided into thirteen parts.

In figure 7, there is an example of a mistake for performing the operation. The student was able to construct the number line correctly while performing the operation on the number line. However, when performing the addition operation on the number line, focused only on the fractional expressions, and identified the places of these on the number line and showed the numerically known (calculated) value on the number line. Student could not perform addition operation in fractions by using number line.

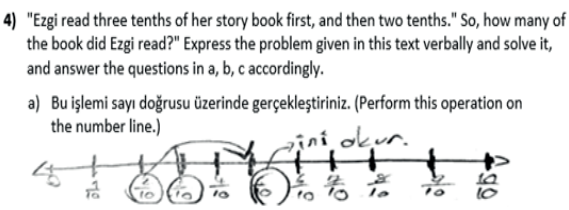

Figure 7. Example of performing an operation mistake (S27)

Issues encountered in verbal representations

In table 8, the mistakes the students made when performing the addition and subtraction operations on the verbal representation in fractions were identified. In general, mistakes were encountered in each step, but it has been determined that most of the mistakes are made by the students in the steps of creating the verbally appropriate scenarios and expressing the operation given at the root of the question correctly. It is noteworthy that the number of unanswered questions in the addition subtraction operation in verbal representations is rather high, and that the number of unanswered questions is higher in subtraction operation compared to addition.

Table 8. *Issues encountered in verbal representation forming (f)*

Steps	Addition	Subtraction	Total
Expressing the fractions correctly	32	24	56
Identification of objects suitable for given fractions (wholes to be fragmented)	25	33	58
Creating a scenario that is suitable for given operation	36	60	96
Being able to express the operation given at the root of the question.	84	82	166
Unanswered	52	69	121

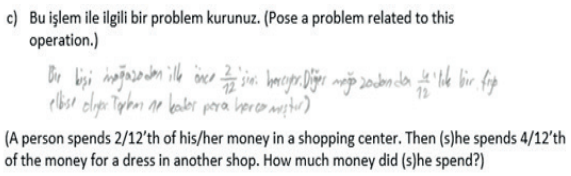

Figure 8. Mistake in scenario creation and question root determination in transition to model representation to verbal representation (S27)

In figure 8, an example of mistakes in creating scenarios and expressing the operation given in the root of the question in relation to the verbal representation of the model representation addition operation is given. The student has set up a scenario by expressing mathematically the fractions given and spent 2/12 of his money first, then 4/12 of it in the scenario. The student, while creating the problem scenario, could not reveal the initial situation clearly, could not express the sentences fully and also formed a question root as "how much money did (s) he spent" while it should've been "what was the portion of the money that (s)he spent?"

In figure 9, an example of a mistake in creating a scenario that is suitable for given operation (subtraction in this case) is given. The student has correctly expressed fractions in the given (as model) subtraction operation. Although (s)he expressed the subtraction operation by asking the remaining amount, (s)he set up a scenario requiring the addition of fractions. In addition to this, the question root asked about the number of slices, not the fractional result, resulting in a situation that the answer should be a natural number.

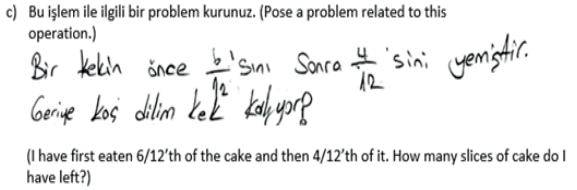

Figure 9. Mistake in creating a scenario suitable for the operation (S15)

In figure 10, an example of mistake in identifying an object suitable for operation (fragmentable) is given. This question requires constructing a verbal representation appropriate to the subtraction operation given on the number line. The student has not been able to express exactly the fragmentable wholes even though (s)he identified the fractions correctly. It has been seen that the student has set up a problem sentence requiring a subtraction operation as question root but he has expressed the subtraction operation with natural numbers (20 pieces) instead of the subtraction operation with fractions.

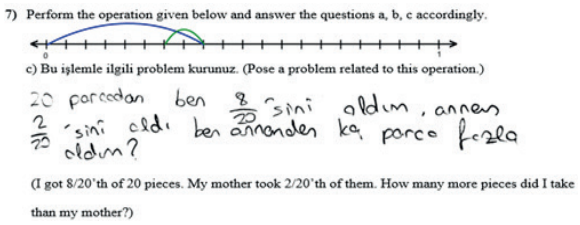

Figure 10. Mistake in identifying suitable objects for given fractions (wholes to be fragmented) and being able to express the operation given in question root (S32)

Conclusions and Discussion

In this study, using multiple representations and transformations into each other were sought by focusing on model, number line, verbal and numerical representations involved in addition and subtraction operations in fractions. According to research findings, it has been determined that the achievement of students in using different representations in operations with fractions is higher in addition operation compared to subtraction operation. In addition, it turns out that students are more successful in numerical-numerical, model-model, model-numerical, and numerical-model transitions compared to other transitions in both operation types. This situation is in parallel with the different studies that reveal student achievement towards numerical and model representations (Herman, 2002, Pitts, 2003, Şiap & Duru, 2004). It was also found out that they fail in other representation types such as number line and verbal representation transition situations. Students also expressed the difficulties experienced by students in verbal (Sert, 2007) and numerical line representations (Kılıç & Özdaş, 2010).

In forming model representation, more mistakes were identified in the denominator and numerator determination steps in addition operation. On the other hand, mistakes in subtraction of fractions were more frequent in the steps of performing the operations and determining the numerator. This situation indicates the difficulties that students have experienced in constructing the concept of fraction. The use of models in the teaching of fractions

and in the construction of fractional numbers is the basis for the development of fractional numbers (Vergnaud, 1983). The use of a number of models and manipulative tools in introduction to fractions makes it easier to learn the concept of fractions and makes it easier for students to deal with fractions because it makes the fractions concrete for elementary school primary learners who are still in the concrete operations stage (Kieren, 1976).

In numerical representations, students were more challenged in the subtraction operation, and mistakes were made in the steps of performing the operation and writing the numerical expression of the representation. Particularly, in the fractions with different denominators, it is determined that the students continue their natural habits and that they consider the denominators and numerators as separate numbers and add. The relevant problem has been widely described in the literature (Carpenter, Coburn, Reys, & Wilson, 1976; Işık & Kar, 2012).

In representation of number line, the difficulty experienced by the students in dividing number line into required denominator was the result of dividing into missing or more equal parts. Similar difficulties that students have experienced with respect to the number line have also been demonstrated by Pesen (2008). The situations in which the students create verbal representation types in the addition and subtraction operations of fractions are examined and different errors are noticed in the operation steps according to the results. In this case, where the students preferred non-fragmentable wholes, the situation emerged as perceiving the question as rational number rather than fraction meaning.

It was determined that, while performing addition and subtraction operation in fractions on the verbal representation, the students generally made mistakes at each step, but most mistakes were made in the forming suitable scenario and being able to express the operation given at the question root correctly stages. It has been found that the students made mistakes in the addition and subtraction operations in forming the root of the question. Moreover, setting up sentences that give the meaning of integer to a fraction was among the most frequent question root mistakes. Işık and Kar (2012), in the study they conducted, have also identified problems such as the inability of the students to perceive the quantities specified by the numbers in the fraction operations and the inability to reflect the operation to the root of the question. The content of the identified difficulties and the high number of difficulties identified in the established problems indicate that the students are lacking conceptual dimension for fractions and addition and subtraction operation in fractions. This result supports the conclusion that the difficulties oriented to fraction operations cannot be evaluated separately of difficulties in learning fractions and the roots are based on fraction concepts as indicated by Charalambous, Delaney, Mhuire, Hsu and Mesa (2010). Students' difficulties in adding and subtracting fractions have concerned educators for years. Researchers have also explored what causes student errors such as adding (or subtracting) the numerators and the denominators. This exploration suggested that several cognitive factors might explain such errors. For instance, it was proposed that students often view fractions as two separate whole numbers (one corresponding to the numerator and another to the denominator) rather than as individual quantities (Carpenter et al., 1976), and that they are often misguided by inappropriate analogies (e.g., they believe that when adding or subtracting fractions it is legitimate to add or subtract the numerators and denominators because in the multiplication of fractions one multiplies the numerators and the denominators) (Vinner, Hershkowitz, & Bruckheimer, 1981).

Students' difficulties in adding and subtracting fractions cannot be separated from their difficulties in learning fractions generally. Studies suggest that such difficulties have their roots in the complexity of the notion of fractions and in instructional approaches employed when teaching fractions (Ball, 1993; Behr, Harel, Post, & Lesh, 1993; Lamon, 1999). For example, meanings, models, and symbols that worked well for students when working on whole numbers may interfere with students' developing understanding of fractions (Lamon, 1999). Furthermore, fractions make up a multifaceted concept, consisting of five interrelated constructs: part-whole, measure, operator, quotient, and ratio (Kieren, 1976). Because each construct captures different aspects of fractions, constructing a comprehensive schema of fractions requires developing a robust understanding of all five constructs and of their confluence (Behr et al., 1993).

Research has also shown that instruction may impede the learning of fractions, especially when (1) it fails to build on students' prior knowledge (Mack, 2001), (2) it emphasizes rote learning at the expense of conceptual understanding (Ball, 1993; Mack, 2001), (3) it introduces formal symbols and algorithms before familiarizing students with the different aspects of the notion of fractions (Smith, 2002), or (4) it emphasizes only one of the constructs (usually the part-whole construct, (Moss & Case, 1999). Textbooks, as one tool of instruction, may contribute to compounding or ameliorating such difficulties. In the framework used in the present study such criteria are given detailed consideration.

Findings obtained from this study are thought to be important for those who guide educational policies and those who contribute to the preparation of the mathematics curriculum. Educational research studies are important for shedding light on the development of educational reforms and the curricula prepared in this direction. In this context, it is thought that the institutions or individuals involved in this process will contribute to matching the findings obtained from this study with targeted outputs in educational policies or curricula.

This is a study conducted in the form of special case analysis. Further qualitative or interventional research that focuses on teachers' classroom practices, student preferences for representation and ability to use representations might be useful to investigate and broaden the results obtained in this study. It is also contemplated that tools developed to determine the representation usage competencies or skills, perceptions or attitudes towards representations of students (or teachers) will contribute to quantitative and qualitative studies with subject of "multiple representations and mathematics learning".
The results of the research indicate that students are experiencing difficulties in verbal representations of addition and subtraction operations in fractions. In order to develop the skills of problem-solving in the development of these skills, it is important to establish a relationship between real life situations and fractions (Abu-Elwan, 2002, Akay & Boz, 2008, Dickerson, 1999, Işık, Işık, & Kar, 2011). Moreover, these activities support the conceptual understanding in the students (Akay, 2006; Crespo and Sinclair, 2008; English, 1998, 2003; Işık, 2011; Stickles, 2006; Toluk-Uçar, 2009). For these reasons, teachers should provide students with the opportunity to express themselves in a verbal and linguistic way in order to improve their problem-solving skills in lessons and give students opportunities to problem-solve as well as problem-solving methods.

Again, while the verbal questions are being asked, the scenario part should be cut in half and the students should be asked to complete or the part of the question root should be left empty, students should be gained expressing fractions.

Fractions are conceptually abstract for middle school students. When the concept of fractions is explained only by verbal expressions or numerical representations, students cannot understand these concepts that are abstract to them (Piaget, 1952). For this reason, the use of models and teaching materials that represent multiple forms of representation in the teaching of addition and subtraction in fractions is crucial for the realization of meaningful learning. This study can be regarded as a study that especially sheds light on teacher and teacher candidates.

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Appendix

Multiple Representations In Fraction Operations Test

This test consists of 8 questions. There are 3 sub-questions in each question. Please answer carefully.

Activities

1) Perform the operation given below and answer the questions a, b, c accordingly.

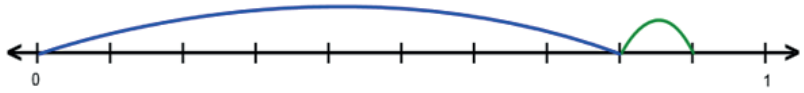
a) Perform this operation using numerals.
b) Perform this operation on the number line.
c) Pose a problem related to this operation.

2) Perform the operation given below and answer the questions a, b and c accordingly.

$$\frac{1}{4}+\frac{3}{8}=$$

a) Perform this operation on the number line.
b) Perform this operation using a model.
c) Pose a problem related to this operation.

3) Perform the operation given below and answer the questions a, b, c accordingly.



a) Perform this operation using numerals.
b) Perform this operation using a model.
c) Pose a problem related to this operation.

4) "Ezgi read three tenths of her story book first, and then two tenths." So, how many of the book did Ezgi read?" Express the problem given in this text verbally and solve it, and answer the questions in a, b, c accordingly.

a) Perform this operation on the number line.
b) Perform this operation using model representation.
c) Perform this operation using numerals.

5) Perform the operation given below and answer the questions a, b, c accordingly.

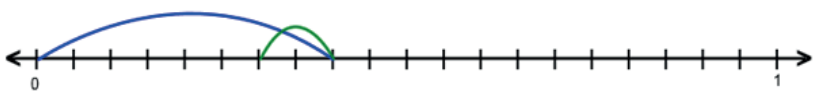
a) Perform this operation using numerals.
b) Perform this operation on the number line.
c) Pose a problem related to this operation.

6) Perform the operation given below and answer the questions a, b, c accordingly.

$$\frac{5}{6}-\frac{1}{3}=$$

a) Perform this operation on the number line.
b) Perform this operation using a model.
c) Pose a problem related to this operation.

7) Perform the operation given below and answer the questions a, b, c accordingly.



a) Perform this operation using numerals.
b) Perform this operation using a model.
c) Pose a problem related to this question.

8) “How many more pizza did Ahmet, who ate one half, ate compared to Zeynep, who ate one fourth of the pizza?” Express the problem given in this text verbally and solve it, and answer the questions in a, b, c accordingly.

a) Perform this operation on the number line.
b) Perform this operation using a model.
c) Perform this operation using numerals.

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March 2018, Volume **10**, Issue **4**, **475-487**

An Analysis of A Teacher's Questioning Related to Students' Responses and Mathematical Creativity in An Elementary School in The UK

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Received: **14 February 2018**
Revised: **20 March 2018**
Accepted: **20 March 2018**
ISSN: 1307-9298

www.iejee.com

DOI: **10.26822/iejee.2018438138**

Abstract

Questioning has an important role in teaching mathematics. There is current research about questioning, especially related to class discussion and students' responses. Some researchers suggest teachers pose any kind of questions in mathematics classroom regarding problem solving and mathematical creativity. This research focused on a teacher's questioning activity and students' responses as well as students' mathematical creativity in response to the teacher's questions. This study used observation of a lesson that involved a teacher and twenty-seven third-year students (aged 7-8). Audio recording and notes were taken during the observation, and six students' work samples were also collected. The researcher transcribed the audio and then formulated appropriate interview questions for the teacher and six students chosen. The interview was conducted for clarifying the observation done and analysing what students' mathematical creativity looked like. This interview was also recorded and transcribed. The teacher applied some questioning techniques like using PowerPoint and a wait-time technique asking different questions both closed and open-ended questions. When asked questions, students were able to produce different responses. However, students gave longer answers to open-ended questions especially while the teacher asked questions "How?" and "Why?". The results also showed that open-ended questions could stimulate students' mathematical creativity.

Keywords: Questioning activity, students' responses, mathematical creativity, closed questions, open-ended questions

Introduction

Questioning has a significant role in teaching and learning activities included in a mathematics classroom. The majority of mathematics teachers are likely to spend 60% of their lesson asking questions (Sullivan & Lilburn, 2002). Martino and Maher (1999) stated that some studies found that teachers' questioning affected the growth of students' conceptual knowledge that helped the advancement of students' mathematical thinking. Questioning can also help teachers for some points: to investigate whether the students were listening and understand the lesson; to stimulate students' thinking; to develop communication between students and teachers; and to help students achieve educational objectives (Shahrill, 2013). Furthermore, Boaler and Brodie (2004) explained that a teacher's questioning plays a role in controlling classroom environments and creating the flow of classroom discussion. These roles identified the importance of teachers' questioning in the classroom. It seemed that the previous studies were conducted to figure out the interaction between teachers and students, but there are still few areas to research about questioning and classroom discussion (Muir, 2009). Therefore, a study regarding to teachers' questions that stimulate a rich discussion is still required to be analysed further.

Capraro et al. (2007) think that it is necessary to provide students with numerous problem-solving experiences that include both closed- and open-ended problems. However, some studies found that most of the questions that teachers provided in teaching and learning mathematics were closed questions that had only one correct answer (Muir, 2009; Kwon et al., 2006). Teachers are required to pose different kinds of questions in order to stimulate mathematical creativity as one of standards of a mathematics curriculum (Kwon et al., 2006). Kwon et al. (2006) believe that mathematics education should emphasise mathematical creativity to give an opportunity for students to develop multiple solutions when answering a question. Although creativity is pivotal in teaching and learning mathematics, it is still questionable what kind of students' creativity in the classroom (Silver, 1997). Hence, it is still become an issue that can be studied.

Because of this background, I intend to find out the answers for two research questions in this study: how a teacher asked questions to students? and what mathematical creativity looked like from students' responses to the questions in the mathematics classroom?

Theoretical Framework

Teachers' questioning

Teachers have to consider how they should ask questions to students, encouraging students to share their answers (Cotton, 2001). Teachers can also ask either oral or written questions to individuals or groups. Cotton suggested that teachers do a wait-time technique after asking a question in which teachers provide time for students to consider about the question before answering because occasionally students are not able to respond to questions spontaneously.

The type of questions

Although Boaler and Brodie (2004) classified teachers' questions into nine categories based on teachers' goals and questioning techniques, they will be hard to use for analysis because some categories have a similar meaning. Meanwhile, Yee (2002) divided the type of questions regarding the number of possible correct answers, into two types of questions, closed- and open-ended questions. Closed-ended questions have only one correct answer while open-ended questions have multiple answers.

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Students' responses

Muir (2009) classified students' responses into explanation, sharing, justification, challenge and answer/response. Explanation is different to sharing because students are required to explain their answer or strategy. Justification refers to when students elaborate their explanation, usually occurring when responding to a probing question. The challenge category is given by students while they question or challenge the answer. Meanwhile, if students give a brief answer or response, this response would be termed the answer/response category.

Mathematical creativity

Silver (1997) described three parts of mathematical creativity: fluency (the number of different answers); flexibility (the number of strategies to solve the question); and originality (how rare the response in the set of all responses or the infrequency of the response). Kwon et al. (2006) found that open-ended questions were effective in fostering students' mathematical creativity because these questions allowed students to apply their own strategy in finding diverse answers that were likely to be novel.

Methodology

This study involved a female teacher who teaches mathematics for third-year children (aged 7-8) in primary school as well as a whole class of year three that consisted of twenty-seven students. Data was collected using observation and interviews. The observation was done in one lesson that involved a whole class for investigating the way the teacher asked questions, the type of questions that the teacher posed and the responses that students gave. During the observation, a whole-class activity between the teacher and students was recorded, notes were also taken, and six students' work samples were collected randomly. The audio was transcribed, and then the researcher set up appropriate interview questions based on the purpose of the study and the issues that were found in the observation and then required clarification. The interview process engaged the teacher and six students individually for clarifying the observation done and analysing what students' mathematical creativity looked like. This interview was also recorded and transcribed.

In this qualitative research, there is found an issue related to the validity and reliability of the recording data. Therefore, the researcher ensured that the data was valid by applied "appropriateness of the tools, processes, and data" (Leung, 2015; p. 328) in this study through a lesson observation. The researcher was also not involved in the teaching and learning process in which it could prevent biased interpretations during data collection process. Furthermore, previous researchers (Chin, 2007; Franke et al., 2009; Martin & Hand, 2009; Muir, 2009) used the similar method, observations, for investigating teachers' questioning activity though they have different research aims. Meanwhile, related to reliability, Leung (2015) stated that researchers have to ensure a consistency of their research process and findings. During collecting data the researcher applied the same approach using voice recording and then transcribing it by rewinding the recorder some times. Thus, I assumed this study will be valid and reliable.

Results

The observation of one lesson

During the lesson, the teacher taught about numbers and angles. This is a short extract from the transcript showing the teacher's questioning about numbers and students' responses to the questions.

Table 1. *Teacher's questioning activity*

Time	Questioning activity	
11:12:40	Teacher: If the answer is 42 what could the question be? You can use one add, one takeaway, one times, one divide	Open, Problem posing
11:15:19	Cleo: 40 add 2 equals 42	Answer 1
11:15:23	Teacher: Is it correct?	Checking
11:15:36	Joe: 62 take away 20 equals 42	Answer 2
11:15:53	Amell: 59 take away 7 equals 42	Answer 3
11:16:03	Emily: 4 times 10 add 2. Put bracket for 4 and 10	Answer 4
11:16:14	Teacher: Well done	Praising
11:16:19	Joe: 32 add 10	Answer 5
11:16:30	Sienna: 8 times 4	
11:16:32	Teacher: Can you tell me what 8x4 is?	Additional Question
11:16:40	Teacher: Rovie?	
11:16:41	Rovie: 32, then+10= 42	Answer 6
11:16:46	Teacher: Good, Obsa?	Praising
11:16:53	Obsa: 42+0	Answer 7
11:16:54	Teacher: Wow, 42 add nothing equals 42	Originality
11:17:00	Tom: 6x7	Answer 8
11:17:03	Teacher: OK, 6x7= 42. What's the opposite/the inverse 6x7?	Additional question
11:17:20	Cloe: 7x6	
11:17:31	Brian: 42 divided by 1	Answer 9
11:17:34	Teacher: Oh, I like it, so, if 42 divides to one person= 42	Originality Praising
11:17:47	Sienna: 84:2= 42	Answer 10

Then, in the last part of the lesson, the teacher gave a task that consisted of some questions that were shown by a slide on PowerPoint (see Figure1). The teacher instructed students to draw three different triangles then answer some questions about these triangles. Students might write their answers in their exercise books. The teacher did not check students' answers due to the limited time.

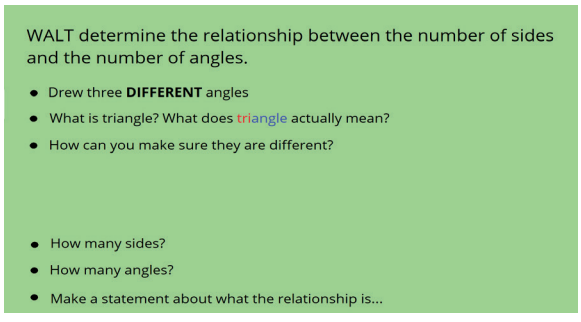

Figure 1. A task on the slide

The researcher collected six students' exercise books to look how the students answered the questions, and then found six different answers below;

The interview of the teacher and six students

The interview with the teacher looked further into the teacher's questioning that was observed before. Individu

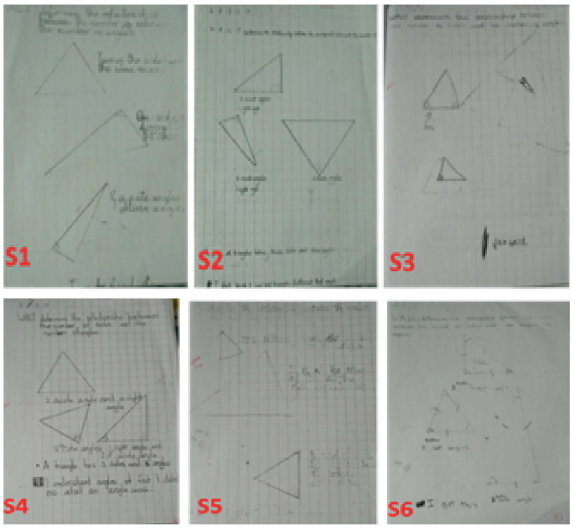

Figure 2. Different triangles drawn by six students

al interviews with the six students for clarifying what they had done were also carried out. From the interview, the teacher stated that she applied two questioning methods, asking students orally and giving students written tasks:

> *Teacher: Both, if I am doing teaching input orally maybe the questions come orally... I think you don't need to have a worksheet every single lesson so it just comes from me, while another day, they might have a list of questions about clocks.*

In addition, when asked about the type of questions that she used, the teacher gave the answer below:

> *Teacher: Sometimes, it depends on the subjects. If you want yes or no answers, you use closed. If you want a deeper understanding, you use open-ended because they can make students think and come up with different ideas, and extend the learning. So, I like to think I do both. More open especially in maths because you want to see links between concepts rather than think just enough.*

When asked what she thought about the correctness of the student's answer, the teacher said she believed there was no incorrect answer.

> *Teacher: I don't believe there is an incorrect answer. I believe there are just misconceptions. So, I would work with the child's response and try, by asking them further questions, to make them realise about their mistakes and get to the right answer. Good questions allow for mistakes and you build more questions from that.*

Furthermore, when asking students about why they thought the three triangles that they drew were different. Four of them assumed they were different because of their sizes:

> *Student 1: It's bigger, this one is smaller and this is thin*

Meanwhile, others looked from the angles that those triangles had:

> *Student 2: I'm not quite sure because two are quite similar. They have the same angles and this one is different.*

The students were also asked to draw as many different angles as they could to further investigate students' understanding of angles. Surprisingly, the students gave the answers below in which they drew triangles instead of angles:

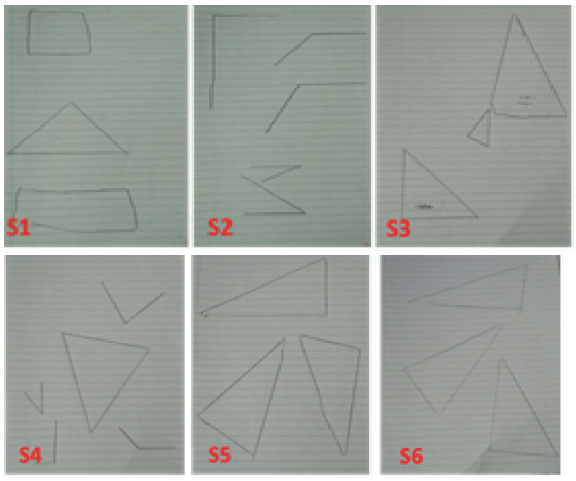

Figure 3. Different angles drawn

Teacher's questioning

The teacher asked different types of questions using different techniques, posing most questions orally. She also used slides on PowerPoint for illustrating the questions (see Figure 1), asking students to write down the answers in their exercise books. Hence, the teacher posed both oral and written questions. It seems from the gap of time between the teacher's questions and students' answers (see Table 1), the teacher did the wait-time technique, waiting for students' responses. She also spontaneously developed additional questions based on students' answers to explore students' ideas further and involved the whole class to check the answer. Through this process, the students could share their ideas with each other and investigated whether the answer was correct or not. In addition, in another topic, angles, the teacher not only posed questions to an individual but also instructed students to discuss in pairs for answering the question (see teacher's instruction in Table 2 below).

The type of questions

There were forty-eight questions that the teacher posed during a lesson, ten questions about numbers and the rest of them about angles. Twenty-six questions are closed, and the others are open questions. The teacher asked some different expressions in asking either closed or open-ended questions (see Table 2 below):

Table 2. *Some different questions asked*

Closed questions	Open-ended questions
Can you tell me what 8 x 4 is?	If the answer is 42 what could the question be? Where does it come from?
What's the opposite/the inverse 6 x 7?	Show me an angle with your body?
What's double two?	Why? Explain to your partner!
What is this (red)? What's rectangle has? Is that straight line?	With your partner, discuss 3 statements about these pictures!
Does it have an angle? What's triangle? Does the length of the side influence angle?	How can you make sure they are different?

Thus, it is seen that the teacher asked both closed and open-ended questions during a lesson. In the interview, the teacher stated that she asked the question based on the subject and what she wanted students to have gained. She would ask closed questions when asking "yes or no answers". However, she would ask open questions if she intended to encourage students to think deeply and to link mathematical conceptions with multiple ideas. When asking closed questions, the teacher tried to push students to analyse what she meant by the question, for example, when the teacher asked about "inverse" that boosted students to think about the meaning of inverse, and then they tried to answer the question (see Table 1). Furthermore, the teacher posed students a problem that was one of the types of open-ended questions, an open-ended problem posing (Yee, 2002), in which the teacher asked students to create their own questions based on the statement that she provided. From this open-ended problem posing, teachers successfully raised different answers from students (see Table 1). The teacher also encouraged students to analyse the errors of their classmates' answers by asking, "Is it correct?" so that students learned to investigate the correctness of the answer. Moreover, the teacher developed students' communication and reasoning skills by asking, "Where does it come from?", "How?" and "Why?".

Students' responses

There are multiple answers orally that students gave during the lesson. These answers are more than the number of questions that the teacher asked because some open-ended questions produced multiple responses/answers from students (see Table 1). From analysing the transcript of the whole observation, students gave answers that were categorised into fifteen explanations, three justifications and forty-seven brief answers/responses. Students would mostly explain the reason behind their answers when facing the questions, "Why" and "How" (see Table 2) and gave short answers when the teacher asked "yes or no questions" that belong to closed questions. Meanwhile, the teacher's instruction to create statements based on the question could encourage students' justifications.

Open-ended questions produced students' mathematical creativity

Students' mathematical creativity related to fluency, flexibility, and originality can be seen from students' answers to open-ended questions. For instance, from an open-ended question in Table 1, there are ten different answers (fluency) that students gave from which the teacher praised three of the responses (originality). Mostly students answered with one basic operation, however, one student posed a question using two basic operations (flexibility). In addition, the six students' answers (see Figure 2) for a task (see Figure 1) showed multiple triangles (fluency). For mathematical ideas (flexibility), most children assumed their three triangles were different by considering the size of the triangle (smaller, bigger, and thin). Meanwhile, two other children thought that their triangles were different because of the angles of the triangles. However, they encountered confusion because two of their triangles had a similar type of angles so that they assumed these two triangles were quite similar. The originality of those six students' answers could not be determined because the researcher did not have enough comparison answers to all students in the classroom. Although the six students were asked directly to draw different possible angles in the interview, the majority of students answered by drawing triangles not angles (see Figure 3). Two of the students also had quite similar answers.

Discussion

The teacher in this study spent most of a lesson by asking questions orally. Whether it is better for students still cannot be looked at directly because she surely had goals and reasons why she did it. She was seen trying to do effective questioning for a lesson by posing closed and open-ended questions. Closed questions make students answer either correctly or incorrectly because those questions have an exact answer. However, teachers do not use open-ended questions just to check the correctness of the answer, but to focus more on developing students' communication, mathematical ideas, reasoning, and problem-solving skills (Kwon et al., 2006). Therefore, both correct and incorrect answers are important for teachers. This study found that the teacher did not look for the correctness of the students' answers during the lesson. However, this teacher's thought has to be investigated further in the future because the teacher may be concerned with the correctness of answers in different lessons based on her teaching goals. Furthermore, open-ended questions seem to foster students' mathematical creativity (Kwon et al., 2006), but to evaluate students' mathematical creativity, teachers may face difficulties especially looking for the originality of students' ideas. The category of an original idea may be different for different teachers because of their personal experience and judgment of the idea. Open-ended questions that encourage students to produce multiple answers will also challenge teachers to think quickly what they should do to respond to unexpected answers. Occasionally, teachers also need to give additional questions to boost students to think further about their answers, especially when they have misconceptions about the questions. This happened during interviews when students had misconceptions between angles and triangles (see Figure 3). The reason why this happened may be caused by students' misunderstandings about the definition of angle or the researcher's pronunciation between "three angles" and "triangles". This pronunciation was likely to be confusing for students because the interviewer is not a native speaker.

Conclusion

Every teacher seems to have his/her own considerations in posing questions so that what the teacher has done in this research may be different to other teachers. Teachers determine the type of questions that they want to ask based on their teaching goals for students' gain. From this research, it also seems that open-ended questions can be used by a teacher not only for producing mathematical creativity but also developing additional questions to stimulate students' thinking and analysing further students' misunderstandings.

Acknowledgements

I am really grateful to my sponsorship, Indonesia Endowment Fund for Education (LPDP), that gave me a great opportunity to continue my master degree in this university. I also thank LPDP because they support the fund for my conference.

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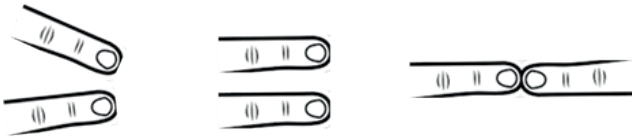
Appendix A

Observation Results

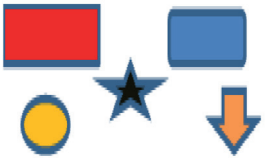
Tuesday, 28 March, Grade 3, Time: 11.00-12.00
T= teacher
S= student, 25 children
Red: Open-ended
Purple: Closed

T: If the answer is 42 what could the question be?
One add, one take away, one times, one divide
T: Oke I will give you one more minute
Let your mathematics brain working
T: Oke, five, four, three, two, one.
T: who can give me?
T: oke, Cleo?
C: 40 + 2= 42
T: is it correct?
S: yes
T: Maybe easy, but it's correct
T:oke, Joe?
J: 62 take away 20= 42
T: is it correct?
S: Yes
T: oke, Amel?
A: 59 take away (-) 7= 42
T: ya, amely?
A: (4.10)+ 2
T: Well done
T: oke, Joe?
J: 32+ 10
T: Sienna?
S: 8 x 4
T: Can you tell me what 8 x 4 is?
T: Rovie?
R: 32, then + 10= 42
T: good, Obsa?
S: 42 + 0
T: wow, 42 add nothing equal 42
T: oke, Tom?
Tom: 6 x 7
T: oke, 6 x7= 42. What's the opposite/ the inverse 6 x 7?
Cloe: have the same answer
T:So?
C: 7 x 6
T: Brian?
B: 42 divided by 1
T: Oh, I like it, so, if 42 divide to one person= 42
Sienna?
S: 84:2= 42
T: SO, what you can see from 42: 1= 42 and 84: 2= 42?
S: talking mathematically, what can you see from between these two?. Amelie, what do you see?
A: if you put 4: 2= 2 and 8: 2= 4
T: yach, you're right, but it's not what I'm seeing here. if you put 4: 2= 2 and 8: 2= 4, but there is something interesting here?
S: it's maybe 42 + 42= 84 and 1 + 1= 2
T: yach, think mathematically. Think what's word could I say that? This number (84) is something this number (42) and This number (2) is something this number (1). Goerge?
G: double two
T: What's double two? Think whole thing
S: 42 double= 82
T: correct, if you double 42 you get 84. SO 1 double is...
S: 2
T: So, here we go! If I am take four doble is 8 2 double is 4, one double is 2. So what number if I put here .....: 4? If two double is 4, so double 84?
T: what's double 4?
S: 8
T: what's double 8?
S: 16
T: so, 168: 4. So how if 2 x 80?
S: we add zero to 16?

T: No, zero doesn't add meaning. So 2x 80?
S: 0 x 2
T: So?
S: 130
T: where is come from?
S: is that 160?
T: who is think it is 160?
T: so, what's we are doing yesterday?
T: what's an angle? Think about it, Write an answer on your whiteboard... Can you remember the little sentence we said yesterday?



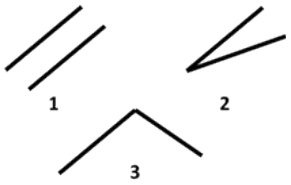
T: I have a picture. So you can help me!
S: Show their whiteboard!
T: let's say together!
S: An angle is the amount of turning (1), between two lines (2), that are joined (3)
T: Show me an angle with your body?
S:
T: Interesting anybody
T: show me smaller one
S:
T: Larger one
S:
T: Now, using your arm, show me a small angle
S:
T: a bigger angle
S:
T: a slightly bigger angle
S:
T: show me really really acute angle
S:



T:

T: Here I have some shapes
T: What is this (red)?
S: Rectangle
T: What is this (blue)?
S: square
T: It's not square. Is it?
S: a curved rectangle
T: I like the idea, but we don't have a curved rectangle because rectangle has a watch. What's rectangle has?
S: straight angles, ages!
T: is that straight ages?
S: Sharp points up
T: rectangle has a sharp point. Can anybody tell me about the sharp point?
S: doesn't has any corner
T: try again?
S: Angle?
T: yes,
T: What's this (black)?
S: Star
T: does star have an angle?
S: yes
S: No
T: why? To your partner explain why? (discussion)
S: it has sharp point
T: think about sharp thing and straight line, Is there straight line here?
S: there are two straight line
T: There are two lines turning and joined. So, is it angle?

S: yes
T: How about this?
S: yes
T: Is this has angle (brown)?
S: yes
T: how's about in the middle?
S: there is no line in the middle
T: perfect!
T: with your partner, discuss 3 statements about this picture!



S: It is not an angle (1)
T: why?
S: it's not joined
T: others?
S: Angle because that's joined
T: How do they join?
S: two lines joined together
T: Tell me something else about (3)
S: 3 joined, larger than 2 and 2 smaller than 3
T: What's larger? What's smaller?
S: 3 larger, 2 smaller
T: Do you agree?
S: yes
T: what's else about 3?
S: Obtuse angle
T: why?
S: Large
T: Why large? Think about degree
S: More than 900
T: What's 2?
S: Acute angle
T: What is that?
S: Smaller than obtuse
S: less than 900
T: what's else?
S: two arms in picture two longer than 3
T: is it influence angle?
S: No
T: It doesn't matter about the length of arms

Appendix B

The Transcript of The Teacher's Interview

1. What do you think about the role of questions in your teaching?

It depends on actual mathematics that I teach. Do more investigations, if the subject needs questions I will give questions.

Sometimes I will give them task. If I want to make children think deeper than normally they can do,, I will use open questions .While close questions you just want to know the answer. I just push them further by asking open questions.

2. Do you develop another question from students' answer?

Yah...you have to work with them rather than closing the questions because there is an opportunity to develop further with open questions. Sometimes what you plan doesn't go to that way because sometimes it just link to deeper understanding.

3. What do you do to an unexpected answer from students?

Reword the questions, so they understand the questions,. Then, give more a clue, where the question can go, push the teaching somewhere.

4. What is type of question do you prefer asking? Closed or open-ended? Why?

Sometimes, it depends on the subjects. If you want yes or no answer you use closed. If you want a deeper understanding use open-ended because they can make them think and come up with different ideas, and extend the learning, and the time you want to go. Questions Yes or no is clearer. So, I like to think I do both. More open especially in math because you want to see link and the conception rather than think just enough. Push them to inquire what's going on rather than yes or no because they do not learn if it's yes or no.

5. What sources do you use for creating questions?

I have questions in my head based on my learning objective in my plan, but in learning process may be will change depends on students' answer (spontaneous questions)

6. Do you like give oral or written task? Why?

Both, if I am doing teaching input orally maybe the questions come orally. I set them to work by giving them a task to do further

On Tuesday, I think you don't need to have worksheet every single lesson so it just comes from me, while another day, they might have a list of questions about clocks. I don't' need worksheet all the time.

7. What do you do if the child answers your question incorrectly?

I don't' believe there is an incorrect answer. I believe there are just misconceptions. So, I would work with child's response and try to get them by asking them, make students realise about their mistakes rather than say no, that's wrong because .it doesn't make a safe environment. They will never hand up to answer. If I say, it's an interesting answer, but let's we look at that and talk about it. So, the whole class will talk about it and I will get to the right answer from that way. We use that wrong as a learning point. We never ever say "No, that's wrong" because it makes students feel terrible. They will never speak questions. Good questions allow for mistakes and you build more questions from that.

Appendix C

GSoE Research Ethiscs Form

1. Researcher access/ exit

Every school has privacy to become a research place so that it will be hard to take example directly at school. Therefore, the researcher will receive a help from a lecturer, Laurinda Brown, in finding an access to school. The participants will be taken from a primary school in UK. The target sample group will be a teacher who is teaching mathematics in primary school and the students in his classroom. Although the school will be chosen by Laurinda, there will be discussion about research's purpose in order to find an appropriate school and teacher.

2. Information given to participants

Information sheet will be given to participants with a briefing of the project which explain some information related to what the study about is, who will be participated, what participant will do, how information will be recorded, stored and protected as well as the contact information of the researcher for any complains or the researchers themselves for further details about the study.

3. Participants right of withdrawal

Participants will be informed about their right of withdrawal in the project through both information sheet and verbally before starting interview. They could withdraw freely at any time up to seven days from the interview taking place without giving any reason and without their rights being affected in any way.

4. Informed consent

Besides getting information sheet, participants will be given a consent form about filming and interviewing process to ensure that they agree that they are fully informed before participating in this research. They will consider some points before deciding to engage, that are their consent to become volunteer, to be videotaped and recorded, and used as anonymous quotes in written project report.

5. Complaints procedure

Participants are still able to express any complaint by contacting the researcher using email provided in the participant information sheet

6. Safety and well-being of participants/ researchers

The researcher will conduct a research in a primary school by filming a whole learning activity without disturbing the learning process (taking children's face is not allowed, so I will observe using observation sheet and sound recording). Then, the interview will be conducted in a place which is agreed by both participant and researcher. The exact location for each interview will be decided further in a way that the participants will feel comfortable in providing the information. Moreover, the participants' voice will be audio recorded, and stored safely.

7. Anonymity/ confidentiality

Due to our nature method that is face to face interview, anonymity of the participants is not completely possible. However, confidentiality will be maintained and participant's details not reported. Interview will be recorded on devices that will be kept safe accessed only by the researcher.

The audio files will be transcribed to documents, and used as anonymous quotes in written project report.

8. Data Collection

Data will be collected by using videotape for observation and interviewer's note taking as well as the recording of the interview.

9. Data Analysis

The videotape of observation will be clarified through interview, but the researchers will not be able to give the transcription of the interview to the participants (to check the accuracy of data) before using the data due to the limited time. However, the researchers will ensure the accuracy of transcription by listening to participants' answer from audio recorder.

10. Data Storage

The videotape as well as the recording and transcript of the interview will be stored in researchers' drives locked by password.

11. Data Protection Act

The research will follow the Data Protection Act 1998, in that the data will not be shared, stored safely and used only for the purposes as described here.

12. Feedback

In case there is a complaint or a request from the participants about the summary or finding of the research, the researchers give the freedom to participants to contact email provided in the participant information sheet.

13. Response to colleagues/ academic community

The research has been planned with consideration of the rights of the participants, and will be carried out following ethical procedures and approaches discussed within. Researchers are committed to maintain the reputation of the Graduate School of Education and the University of Bristol and will avoid fabrication and misrepresentation of the data and results.

14. Reporting of Research

Participant will be informed that this research is the project of one of units taken as Graduate School Education Master Student.

Signed:	xxxxxxxxx (Researcher)	Signed:	xxxxxx (Discussant)
Date:	19 February 2017	Date:	19 February 2017

Appendix D

Participant Information Sheet

An analysis of a teacher's questioning related to students' responses and mathematical creativity in an elementary school in the UK

I would like to invite you to take part in research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Ask question if anything you read is not clear or if you would like more information. Take time to decide whether or not to take part.
What this study is about?

The aim of this research is to describe a teacher's questioning activity related to students' responses and mathematical creativity.

What will taking part involve?

If you agree to take part for this research, you will be asked some questions about your questioning in the classroom regarding the type of questions and questioning strategies. We will ask you to answer the questions based on your questioning activity as a mathematics teacher. The interview will spend about 30 minutes and will be recorded.
Why have you been invited to take part?

We would like to invite you as participant because you are a mathematics teacher.

Do you have to take part?

Taking part in this research is voluntary and you have right whether you agree or disagree to become participant. Then, if you later decide to withdraw from the research after agreeing to involve then you are free to do so at any time up to seven days from the interview taking place without giving any reason and without your rights being affected in any way.
What are possible risks and benefits of taking part?

There will be no possible risk for you in this project but we will obtain the description about British mathematics teachers' questioning activity which likely enriches my insight and experience as future mathematics teachers.

How will information you provide be recorded, stored and protected?

Original audio recording will be stored safely. In addition, the transcript of interview will be revealed in my research report.

Who should you contact for complaints and further information?

If you want to ask about further information about this study, please contact Mela Aziza at ma16922@my.bristol.ac.uk

Appendix E

Consent Form

To be completed by the teacher

An analysis of a teacher's questioning related to students' responses and mathematical creativity in an elementary school in the UK

Please answer the following questions to the best of your knowledge (delete as appropriate):

I confirm that I have read and understood the accompanying participant information sheet **Yes/No**

I agree to take part in this study **Yes/No**

I understand that my name or the schools name will not be used in any report **Yes/No**

I agree that data gathered in this study will be stored anonymously and securely **Yes/No**

I understand that all personal information will remain confidential **Yes/No**

Name _____

Signature _____ Date _ _/ _ _/ _ _ _ _

Researcher Name _____

Researcher Signature_____

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March 2018, Volume **10**, Issue **4**, **489-496**

An Ethnographic Approach to Peer Culture in A Turkish Preschool Classroom

Received: **02 January 2018**
Revised: **14 March 2018**
Accepted: **26 March 2018**
ISSN: 1307-9298

www.iejee.com

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DOI: **10.26822/iejee.2018438139**

Abstract

The purpose of this study was to examine the features of the peer culture that a group of preschoolers created in their classroom in the province of Kahramanmaraş, Turkey. An ethnographic approach was adopted in this study to obtain an in-depth understanding of children's peer interactions. The data were collected through variety of data collection methods such as participant observation, interviews, document analysis, and researcher diary for three months period. Twenty children, the classroom teacher and the other school staff participated in the study. Descriptive and qualitative content analyses were conducted to analyze the data. The results suggest that the children formed a complex culture through symbols and games to negotiate about the features of day to day interactions in the classroom. In addition, the children resisted against the influences of the teacher by turning places like the washroom and the cafeteria into a nesting area for a deeper level of personal interaction.

Keywords: Peer culture; early childhood education; interpretive reproduction; ethnographic approach

Introduction

Recently, there has been a considerable increase among the studies focusing on children's social and emotional lives. Children used to be seen as passive members of society and as wild threats that could only be controlled through education (Corsaro, 2015; Prout, 2005). The passive role that was attributed to children changed with the emergence of the constructivist theory. Corsaro and his colleagues advanced the constructivist theory by introducing the term interpretive reproduction to the child sociology field with their studies on peer interaction and culture (Corsaro, 1985, 1992, 2015; Gaskins, Miller & Corsaro, 1992). The term, interpretive reproduction, includes the creative sides of children's' participation in the society by underlining the idea that children play an active role in both acquiring the cultural values of the society and changing the society by contributing to the culture (Corsaro, 2015; Corsaro & Molinari, 2005). Children do not only actively participate in their society but also contribute to the change and production of the social order by carrying their daily routines and their communication styles (Corsaro, 1992). Therefore, they create their unique peer culture with the knowledge that they have acquired from the adult setting (Corsaro, 1992).

Children's peer cultures have many properties that are different from the adult or mainstream culture. Corsaro (2015) defines peer culture as "a series of activities, plays or behaviors that have become habits, toys and other materials they create together, shared values and interests that are result of peer interaction among children" (p. 125). This culture is created through the communication among children and the interaction between children and their teachers (Fernie, Davies, McCurray, & Kantor, 2006).

Children adapt and creatively use the information they receive from the adult world to create and join their own private peer cultures to meet their interests and needs (Corsaro, 2005). The essence of a peer culture is the resistance that children hold out against the world of limitations and rules that adults set for them. The attempt to capture the control of their own lives is reinforced by the games, behaviors, and a range of activities that children have as a result of their interaction with their peers (Kantor & Fernie, 2003). Through peer culture, children create a shared identity. This identity is structured and developed by the active solidarity of children. Thus, with this identity, children strive to gain the control of their life (Corsaro, 2015).

Peer relationships have functions such as improving social skills, socializing, developing self-esteem, making sense of their own lives, and supporting each other socially and emotionally (McDevitt & Ormrod, 2004). As children grow older, communication skills improve and mental capacities increase, children can more easily understand the roles of others and, as a result, they can establish more effective friendship associations (Zanden, 2000). Acceptance to playgroups within peer culture and developing friendship are complex processes for children (Corsaro & Eder, 1990). The tendency of children to protect their belongings and toys from the others makes it difficult for children to enter the playgroups of their peers (Corsaro, 1985). Children must acquire some necessary social skills in order to be accepted to peer culture.

Children discover the meaning of friendship through their games and playful activities that they engage with other children in playgrounds. To construct mutual trust and solidarity, they frequently ask each other questions like "We are friends, are not we?" (Corsaro, 2003). Corsaro (1985) has attempted to explain children's social considerations (friendship, roles, norms, status) by identifying certain characteristics of peer culture in kindergartens. Corsaro (1988) emphasizes that researchers must try to understand what it means to be a child in order to learn how children model and prepare their activities for the adult world.

Although the studies on children's peer culture are gaining importance, many of these studies have remained limited in terms of peer values, interests and identities (Corsaro, 2015). Studies in Turkey on preschool children's peer cultures are

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especially limited. In those studies, development is regarded as a linear process (Gülay, 2010; Kaytez & Durualp, 2014). In addition, the studies investigated children's lives and experiences thorough teachers' and parents' perspectives by using standardized scales (Doğanay, 1998; Erşan, 2011; İnan, 2011; Kol, 2006; Şahin, 1993). This approach silenced children's voices and provided us second hand information about children. However, qualitative studies, especially ethnography, give researchers the opportunity to examine children' behaviors and relationships in their natural environments and help them to explore how children contribute to the society (Corsaro, 2015).

The purpose of this study is, therefore, to examine and explore the peer culture that a group of preschoolers created through everyday interaction in a preschool classroom. This study focused on the complex and dynamic flow of friendship relationships, which emerge in the context of peer culture.

Method

In this qualitative study, ethnographic approach was utilized to explore the socially constructed practices and experiences of children in a preschool classroom. Ethnography suits perfectly in this study because how the members of a community creates meaning and attributes meaning to specific actions or rituals within that community are difficult to reveal through mere observation from outside. This study is ethnographic because "it not only treats a social unit of any size as a whole but that ... portrays events, at least in part, from the points of view of the actors involved in the events" (Erickson, 1984, p. 52). Ethnography seems to be best way to reveal and present children's peer cultures that were often overlooked by researchers (Hoyte, Torr & Degotardi, 2014). As Corsaro and his colleagues (Corsaro, 1985, 1992, 2003, 2015; Corsaro & Molinari, 2005; Corsaro & Rizzo, 1990; Gaskins et al., 1992) repeatedly demonstrated, children's peer culture is very elusive to adult perspective. Secrecy and opposition to adult rules and limitations are often considered an integral part of a peer culture (Corsaro, 2015). The best way to investigate and understand a culture is to look through the eyes of the participants in that culture. Ethnography enables the researchers to document daily lives and routines of people while exploring how participants view their world (Maggs-Rapport, 2000). In order to explore events and actions, ethnographers make "extensive definitions" rather than simply expressing things they see and hear (Corsaro, 2015; Geertz, 2006).

As participants in this study, 20 preschool children, the classroom teacher and all the school staff including one administrator, two cooks, five cleaners, and one student teacher in an independent kindergarten affiliated with the Ministry of National Education in the province of Kahramanmaraş were chosen. Twelve of the children participated in this study were male, while eight of them were female. The classroom teacher was 27 years old and graduated from a public university. He was appointed to this preschool as teacher after graduation and since then he had been working there for three years. To capture the features of the peer culture of these children the other people who worked and interacted with these children included in this study.

In this study, participant observation, semi-structured and unstructured interviews, collecting documents and researcher diary techniques were used as data collection methods. Participant observation in ethnographic studies allows researchers "participating, overtly or covertly, in people's daily lives for an extended period of time, watching what happens, listening to what is said" (Hammersley & Atkinson, 1983, p. 3). In this study the data was collected through a very unique way of participant observation. During the participant observation process, the focus was on the physical characteristics of the school and classroom, the educational program and activities, and the attitudes and behaviors of the individuals toward each other in the classroom. Additionally, the focus of observations included activities, games and routine behaviors that children developed among themselves and the values and beliefs that children shared. Instead of just joining their play and the other activities, the researcher tried to become part of the social community of the preschoolers. The researcher visited the preschool classroom three times a week during three months. When she met children first time she introduced herself as a preschool student and during the whole data collection period she followed their examples and acted as if she was six year old. The researcher completed the tasks with children that the classroom teacher assigned to them, she obeyed the rules of the classroom such as being silent or getting in line, got warned or punished when she broke the classroom rules, went to cafeteria and washroom with them, etc. An adult acting as a student like themselves did not seem real for children during the early days of the study. The children tested and questioned her during this period. The researcher made sure not to give the impression of an ordinary adult and she was gradually accepted into friendship groups. After gaining access she participated in various activities with twelve boys and eight girls. The majority of data, including photos, pictures, documents and artifacts from children's activities were collected through participant observation during this stage of the study.

The photographs illustrated children's play in different places in the school, friendship relations, objects that were popular in their peer cultures. The pictures included some intimate moments of friendship such as a girl gathering her friend's hair in the dining room, boys making funny sounds by holding their drinking water in their mouths, boys making friendship oaths by putting their hands on top of each other's hands, boys catching girls by wearing military and spiderman costumes, and some significant objects such as Ben Ten clock made of paper, and pencil cases with popular pictures for boys and girls. The documents also included children's drawings. The children draw their best friends or the super heroes of their choices.

Addition to participant observation, the researcher carried out semi-structured and unstructured interviews with all the children, the teacher and the school staff. According to Cohen (1984), ethnographic interview is different in a way that these interviews are conducted as a form of conversation in which ethnographers assume naivety and ignorance in order to understand what is being said. Most of the interviews with the children were done while the researcher and the children interacting as a part of classroom life without premeditated questions. The interviews with the classroom teacher and the school staff took place while they were engaged with their jobs. Only the school administrator was interviewed in her office. Before the interviews, an interview form was developed according to the research questions and targets of interviews. In the semi-structured interviews, the children were asked about their friendship relationships, the games they played together with the other children, their activities, and their thoughts about the classroom rules. In interviews with teachers and the school administrators, inquiries about the school education curriculum and rules, children's approach to these the school and classroom rules, and the relationships established within the school were ad-

dressed. In the interviews with the school's staff, the staff members were asked about the relationship they established with their children, their shared moments with their children and their observations of children's interaction among each other.

Because the purpose of this study was to explore the children's peer culture, the data analysis included how the individuals were relating to each other and interacted within the classroom and school context. In this study, seventy pages of observation notes, thirty four pages of researcher diary, fifty five photographs taken during observation and pictures that children drew in the school were obtained as raw data. After the data collection process was finished, all the data were transcribed and the researchers started the coding process. The two researchers who are experts in early childhood education read the whole data repeatedly in detail by assigning codes to small data unites. After the free coding process was completed, the researchers concentrated on commonality of the themes and patterns to develop "a set of analytic categories that captured relevant aspects of these data, and the assignment of particular items of data to those categories" (Hammersley & Atkinson, 1983, 161). After the themes were formed, relations between each other were determined and organized under the research questions. The themes obtained were; peer relations, team games, military games and superhero play, the settings that cultivated children' peer culture (cafeteria and washroom). The design of the report was carried out according to the themes and categories. While one researcher focused on field observation and data collection, the second researcher served as academic adviser and monitored all the process. During this iterative process, two researchers worked together in order to use ideas to make sense of the data and the data to make sense of ideas (Hammersley & Atkinson, 1983).

The issues of credibility and trustworthiness were an integral part of this research process. According to Lincoln & Guba (1985), there are three major activities to increase the probability of producing credible findings. These activities are prolonged engagement, persistent observation, and triangulation. In this study these three activities were closely interrelated. To increase the trustworthiness of the data collection process, the first precaution was to stay in the field for a longer period to engage and build rapport with participants. The researcher joined in these preschoolers' lives three days a week for a three months period. These three months not only helped the researcher to be part of the preschool classroom but also gave her opportunity to build rapport with school personnel. During this time she did persistent observation while joining children's daily life in the classroom so that the observations became both intense and focused. Triangulation of the data was achieved by gathering the data through different data sources (Hammersley & Atkinson, 1983). In terms of triangulation of multiple methods, the researcher used observation, interviews, document analysis and researcher's diary to improve the credibility of findings. In addition to the triangulation of data collection methods, the researcher collected data during different activities, from different settings such as cafeteria and washing room, and from different informants other than children. Besides, through the researcher diary, the researcher aimed to reach a level of controlled subjectivity (Erickson, 1984) by recording her thoughts and reflections during data collection and data analysis process. Two researchers also worked collaboratively during the all stages of the study to increase the credibility of its findings

Results

The results suggest that there was a dynamic interaction between the school culture, classroom culture and children's peer culture. In the classroom, the children formed a complex culture through their friendship relationships by creating symbols and games. While the symbols created by the children helped them negotiate about the features of their day to day interactions, the team games and the war games were two important activities that shaped the nature of their peer culture. The war games and dramatic play that included popular cultural motifs such as Spiderman, Ben Ten played an important role in forming the nature of their peer culture. In addition, the children resisted against the teacher's influences by turning places like the washroom and the cafeteria into a nesting area for a deeper level of personal interaction.

The school and classroom context

The preschool that this study was conducted was a two-floor building with a wide schoolyard. The school had the capacity of one thousand students and thirty-four teachers. It was a popular school among families of high socio-economic status. Children between the ages of three and six attended to this school. Classrooms are formed according to children's ages.

There were twelve male and eight female children in the classroom. While girls preferred to play separately with their close friends, boys preferred to play in groups. Boys and girls came together only in chasing game and during gardening activities. The teacher determined all the rules of the classroom. The most important rule required children to move and talk quietly in the classroom. The children who obeyed the rules and who did not comply were rewarded and punished with the star panel prepared by the teacher. The teacher put a star on the board next to the picture of the child who obeyed the rules or took back a star from the picture of the child who obeyed the rules. According to the teacher and other staff, the school was too much family oriented and the only goal of the school was to please parents and protect the charities that collected from families. As a result, parents put pressure on teachers and the school staff about how things should be done in the school. The teachers stated that parents interfered even with classroom management and tried to inspect them. Some teachers prepared their daily activity plans according to parent demands and concentrated on reading and writing activities even though it was clearly against the suggestions of the national curriculum.

The classroom teacher who participated in this study resisted against parents' influences and structured the daily educational program by himself. The teacher determined the rules of the classroom and announced them to the children every day. The teacher prepared a star board to enforce the classroom rules and get children to follow these rules. Stars were pasted next to the photos of the children who had behaved quietly and obeyed the rules throughout the day. The teacher believed that guns and war games were harmful for children; therefore, they were banned within the classroom.

Acceptance to the peer culture of children

The study began when the researcher introduced herself to the classroom and started interacting with the children and the staff. Getting the children accept an adult as one of them in the classroom was the first challenge in this study. An adult student in a preschool classroom caused some confusion among the children during the first days

of the study and continued drawing the children's attention the following days. While some children ignored the researcher, some girls showed some interest in the researcher. The researcher spent the first month trying to convince the children that she was not a typical adult. The children examined the researcher with various questions such as; "Why are you here? Have you ever been here? Haven't you ever been to a preschool before? If you have, why are you coming now? How old are you?" Some children thought the researcher was one of the student teachers. The researcher participated in the activities with the children in every setting. She used the same washroom to wash her hands and ate with them at the same table in the cafeteria.

Gradually, the children started to be accustomed to the presence of the researcher in the classroom and started to treat her as one of them. The children warned the researcher to obey the rules, complained about her to the teacher as they did with their other friends and started to let her join in their play. During the second month of the study, the researcher's position changed. She made a close friend in the classroom. Making a close friend increased the researcher's relationship with the other children. She witnessed the children gossiping, teasing, offending, protecting and embracing each other. After she gained access to their peer culture, the children started to reveal the secrets that they shared among their peers, the rules that organized their friendship relationships and the group rivalry, and the games that they play against the teacher's will.

Friendship among children

Identifying the important elements of the peer relationships was crucial for exploring and understanding the friendship among the children. The researcher began to observe the interactions among the children more closely. When the children were in line to go to the cafeteria, waiting in the corridor, or sitting in the cafeteria, she observed that the children pointed at each other by lifting up the thumbs. With this sign, the children indicated and confirmed their friendship. The children verbally informed other children who they didn't want to include in their play and also expressed this intent by not showing to them their thumbs as a friendship symbol. This symbol was even more apparent during their dramatic plays. In the following note, a boy named Kutalmış was observed to give a message to another child by not showing this symbol.

> *Meanwhile, Kutalmış, who was playing chess, whispered to the other children "Don't be friends with Mehmet (another boy)". Mehmet was standing besides watching them. Later on Kutalmış hid his thumb between his other fingers and showed his hand to Mehmet. Some of the other children showed their hands with their thumbs up. Kutalmış said "No, you have to do it like this" and made them hide their thumbs. Mehmet then went to draw a picture.*

The children confirmed their friendships not only with the thumb symbol but also by verbally expressing it. They asked each other "We're friends, right? We're pals, right?" to confirm their friendships. Here is a following example observed two girls in the girls' washroom.

> *Pınar (P): You're my friend, aren't you?*
> *Eda (E): Yes.*
> *P: But you didn't sit next to me.*
> *E: I didn't because the teacher said so. I will sit next to you later on, okay?*

The term friendship was used among the children for different purposes. The children used the term friendship to decide who would join their play. A child who was not let in a play asked the others "But aren't I your friend?" and insisted on playing with them. Friendship allowed the children to share the toys and gifts and built solidarity among them. Some children were observed to give offers like "If you be my friend I will give you my play dough". The children who were close friends gave picture gifts to each other and shared their personal belongings (soap, play dough, pencils). In addition, they gave their belongings to each other and reserved seats in the cafeteria for their friends.

Close friends were staying very close to each other and supporting each other different ways. They opened up their friend's page during reading activities or tied up their friend's hair when it became undone. They asked the teacher to give stars to their friends who couldn't win any stars. Sometimes, they expressed their support as a group and by putting their hands on each other yelled out "All-for-one, one-for-all". In order to entertain themselves the children played language games and made fun with their friends. In the cafeteria they made fun with word plays like "Burnt author, Roasted author" because the researcher's surname meant "burnt" in Turkish.

While they confirmed their friendship verbally or with symbols, sometimes they tested their friendship by sitting apart, not talking or showing some resentment. They also talked behind a friend when they got offended and whispered to each other's ears. These resentments lasted for a short time and friendships resumed without any apparent changes.

Team games for boys

The peers' attempts to gain the classroom control caused some conflicts within the classroom. In order to understand these conflicts, it is crucial to clarify concepts such as status quo and power relationships within the classroom. The boys' attempts to gain the control of the classroom became explicit when they started to play team games. The researcher observed during the first month how the children were making play offers to each other and trying to join a game. However, it became apparent later that play relationships were not simple or superficial; they were rather structured in a complex way. The researcher observed two different boy groups who made a team and started competing against the other group. Two leaders of the teams, Kutalmış and Özgür, strived to pull the other children into their groups and also to sustain their authorities within the groups. They used water bottles as symbols to identify their team. The children of the same team put their water bottles side by side. The children who did not have a water bottle were not included in either team. The researcher also tried to be a member of one of the teams. Here is a dialogue between the team leader and the researcher:

> *The researcher: Which one is your team?*
> *Özgür: Our team is over there (pointing to the other children)*
> *The researcher: Can I join in your team as well?*
> *Özgür: No, you don't have a water bottle.*

The researcher decided to obtain a water bottle to become a member of the group. The following dialogue expresses this:

> *Researcher: Then if I bring my water bottle tomorrow can I join the team?*
> *Özgür: No, you can't be in our team. You're a girl.*
> *Researcher: Why, can't girls join your team?*
> *Özgür: No, girls join the girls' team.*

The researcher talked with other team members to convince the leader. When the team leader Özgür was finally convinced, he said "Well, okay. But get yourself a water bottle. But make sure it's one for girls!" When researcher asked how girl water bottles looked like, Özgür showed her the water bottles with girl pictures. Next day, the researcher brought a water bottle with a spider-man on it, instead of a girl water bottle that the leader had told her to bring. This became a joking matter among the children and they started to say "Author brought herself a boy water bottle" "Author is a boy" and showed it to each other. Bringing a boy water bottle to the school did not please the team leader, but with the help of the other members he let her in the team. When the researcher joined boys' teams the other girls got interested and they also wanted to join in the teams. The following dialogue between a team leader (Özgür) and two girls illustrated this request of the girls.

Tuba and Ayça: We want to join in your team as well.
Özgür: No, you can't, girls aren't allowed.
Tuba: But author is a girl.
Özgür: But she's a big girl. We let big girls in the team.

When they entered the third month of the study the researcher became a member of a boy team and got the opportunity to observe their conflicts closer. She witnessed the toy exchanging fight that broke out between the two teams frequently. These fights often ended when some children complained the teacher about the children of the other team. The teacher advised the children to share the toys and warned them not to misbehave. However, the following note shows how the team leaders continued this rivalry:

Mehmet: Teacher, Özgür won't let me play with the toys.
The teacher: Özgür, you're not the only one who can play with those toys.
Özgür: Okay, come here my friend.
Mehmet goes near Özgür.
Özgür: If you want to be among our team you have to sit beside me.
Mehmet: Okay

The members of the teams continuously changed alliances with the groups and went in-and-out between the two teams. The boys sometimes left the team with their own will and sometimes they were kicked out. It was the team leaders who decided who would join the team and who would be expelled. With this power, the team leaders threatened the members to exclude from the team and influenced them as they wished. The group members explained this as "playmaker is the boss of the play" and agreed to follow the leader. Some girls were not interested with the boy teams, the other girls were interested but they were not allowed to join in these teams.

War games and superhero play

The children showed great interest in war games even though war games were banned by the teacher. They played these games in places where the teachers' control was less obvious. When the teacher caught them playing such games in the classroom, he reminded them that "No guns are allowed in this classroom. These games are not suitable to play. In this classroom we give each other roses." However, despite the teachers' warnings, the children continued these games by making guns out of Legos and fruit juice straws. During the interviews, the children stated that they filled fruit juice straws with sand and fired with them at each other. Some of the children said "This gun fires fruit juice. This is a fruit juice gun" and tried to explain it to the teacher. When one of the children was asked about war games, he explained "we put on masks, throw our webs and fight the evils". Both teams waged war against each other in these games and blamed the opposite team of being evil. On interviews about the team leader children said that there are two Spiderman in the classroom, but that one was evil. Just like the team games, in order for the girls to join in the war games, they had to fulfill some requirements. The girls were allowed to join in the games if they knew how to throw a web and if they did what the team leader asked them to do. In war games, the boys chased the girls as if they were spider-men and the girls tried to escape from them.

Although the war games were banned by the teacher, the teacher let the children bring some materials closely related to comic book or cartoon characters such as Spiderman and Ben Ten to the classroom. Some of the boys came to school with a Spiderman outfit or a Ben Ten watch. Some children lent their Ben Ten t-shirts to each other claimed that girls fell in love with them when they wore these outfits. The following dialogue illustrates this:

Aykut (boy): See that girl is in love Kutalmış.
Researcher: Who said so?
Aykut: The girls did.
Researcher: What did they say?
Kutalmış (boy): They only looked at my Spiderman costume

The children who didn't have Ben Ten watches made watches out of sticky papers behind books. Two children started doing these paper watches, but soon it spread around the school and many children started to wear those paper watches.

The settings that cultivated children's peer culture

The children created plays and activities in every setting in the school. However, the children carried out their peer interactions and communications mostly in the cafeteria and the washrooms. The washrooms and the cafeteria became a nest for their peer culture. The common feature of these settings was that they were the places where the teacher's control was the least evident. The children used various settings during in this study in order to decrease the control that adults imposed on them. In a way, the peer culture helped the children to resist against the rules and the control of adults.

Although the cafeteria was commonly accepted as the place where the children met their physical needs, it had another function for the peers. Here, the children threw their metal plates at each other from under the tables, showed their personal belongings to each other, filled their mouths with tissues and tried to talk, made mustaches and beards from the ayran and bread, made weird noises with the fruit juice, peeled mandarins and played around with them. They also played word games and teased each other. "Hello, I'm Mr. Penny bank. I will beat you if you throw money in me" or put the words fork, spoon and other words in front of their names and repeat sentences. The children would race each other to sit at the end of the table and be distant from the teacher who sits at the front end of the table. Some children felt they were under the inspection every minute and this was evident in their behaviors. The following dialogue from the cafeteria illustrates this:

Tuba (T) (girl): See, did you know that there's a camera over there.
Researcher (R): Really?
T: Yes, if you don't finish your plate they see from that camera and write it in your school report. The principal told us. In fact, I don't eat desserts at home, I eat it here.
R: Why?
T: I don't like desserts, but I eat because they're watching us.

Like the cafeteria, the children used the washroom for other functions related to the peer culture. They asked permission from the teacher to go to the washroom, but they would play over there instead. During the interviews, the cleaning personnel said that the children would go to the washroom to play and hide each other's belongings. In the washrooms, the children communicated with their peers from other classrooms; they made bubbles from soap and played with them. They used the rubbish bin instead of the toilet bowl; they hid their personal belongings and they wet each other. The woman in charge of cleaning the washrooms stated that:

> *For example I say, Kerem (boy), what are you doing here, go wash your hands and don't wait. He's taking time, playing, talking. I want him to wash his hands and go, I don't want him to keep waiting. Children like playing there; they do something with the water, soap and the toilet bowl. They don't come to the washrooms for the need to use the washroom, but they come here to play. They sit and run away. They come by saying they are in need and return without using the toilet or washing their hands pretending that they used the toilet.*

Discussion

The results of this study suggest that children form friendship relationship by creating symbols, rituals and solidarity among themselves similar to how adults do. Peer relationships of children are not so different from those of adults (Garvey, 1984). Just like adults, children focus on themes such as trust, solidarity and sharing (Corsaro, 2015). Friendship and love can be observed openly among preschool children (Madrid, 2007; Sebanc, 2003). During play children gain insights about other people and learn how to share, collaborate and express their feelings (Wilson, 2008).

In this study, the children were observed to make word plays by putting different words in front of their names and created some language game rhymes. A study on Italian children also found that the children made effective discussions among themselves and made tongue-in-cheek challenges during these discussions (Corsaro & Molinari, 2006). This was also observed on African girls while they were skipping rope (Goodwin, 2006), in Taiwanese children's routine language games (Hadley, 2003) and Italian children's verbal activities which they called "cantilena" (Corsaro & Rizzo, 1990). These language games help children improve their language and communication skills (Pramling & Samuelsson, 2013). Language games among children include rhymes, alliteration, laughing, analogy, imitation and absurd poetry (Pramling & Samuelsson, 2013).

In this study, the children used some of the peer culture elements to manage their relationships in the classroom. Who was going to join in their play was one of the focal issues among the children's interaction. These children created some symbols to exclude the other children from their play and formed some secret symbols to indicate close friendship. Research on peer relationships suggests that most of the problems among peers happen during the stage of acceptance to the peer group (Moon, 2001). Although many teachers and parents consider that excluding other children in play as a selfish and non-cooperative act, this act does not always mean that children show resistance against the idea of sharing or refuse cooperation. This kind of resistance has often some functions in creating the imaginative play and, consequently, forming the relationships among children (Corsaro, 2015).

According to Corsaro, (2015), the essence of peer culture centers around the idea of gaining one's own autonomy from adult authority and rules. The children in this study often showed resistance against the classroom and school culture. These children resisted against teacher's prohibitions by turning restricted places like the washrooms and the cafeteria into a nesting area for their peer culture. Similar situation that children prefer areas that are away from adults was observed in the study of Skånfors, Löfdahl, & Hägglund (2009). They found that the children created secret hiding places. The boys, as in this study, chose the toilets for this purpose and tried to lock the door, while the girls found a small room and put a chair behind the door to prevent intruders.

Another setting where the children tried to gain power and control is the imaginative play. Superhero play have always entertained and attracted children and found almost every aspect of preschool routines and activities (Galbraith, 2007). The need for control and power in children is recognized by scholars and superhero play is seen as an important venue to meet this need (Boyd, 1997, Galbraith, 2007). Superhero play helps children not only to gain acceptance but also to develop a place for themselves in a group (Boyd, 1997). Stone's (2008) study underlined that superhero play can help some children overcome their fears and develop self-esteem and confidence. In addition, teachers can utilize superhero play to motivate children for different chores that children are often reluctant to do such as putting away their toys or eating broccoli (Bauer & Dettore, 1997).

However, educational counselors and families believe that superhero play includes violence and can negatively affect child development and should be prohibited (Galbraith, 2007). Boyd (1997) observed that children preferred to play superhero games in places where the teacher could not see them. While most teachers prohibit war toys and games in their classrooms (Doliopoulou, 1998), research indicates that prohibition and restrictions make unwanted behaviors even more attractive (Rogers & Evens, 2008). When parents prohibit their children to use toy guns, they noticed that children start using their body parts (e. g. fingers) or sticks or brooms as weapons in their play (Doliopoulou, 1998). In addition, playing games that prohibited by their adults makes children feel guilty and lie more (Bauer & Dettore, 1997).

The classroom teacher participated in this study did not perceive war games and superhero play as educative and positive; as a result he banned them in the classroom. The classroom teacher prohibited such games and did not allow toys used as guns and weapons. In fact, by doing so, the teacher ignored and excluded an important part of the peer culture that was developing in his classroom. However, this prohibition was ineffective within these peer culture and these were frequently evident in children's' play. Against the teacher's will, the boys created teams and played war games and superhero play in the classroom.

A teacher should allow children to express their interests rather than banning them and should recognize peer culture elements as a part of the learning environment of the classroom. They should include them in the system rather than ignoring or excluding them (Cook, 2001). It is crucial for teachers to understand peer culture in order to resolve conflict between peers and to increase educational efficiency. Teachers can create a balance between school culture and peer culture by observing their children to reveal the features of peer culture and by using these features while planning their own curriculum. By joining children's play, teachers can not only improve their play but also promote their overall development (Carlsson-Paige & Levin, 1987). Thus, the negative and counter-productive effects

of peer culture that children can introduce to the classroom can be reduced.

Conclusions

This study provides a window for preschool classrooms where multiple cultures often coexist and most of the time conflict each other. The peer culture is often overlooked and its power underestimated by teachers and scholars alike while they focus mostly on how teachers should act and what kind of classroom environment is more efficient. Looking closely in children's lives and their interactions with adults and peers provides us a new understanding about how children live and what goes on in classrooms. Because children's peer culture is very elusive to adult perspective, further studies on peer culture will both enhance our understanding and help children's voice to be heard.

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iejee INTERNATIONAL ELECTRONIC JOURNAL OF ELEMENTARY EDUCATION

March 2018, Volume **10**, Issue **4**, **497-504**

Investigation of Writing Habits of Primary School Teachers*

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Received: **09 January 2018**
Revised: **05 March 2018**
Accepted: **29 March 2018**
ISSN: 1307-9298

www.iejee.com

DOI: **10.26822/iejee.2018438140**

Abstract

Primary school holds an important place in the acquisition of writing skills. Writing attitudes and habits of teachers are influential in writing education provided by primary school teachers during this period. This study aims to examine the writing habits of primary school teachers. To this end, writing habits of teachers were investigated in terms of the use of writing skills in daily life, types of writing texts, contribution of writing to the professional life, teacher participation in classroom writing activities and digital medias where teachers write. The case study, a qualitative research method, was used in the study. Participants of the study consisted of 35 primary school teachers who worked in primary schools in Bartın (*n*= 22) and Ordu (*n*= 14). The semi-structured interview form created by taking the expert opinion was used in the research as the data collection tool. The obtained data were analyzed using descriptive analysis technique. In the study, it was found that 57% of primary school teachers did not use writing skills in their daily life or that they used writing skills occasionally, used writing skills the most in taking notes or poetry, 61% of them participated in classroom writing activities and used Word and social media to write on digital platforms.

Keywords: Primary school teacher, writing skill, writing habit

Introduction

Writing is a complex and difficult skill that requires the mastery of different types of knowledge (Flower & Hayes, 1981). That writing is a difficult skill brings some benefits with it. Knowing what to write and how to write influences the success of individuals in academic and social life positively (Bruning & Horn, 2000).

Today, writing is an indispensable skill for most people. Since writing is a valuable means of communication, learning and self-expression; those who do not have adequate writing skills can face disadvantages and limited educational and employment opportunities (Graham et al., 2012).

In the writing process, many language components such as linguistic knowledge, punctuation, spelling and vocabulary must be presented in written. Also in writing; planning, drafting, forming, editing, revising and evaluation processes are required. For this reason, more effort is needed to create meaning through writing compared to other language skills (Widosari et al., 2017).

In particular, teaching writing to students at primary school level is vitally important (Bulut, 2017). Although writing is a complex skill it can be an appealing, interesting and even inspiring activity as long as it is learned through social interaction, taking into account the characteristics of the students. Students need an effective guidance in this process (Widosari et al., 2017).

Teachers should be a model to improve the writing skills of students (Graham, 2006). However, the first thing that teachers should understand in order to improve the writing skills of their students is that what needs to be taught primarily is not teaching how to write, handwriting, spelling, punctuation, grammar, and similar mechanic aspects. Teachers have two important functions to guide children in writing: to show their own involvement to teach writing and to help children write on their own (Smith, 1983).

When setting a model their students in writing, teachers should pay attention to create a supportive and motivating environment (Zemelman, Daniels, & Hyde, 1998), to show how writing can affect daily lives of students (Troia & Graham, 2002) to share especially what they write as drafts with students (Zemelman, Daniels, & Hyde, 1998), to introduce effective writing strategies (Troia & Graham, 2002), to teach different kinds of writing (Graham, 2006) and to leave the writing responsibility from teacher to the student gradually (Graham et al., 2012). Today, digital tools have become indispensable for our lives, and accordingly the teacher's being a model in writing teaching process has been subject to change.

Writing has shifted from a pen and paper activity to technology-focused work (Peterson-Karlan, 2011). In order to maximize the writing performance of our students, there is a need for teaching practices that combine ICT [Information and Communications Technology] and cooperative writing. Students who write on a computer are more involved in peer work and share their work more easily with each other (Smedt & Keer, 2014). Despite the potential value added, ICT has not yet become an indivisible part of teaching writing (Cutler & Graham, 2008).

Cognitive research in the writing field has either traditionally focused on the educational practices teachers use to improve the composition skills of their students, or the authors' use of this skill (Pajares, Johnson, & Usher, 2007). Nowadays, it is needed to widen research on whether or not writing has turned into a habit as a skill as well as writing skills on digital

*A part of this study was presented as an oral presentation in the 1st International Unlimited Education and Research Symposium (24-26 April 2017, Alanya Turkey)

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platforms.

Writing habits include the use of writing skill in everyday life (Culter & Graham, 2008), different types of writing texts (Graham, 2006) and beliefs regarding writing (Draper, Barksdale-Ladd, & Radencich, 2000). This must be taken into consideration when writing habits of the individuals are identified. Below are some research on writing habits of teacher and teacher candidates.

Writing practices of primary school teachers across the United States have been investigated. About two-thirds of the teachers who participated in the study stated that the teacher training courses they took in college did not have a significant effect on teaching them writing. They also stated that they wrote only 15 minutes a day and that their students took only 25 minutes a day to write (Gilbert & Graham, 2010). A similar result is seen in the study by Culter and Graham (2008). In their study, Draper, Barksdale-Ladd, and Radencich (2000) asked prospective teachers what they could do in the future when they become teachers in order to instill writing love and habit in their students. Majority of the prospective teachers who participated in the study failed to provide effective suggestions to promote writing love and habit.

Habits and literacy skills of teachers influence their views on literacy teaching and how they administer literacy education (Benevides & Peterson, 2010; Fang, 2006). There is no way to help teachers regard themselves as authors if it does not interest children. For this reason, the first responsibility of teachers is to demonstrate to the students that writing is interesting, possible and valuable. However, if the teacher does not think writing is interesting, possible and valuable, there is no way to help children write (Smith, 1983).

Literacy experts specify that primarily teachers should have the writing habit in order to enhance the writing skills of students (Draper, Barksdale-Ladd & Radencich, 2000). Some researchers (Bowie, 1996; Decker, 1986) argue that teachers who are unsure of their writing skills conduct less writing activities with their students and that they are less involved into these activities. For this reason, writing habits of teachers, especially primary school teachers who play a key role in helping students gain writing love and habit, should be investigated.

The aim of this study was to examine the writing habits of primary school teachers. In order to achieve this aim the following questions were addressed:

1. To what extent do primary school teachers use their writing skills outside their work life?
2. What are the types of writing texts that classroom teachers write?
3. What are the contributions of writing skills of primary school teachers to their profession?
4. How is the participation of primary school teachers in classroom writing activities?
5. On which digital media or programs do primary school teachers write?

Method

Research model

The model of the research is a case study which is one of the qualitative research designs. Case study method enables a researcher to closely examine the data within a specific context. Case studies, in their true essence, explore and investigate contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions, and their relationships (Zainal, 2007). The case to be selected as the research subject may be a person, a student, an administrator, a program, or a group such as a class, school, community (Creswell, 2011). In the case study design, it is aimed to investigate the case deeply in its own flow and in its real environment and to describe it in a comprehensive way (Yin, 1994). In the present study, since the writing habits of the primary school were studied in depth by the data obtained through the interview administered in the study, they were investigated in the case study design. Yin (1994) divides types of case studies into three as descriptive, exploratory and explanatory. The present study is a descriptive case study because writing habits of primary school teachers are described according to various variables.

Participants

35 primary school teachers working in primary schools in Bartın (*n*= 22) and Ordu (*n*= 14) make up the study group of the study. The study group was determined by the homogeneous sampling method, one of the purposeful sampling methods. Purposeful sampling allows for in-depth research by selecting cases rich in information based on the aim of the study. It is preferred when it is aimed to study one or more special cases satisfying certain criteria or having certain characteristics (Büyüköztürk et al., 2013). Descriptive data on the demographic characteristics (gender, seniority, level of education) of the teachers included in the study group are presented in the table below.

Table 1. *Descriptive statistics regarding the study group*

Gender	*f*	%
Female	19	54
Male	16	46
Working Years in the Profession		
1-5 years	5	14
5-10 years	9	26
10-15 years	11	32
15-20 years	6	17
20 years and above	4	11
Level of Education		
Bachelor's	30	86
Master's	5	14

When Table 1 is examined, it is seen that 54% (*f*= 19) of the primary school teachers in the study group are female and 46% (*f*= 16) are male. In addition, teachers in the study group consist of the teachers (32%) who have maximum 10-15 years service period. The table reveals that a significant majority (86%) of the primary school teachers have a bachelor's degree, while the ratio of teachers with master's degrees is 14%.

Data collection tool and data collection process

Semi-structured interview form was used as the data collection tool in the research. It was determined that the most suitable data collection technique that could be used to find answers to specified research questions was the interview technique. This is because interview techniques are highly effective in obtaining information about experiences, attitudes, opinions, complaints, emotions and beliefs of the individuals (Yıldırım & Şimşek 2011). The interview form was prepared based on the relevant literature (Culter & Graham, 2008; Draper, Barksdale-Ladd & Radencich, 2000; Graham, 2006). The questions on the

interview form are:

1. Do you use your writing skills in everyday life other than work?
2. What type of things do you write? Please explain why you write such kinds of things.
3. What are the contributions of writing to the teaching profession? Please explain.
4. Do you participate in classroom writing activities? How?
5. What digital media or programs do you write on? Why? You can specify one or more.

A preliminary application was carried out in using the interview form. Other than the teachers who participated in the study, questions in the form were asked to five primary school teachers and the understandability and the answerability of the questions were checked.

The research data were obtained by the researcher via interview form prepared in writing upon explaining the aim of the study and that confidentiality is reserved and participation is on voluntary basis.

Data analysis

The data obtained in the study were analyzed using the MAXQDA qualitative analysis program. The creation of codes and categories in MAXQDA is controlled by the user, who can create codes before, during or after the material is analyzed. The codes are presented in a hierarchical, tree-like, structure that allows several levels of codes to be indexed (Oliveira et al., 2015). The descriptive analysis technique was utilized in the analysis of the data with the MAXQDA program. This analysis technique was employed because writing habits of teachers were described according to the themes prepared previously within this scope. The data were organized taking into consideration the questions on the interview form prepared within scope of the themes based on the conceptual framework. These themes are as follows; use of writing skills in daily life, types of texts written by teachers, contribution of the writing skills, participation of classroom writing activities, writing in digital media. The basic points in the statements in the interview form were examined taking into account the frequency and percentage values. Care has been taken to protect the context within the meaning units and individual units were double-coded if they contained information about more than one category. After separating interviews into sections, the units of meaning were grouped into categories. In addition, direct quotations were taken from the interviews and interpreted. Codes (T1, T2, T3,...T22) were used when the opinions of the teachers were provided.

Validity and reliability

The data collection tool used in the research was prepared based on the relevant literature review (Culter & Graham, 2008; Graham, 2006; Draper, Barksdale-Ladd & Radencich, 2000. It was also presented to the expert opinion and shaped by being tested in trial interviews. Three expert opinions were consulted for the questions in the interview form. In line with the expert opinions, the form was finally established. In addition, the obtained data were coded by two different experts and an inter-coder reliability analysis was performed. In this process, Inter-Coder Reliability = [Agreement / (Agreement + Disagreement)] X 100 formula (Miles & Huberman, 1994) was utilized and the inter-coder reliability percentage was calculated as 88%. In addition, direct quotations from the participant comments were included. Finally, the research report was examined by independent experts for confirmation and the compatibility between the data and findings and interpretations was revealed.

Findings

The data obtained in the research were analyzed through the questions in the interview form within the conceptual framework. The research findings are presented in the tables according to the order of the interview questions.

Use of writing skill in daily life

The data regarding the use of writing skills by primary school teachers other than their profession are presented in Table 2:

Table 2. *The use of writing skills by primary school teachers in daily life*

	f	%	Participants
I use it	15	43	T1, T3, T5, T7, T9, T13, T16, T17, T18, T19, T20, T29, T30, T32, T33
I occasionally use it	16	46	T2, T6, T8, T10, T11, T12, T14, T15, T21, T22, T23, T25, T26, T27, T34, T35
I don't use it	4	11	T4, T24, T28, T31

When Table 2 is examined, it is seen that 43% of the teachers use the writing skill in daily life, 46% use it occasionally and 11% do not use it. This indicates that more than half (57%) of the teachers who participated in the study do not use writing skills other than their professions or use them occasionally. The views of some of the teachers are as follows;

> *"I use writing skills in everyday life. While filling out a class folder, writing a message, doing helping a child do their homework, taking notes ... " (T1)*

> *"I use the writing skills in the classroom when I apply the dictation method in writing activities, when I express my thoughts on social media, when I comment and when I do activities with the students." (T13)*

> *"I love writing. Sometimes I feel like writing, I get a paper and pen, I would like to write what crosses my mind. Sometimes this happens to be a child's story, sometimes it's a situation worth experiencing. " (T33)*

An example of the opinions of those who used it occasionally;

> *"I use it when I need it, I do not use it very often." (T27)*

An example of the opinions of those who say they do not use it;

> *"I don't use it. Because, in my life, unfortunately I work on something other than my job."(T28)*

Types of texts written by teachers and their reasons

Within the scope of the research, it was aimed to identify types of texts written by primary school teachers and why they preferred these types of writing texts. The results obtained from the analysis are presented in Figure 1:

When Figure 1 is examined, it can be seen that primary school teachers wrote the most while taking notes (27%), writing poems (23%) and writing daily things (11%). The less common types preferred by teachers are stories (8%), free writings (6%), tales (4%), memories (4%) and opinion writings (4%). This indicates that the teachers do not write much in the types that require high-level thinking processes (opinion writing, etc.). 13% of the teachers stated that they write routine writings (writing on the class board, writing on the computer, etc.) that do bear literary type characteristics. Since some teachers stated a few types of

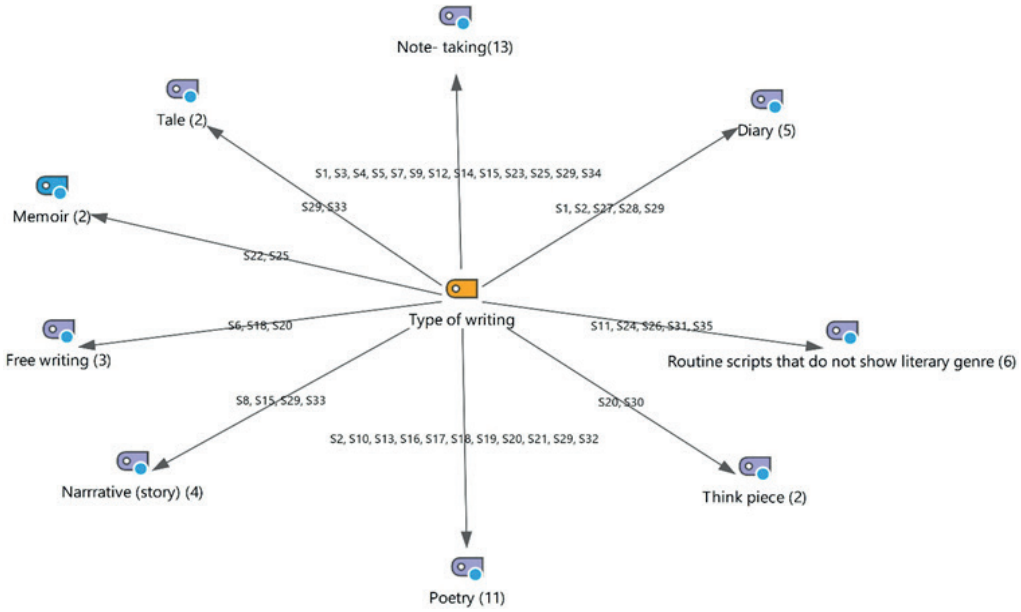

Figure 1. Types of Things Written by Primary School Teachers

texts in their views, the frequency of the types obtained as a result of the analysis was found to be higher than the number of interviewed primary school teachers. The views of some of the teachers are as follows;

> *"I rather write short stories to help my students" (T8)*
>
> *"I like to write poems. I think that poems are a good way to reflect instant feelings. "(T10)*
>
> *"I usually write memoirs. Because it becomes easier and fluent to describe and remember the memories. Memoirs are not boring. They are short writings and quickly affect the person reading them. "(T22)*
>
> *"I write diaries. I can express myself better. I prefer it because of a more comfortable language and naturalness. "(T28)*

One of the teachers stated that they did not write in different types;

> *"I use writing skills as little as possible to save time." (T35)*

The contribution of the Writing Skill to Teaching Profession

In the scope of the research, the contribution of the writing skills of primary school teachers to the profession of was examined. The findings are presented in Figure 2.

When Figure 2 is examined, it is seen primary school teachers stated that their writing skills contributed the most to the profession regarding communication (34%) and being a role model to students (34%). They also said that writing skills were helpful in terms of punctuation and spelling (10%), development of thought and imagination (8%), permanence of knowledge (3%), reading and comprehension (3%) and self-confidence (3%). Two of the teachers stated that writing would have no contribution to their profession.

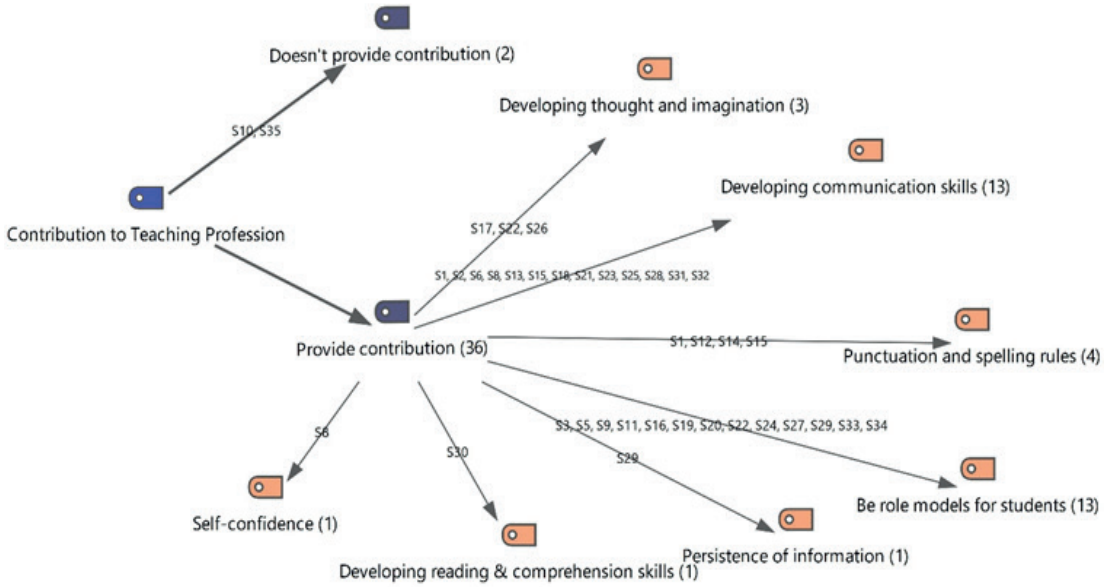

Figure 2. The Contribution of Writing Skills of Primary School Teachers to the Teaching Profession

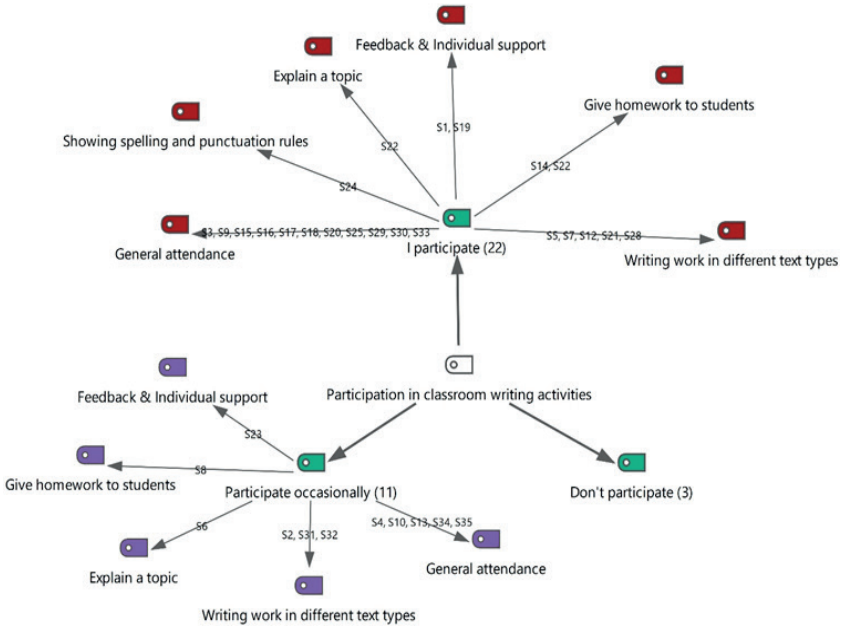

Figure 3. The Participation of Primary School Teachers in In-Class Writing Activities

The views of some of the teachers are as follows:

> *"Teachers should pay attention to the writing beauty, the content beauty, and the richness of expression, as they will set an example to every student. This will ensure that the students show a positive development. "(T5)*
> *"I think writing actually increases communication skills of a person. I also think it will contribute to the professional development. "(T23)*

> *"Concerning teaching, I think that writing will provide contribution. Because I think that a teacher who does not like to write cannot raise a student who likes to write. I make sure my knowledge becomes permanent by writing. I read the things I write frequently, and I increase the permanence of my knowledge. "(T29)*

> *"As I write, I pay attention to spelling and punctuation rules. For this reason, I think writing provides contribution. "(T12)*

One of the teachers stated as follows that writing did not contribute:

> *"I do not think it will make a direct contribution. I think that people from every professional group can use it as a tool. "(T10)*

Participation of primary school teachers in classroom writing activities

Within the scope of the research, the participation of primary school teachers in classroom writing activities was examined. The obtained data are shown in Figure 3:

When Figure 3 is examined, the participation of primary school teachers who participated in the research in classroom writing activities is as: I participate (61%), I occasionally participate (31%) and I do not participate (8%). This shows that more than half of teachers participate in writing activities. Participation of the informants into classroom writing activities and occasional participation are divided into sub-units. These sub-units are writing exercises in different types of texts, assigning students homework, feedback and individual support, explaining a subject, demonstration of spelling and punctuation rules, and general participation. When opinions of teachers were examined, opinions of those who did not indicate how they participated in classroom writing activities were evaluated in the general participation category.

The views of some of the teachers are as follows;

> *"I usually participate into classroom writing activities. I walk through the classroom and examine what students write and give feedback. " (T19)*

> *"In general, I write on the class board if I intend to assign something to the students or to explain a topic at the beginning of the lesson" (T22)*

> *"Yes, I participate. My participation in writing activities is more interesting-arising. "(T9)*

> *"In order to improve the writing habits of the students, I administer different kinds of writing activities. From time to time, I participate into the activities with them. "(T31)*

Opinion of one of the teachers who do not participate into classroom writing activities is as follows;

> *"Because my hand-writing is ugly, I usually do good writing activities by projecting them on the board from the computer. For this reason, I do not participate in many classroom writing activities. "(T11)*

When the view of this teacher is evaluated, it is possible to conclude that the teacher presents writings materials that he/she created by using digital tools instead of writing them on the class board or the teacher folders. Today, many teachers manage the writing process this way (Purcell, Buchanan, & Friedrich, 2013).

Use of digital media by primary school teachers to write

Within the scope of the research, the tendency of primary school teachers to write on digital media was examined. The data obtained from this interview are given in Figure 4:
When Figure 4 is examined, it is seen that primary school teachers write the most on Word (35%) and social media (28%) as digital media. They also write articles on Excel (16%) and messaging programs (12%). Teachers stated

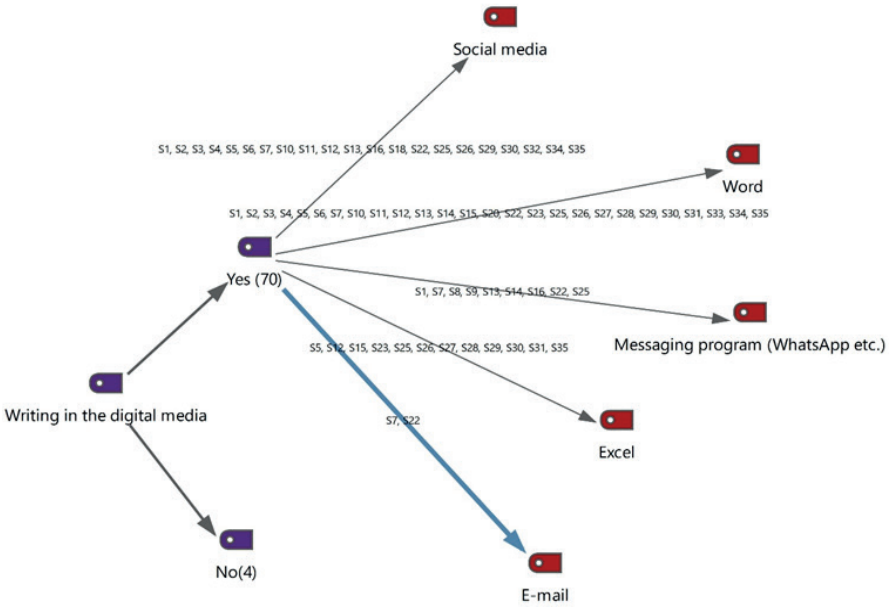

Figure 4. Use of Digital Media by Primary School Teachers to Write

that they wrote the least via e-mail (3%). Six percent of informants said they did not write on any digital media. Writing in digital media is not just writing on Word and social media. Teachers should use the writing skills in these settings for educational purposes.

Views of some of the teachers are as follows;

> *I use word for homework, exam etc... On social media, I use my Facebook account actively. (T5)*
>
> *"I use it to prepare a homework on Word, to prepare a table in Excel. I write on Facebook, Instagram and WhatsApp to share my feelings and thoughts. "(T25)*
>
> *"Digitally, I write things on Word and social media. I communicate with parents and my friends through social media. I make use of Word while working on things related to my profession. "(T27)*

One of the teachers who did not write on any digital media stated that:

> *"I do not like writing on digital media much. I usually write on paper because I am used to."(T19)*

Results and Discussion

More than half (57%) of the primary school teachers who participated in the study do not use their writing skills in their daily lives or use it occasionally. Erdogan (2017) stated in his research that primary school teachers did not allocate enough time to write in their daily lives. Similar results can be seen in studies by Gilbert and Graham (2010) and Culter and Graham (2008). In the study by Levin (1993), it was found that of the 67 teacher candidates, 42 (63%) had negative feelings about writing and wrote things only when necessary. The results of the present study and the results of these referenced studies show similarity. Primary school education is of utmost importance in the acquisition and development of writing skills. In particular, primary school teachers need to use their writing skills effectively to set a model their students.

It is seen that the primary school teachers who participated in the study write the most in the form of taking notes (27%), poems (23%) and diaries (11%). Primary school teachers write the least tales, memoirs and opinion articles. Whiteman (2010) notes that the use of a single writing style is against the writing habits of each of us. Individuals write different types and standards of things based on their writing habits. Cutler and Graham (2008) examined the writing skills of 174 primary school teachers at the national level in terms of various variables. The research found that the most common writing activities of teachers include writing stories, letters, diaries and poetry. In another study, Gilbert and Graham (2010) state that primary school teachers rarely use different writing types to persuade or inform. When these studies are compared with the results of the present research, it is seen that the teachers show similarity with regard to poetry and diary writing. Students must learn each and every one of these skills so that they can choose the most appropriate type for their writing task (Zumbrunn, 2010). Serra (2014) states that the memoir and diary writing of students are suitable for the characteristics of young children. It is more interesting for students to write their own experiences and life. Teachers should encourage students to write based upon their own lives during the writing education process. In addition, teachers should be able to write informative texts such as articles and opinion essays that require high-level thinking processes and introduce writing processes of these texts to their students.

When the opinions of primary school teachers regarding the contribution of their writing habits to their profession are examined; it is seen they reported that writing habits contributed in terms of communication (34%) and role modeling for students (34%). They also said that writing skills contributed to the demonstration and improvement of spelling and punctuation rules, enhancing thinking and imagination, achieving permanence of knowledge, reading and comprehension, and self-confidence. Writing skill is a communication skill (Graham et al., 2012). For this reason, the development of writing will bring along the development of communication skills. Also, a teacher with good writing skills will be a good model for their students (Graham, 2006).

61% of teachers participate in class writing activities. These participation situations are writing exercises in different types of texts, assigning homework to students, providing feedback and individual support, explaining a

topic, showing spelling and punctuation rules, and general participation. Teachers should participate in classroom writing activities and introduce different types of texts to their students and model how they will write. Moreover, feedback is one of the most important components of the writing process (Paulus, 1999; Ruegg, 2015). Teachers generally fail to provide enough feedback to their students with the concern of keeping up with the syllabus. However, providing feedback to the students within the writing process will help students identify and correct their mistakes in writing. Furthermore, today, the widespread use of digital tools also affects the participation of primary school teachers in classroom writing activities (Purcell, Buchanan, & Friedrich, 2013).

When the use of digital media by primary school teachers to write is examined, it was seen that they wrote on Word and social media most. They use their digital writing skills the least to write emails. Today, the widespread use of digital tools in various areas renders it compulsory to use these tools in the educational process. For this reason, teachers need to be equipped with advanced writing skills on different digital environments and programs. The use of writing skills only on Office programs or social media environments does not meet the requirements of the technology age. Teachers should create diverse blogs on digital media, share their writings and present web-based writing applications to their students. Additionally, strategy teaching and collaborative writing processes must be integrated with ICT (Smedt & Keer, 2014).

In this study, writing habits of teachers were investigated within the scope the use of writing skills by primary school teachers in daily life, types of things they write, contributions of writing to writing professions, participation of primary school teachers in classroom activities, and writing skills on digital environments. This research is limited only to the views of primary school teachers. When a general evaluation is made in this context, it can be said that primary school teachers do not have adequate writing habits. In order to obtain comparable results, quantitative and qualitative studies must be carried out in the field. In the further studies, teacher candidates or teachers of different branches can be sampled, and the effect of demographics on writing habits such as age, gender, and education level can be statistically reported as well. In addition, applied studies aiming to improve the writing habits of the teachers can be conducted.

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March 2018, Volume **10**, Issue **4**, **505-513**

The Effects of STEM Training on the Academic Achievement of 4th Graders in Science and Mathematics and their Views on STEM Training Teachers*

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Received: **09 January 2018**
Revised: **05 March 2018**
Accepted: **29 March 2018**
ISSN: 1307-9298

www.iejee.com

DOI: **10.26822/iejee.2018438141**

Abstract

This study aims to identify the effects of STEM training on the academic achievement of 4th graders in science and mathematics, as well as their views about STEM training. The study group consisted of 4th graders with similar science and mathematics achievement levels from two separate elementary schools with similar socioeconomic profiles in Niğde. The study used the quasi experimental pretest-posttest control group design and focus group interview technique. The data were collected by using the Science Achievement Test, Mathematics Achievement Test and a quasi structured interview form. The results showed that STEM training affects science and mathematics achievement, students have positive views about the training, wish to see more of it in future courses, and may consider choosing STEM areas for their future careers.

Keywords: STEM training, academic achievement, elementary school

Introduction

The rapid advances in knowledge and technology in the 21st century require societies to keep themselves up-to-date. Any society that wishes to improve must be productive, and in the 21st century, this happens mostly in the field of technology. It is natural that productive societies will progress and lead others. Therefore, 21st century schools must not only induce academic success, but also equip students with upper-level skills such as critical thinking, problem solving, cooperation, analytical thinking and creativity. As the Turkish educational system is based on exams, students who can solve the highest number of questions in the shortest time can graduate successfully from high schools and gain admission to top universities, but have difficulty finding jobs afterwards. One reason for this is the expectation among employers that their employees will not only possess theoretical information but also know how to reach information, use it in solving problems, and possess other 21st century skills.

In recent years, a new trend known as STEM (Science, Technology, Engineering and Mathematics) in the USA and translated as FeTeMM (Fen, Teknoloji, Mühendislik ve Matematik) into Turkish (Çorlu, Adıgüzel, Ayar, Çorlu & Özel, 2012) emerged in order to prepare students for the business life of the future and increase their interest in careers in the fields of science, technology, engineering and mathematics. Owing to thecontributionof STEM training to both scientific and technological progress, as well as sustainable growth, many developed and developing countries have been creating national policies based on STEM training and investing seriously in this field (Aydagül & Terzioğlu, 2014). A review of Turkey's standing in international science and mathematics tests TIMMS (Trends in International Mathematics and Science Study) and PISA (Programme for International Student Assessment) leads to concerns about the place of STEM education in the country. In TIMMS 2015,Turkish 4th graders ranked 36 among 49 countries. Only 4% of these Turkish students performed at a high competence level, while 43% and 24% performed at a low level in mathematics and science, respectively. The results of PISA 2015 which evaluated science, mathematics and reading abilities of 15-year-olds showed that Turkey scored 425, well below the average score of participant countries (465) in science literacy, which is defined as the ability to engage in scientific thought and phenomena as active citizens. Similarly, Turkish students scored 420 and remained below the average score (461) in mathematics literacy (Taş, Arıcı, Ozarkan & Özgürlük, 2016). For better TIMSS and PISA results, it has been recommended that STEM training should be prioritized (Ministry of National Education (MoNE), 2016).

The increasing reliance of economy on knowledge and skills and the need to equip students who will be part of the business world in the future with this knowledge and skills have led to many national and international studies on STEM training (Apedoe, Reynolds, Ellefson & Schunn, 2008; Baran, Canbazoğlu Bilici, Mesutoğlu & Ocak, 2016; Becker & Park, 2011; Cejka, Rogers & Protsmore, 2006; Gökbayrak & Karışan, 2017; Gülhan & Şahin, 2016; Judson, 2014; Kager, 2015; Meyrick, 2011; Smith & Hughes, 2013; Şahin, 2013; Talbot, 2014; Tolliver, 2016; Tseng,Chang, Lou & Chen, 2013; Wendell & Rogers, 2013; Yamak, Bulut & Dündar, 2014; Yıldırım & Altun, 2015;). These studies have shown that STEM training improves students' science and mathematics achievement levels (Ceylan, 2014; McClain, 2015; Olivarez, 2012; Ricks, 2006; Vollstedt, Robinson & Wang, 2007; Wade- Shepherd, 2016; Worker & Mahacek, 2013; Wosu, 2013; Yıldırım, 2016;), critical thinking (Şahin, Ayar & Adıgüzel, 2014; Wosu, 2013), creative thinking (Ceylan, 2014), and problem solution skills (Ceylan, 2014; Pekbay, 2017; Saleh, 2016; Wosu, 2013). Even though STEM training is known to be more effective in elementary than in high school and it is crucial to start this training early on (Becker & Park, 2011; Murphy & Mancini- Samuelson, 2012; Lamb, Akmal & Petrie, 2015), no previous STEM studies have been reported at this level in Turkey. The present study is a pioneer for using STEM activities at elementary school level (4th grade) in Turkey.

* This study is part of the corresponding author's doctoral dissertation.

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What is STEM training?

STEM training, which focuses on science and mathematics and combines these two disciplines with technology and engineering, has been defined in various ways. Vasquez, Sneider and Comer (2013) define it as a learning approach which eliminates the usual barriers between science, technology, engineering and mathematics and combines them with real life learning experiences, while Gomez and Albrecth (2014) define the term as a cooperative study philosophy based on practical knowledge which offers students comprehensive and meaningful real life experiences. STEM is based on the belief that science and mathematics achievement is increasingly important and that technology and engineering should be properly integrated (Jorgenson, Vanosdall, Massey & Cleveland, 2014).

When each discipline within STEM is separately examined, it becomes obvious that, on the whole, technology and engineering are not adequately understood. This may be because school curricula are based on science and mathematics, and most people perceive technology solely as digital tools and they perceive engineering as a mere profession (Vasquez, et al., 2013). However, science refers to natural sciences such as physics, chemistry and biology (Jorgenson, et al., 2014); while mathematics is not limited to numbers and operations alone, but is a discipline to be used in daily life; and technology refers to everything created by humans to ease human life (Jorgenson,et al., 2014); and finally engineering refers to a design process. As STEM training is implemented, disciplines should be brought together and integrated to enable students to see the relations between concepts and principles; students should be able to understand how to use their knowledge and skills in daily life; 21st century skills should be emphasized in this process; the tasks given to students should not be easy enough to bore them or too hard to continue; and students should be allowed at the end of the process to explain why they did things in a certain way (Bybee, 2013; Sanders, 2009; Vasquez, et al., 2013).

STEM courses are based on real life problems. In STEM courses, students look for solutions to social, economic and environmental problems. As real life problems are more personal and more important for students' daily lives, they attract students into the topic (Bryan, Moore, Johnson & Roehrig, 2016). Students first define a problem within its limitations, then search it and identify potential solutions via brainstorming, followed by interaction and sharing with each other (Bender, 2017; Jolly, 2017). In this process, students can develop different approaches in order to improve their problem solution skills, creativity, and higher-level thinking skills (Bender, 2017; Moore, Johnson, Peters- Burton & Guzey, 2016). This nature of STEM courses requires problem solution and project-based learning in the instructional process.

Becoming increasingly more important, STEM training is starting to be recognized in Turkey as well. The dissapointing results obtained in international studies such as TIMSS and PISA and the alarmingly small number of students in the advanced bands reveal the need for emphasizing higher level thinking skills such as critical thinking, cooperative learning, problem solution in the country. In addition to advancing their knowledge in each field of STEM, it is crucial for students to also see the relations between them and thus become creative, analytical and critical thinkers and problem solvers. Improving these skills, especially in primary and pre- school, increasing the interest in future STEM careers (Dejonckheere, Wit, Keere & Vervaet, 2016). It is worth noting that STEM training is particularly influential in elementary school (Becker & Park, 2011; Murphy & Mancini-Samuelson, 2012; Lamb, et al., 2015), and the lack of studies in Turkey at this level means that the results of the present study will contribute significantly to the literature. It is also expected that the findings will benefit the field of STEM, which is new in the country, and encourage teachers to get to know and implement it more commonly.

The study aimed to identify the effects of STEM practices on 4th graders' science and mathematics achievement and their views about STEM training. Therefore, the following questions were probed in the study:

1. Is there a significant difference between the science achievement pretest- posttest mean scores of experimental groups 1 and 2 (STEM activity groups) and the control group (regular curriculum group)?

2. Is there a significant difference between the mathematic achievement pretest- posttest mean scores of experimental groups 1 and 2 (STEM activity groups) and the control group (regular curriculum group)?

3. What are the views of students experimental group regarding STEM training?

Methodology

This study is a quasi experimental design. The research design, study group, data collection tools, experiment process and data analysis are as follows:

Research design

This quasi experimental pretest-posttest control group study examined the effects of STEM training on elementary pupils' academic achievement. Quasi experimental design is preferred when the level of control required by real experimental design cannot be achieved (Karasar, 2012, p.99). Qualitative data were also gathered by focus group interview technique to support the quantitative data.

Study group

The study group includes 4th graders from two different state elementary schools with a middle socioeconomic profile located in Niğde. The middle socioeconomic profile was preferred in order to exclude the extremes which might have influenced the results and to investigate the data in average schools.

The study group was identified by using the group matching method. The method involves selecting groups with equal and/or close mean scores (cited from Eckhardt & Ermann by Büyüköztürk, 2014, p. 22). For group matching in the study, 4th graders from 8 different classes in two elementary schools were given the "Science Achievement Test" and the "Mathematics Achievement Test". Based on the data obtained, three equivalent groups were selected. The criterion sampling method was used when the students to be interviewed were determined. A total of 12 students were selected from the experimental groups 1 and 2 according to the scores obtained from the science and mathematics achievement tests. The focus group interview was conducted in two sessions with two group of 6 people.

Data collection tools

The study utilized achievement tests developed to measure students' science and mathematics course achievements and an interview form developed to identify stu-

dent views about STEM training.

Science Achievement Test (SAT). The "Science Achievement Test" was developed to identify the learning level of students in the science course. For validity purposes, the views of a class teacher and an elementary education expert (with a doctoral degree in the field of science education) were obtained, and their feedback was used to create a draft form. For reliability purposes, the draft form was implemented on 118 5th graders; difficulty and distinguishing indices were identified for each item; and faulty or deficient questions were spotted. After corrections, the KR-20 reliability coefficient of the 20-item Science Achievement Test was .80; its mean score difficulty was .65 and standard deviation was 4.33. Tekin (1996) writes that the mean score difficulty of a test should be approximately .50 and KR-20 value should be close to 1. Tan and Erdoğan (2001) argue that a KR-20 reliability coefficient that is lower by "0.50" is enough for 10-15 item multiple choice tests. Therefore, SAT is reliable enough to be used in the study.

Mathematics Achievement Test (MAT). This test was developed to measure 4th graders' learning levels in the mathematics class. In order to ensure the appropriateness of the contents and quality of the draft MAT to measure the acquisitions of 4th grade, the views of a class teacher and an elementary education expert (with a doctoral degree in the field of mathematics education) were taken, and the fit between the experts was compared. For the reliability of the tool, the draft MAT was implemented on 117 fifth graders who were outside the study sample. The difficulty and distinguishing indices of each item were determined and faulty or deficient items were cleared. The KR-20 reliabilitycoefficient calculated from the item and test analyses was .80; the mean score difficulty of the test was .65 and its standard deviation was 4.33. Therefore, MAT was reliable enough to be used in the study.

A semi- structured interview form was prepared to identify students' perception about STEM activities and STEM practice. In the process of preparing the form, firstly the literature was searched and form a draft was prepared in the direction of the obtained data. The questions are prepared so that students can not be bored and can be answered easily. The draft form, which has been corrected according to expert opinion, consist of 8 questions.
The experimental process

Prior to designing theSTEM activities, the literature was surveyed. In line with the STEM lesson plan criteria prepared by Maryland State University Department of Education (2012), a total of 6 lesson plans were drawn with 14 science and 10 mathematics objectives. In order to ensure the appropriateness and feasibility of the lesson plans in an elementary school, views were obtained from five experts (two class teachers, one science teacher, one science education expert and one elementary education expert). Later, the following activities were finalized:

1. Activity 1: Let's Make a Street Lamp
2. Activity 2: Let's Get Heard
3. Activity 3: We Build Our City
4. Activity 4: Microbe Hunters
5. Activity 5: Clean Enough to Drink?
6. Activity 6: Let's Light Up Our City

In experimental groups 1 and 2, classes were implemented with STEM activities while the control group followed the textbooks and worksheets recommended by the Ministry of Education. The instructional process was run by the class teacher in Experimental group 1 and by the researcher in Experimental group 2. The control group was taught by the class teacher.

Prior to the implementation, the class teacher of Experimental group 1 was informed in detail by the researcher about the goals and importance of STEM and the lesson plans. The instructional process in Experimental group 2 was run by the researcher. In line with the lesson plans, the students were presented with a global or daily life problem. They first articulated the problem, then listed their personal solutions and finally decided in groups on the most appropriate solutions. Based on their solution proposals, they decided which of the materials provided by the teacher they would need, and in what quantity. Following this, groups undertook their designs. In the next stage, the designs were tested, amended, if necessary replanned and re-designed, and thus finalized. During the process, groups prepared presentations about their work and presented them during the evaluation stage.

In addition, focus group interviews were held to identify the views of 12 experimental students with different achievement levels about the experiment. This was done to reveal whether the students had internalized the engineering design process and their views about STEM activities throughout the process.

The process in the control group was run by the class teacher. They used textbooks printed by publishers endorsed by the ministry. Throughout the process, observation was done in the control group to check whether the teacher was indeed following the textbook.

Data analysis

SPSS 15.0 (Statistical Package for Social Sciences) was used in the study to analyze the quantitative data obtained from the tools. The Science Achievement and Mathematics Achievement pre and post test mean scores of the groups were compared by using Two Factor ANOVA for Mixed Measurements and the significance level was set at 0.05. At the same time, interview questions were analyzed by using the content analysis technique.

Findings

This section includes findings from the "Science Achievement Test", "Mathematics Achievement Test" and interviews with experimental students about STEM training.

Findings about the achievement tests

Findings about the experimental and control groups' Science Achievement Test (SAT) and Mathematics Achievement Test (MAT) pre test-post test mean scores are given below.

Science achievement test results of the groups. The Science Achievement Test (SAT) results of experimental and control groups are shown in Tables 1 and 2.

Table 1. *Experimental and control groups' SAT mean scores and standard deviations*

Groups	Pre Test			Post Test		
	N	*M*	*Sd*	*N*	*M*	*Sd*
Experiment 1	21	9.04	2.81	21	15.38	2.51
Experiment 2	25	10.36	4.01	25	15.92	2.85
Control	22	9.13	3.35	22	10.31	4.14

Table 2. *ANOVA results on science achievement test (SAT) pretest-posttest mean score*

Source of the Variance	Sum of Squares	*sd*	Mean Square	*F*	*p*	Significant Difference
Between groups	1431.5	67				
Group (Experiment1/ Experiment2/ Control)	285.681	2	142.841	8.10	.001	
Error	1145.819	65	17.628			
Within groups	1133.38	68				
Measurement (Pretest- Posttest)	642.350	1	642.350	130.05	.000	
Grup* Measurement	169.980	2	84.990	17.20	.000	E1-C; E2-C
Error	321.050	65	4.939			
Total	2664.88	135				

According to Table 1, Experimental group 1 (where STEM activities were taught by the class teacher) had the science achievement mean score of 9.04 before the experiment, which rose to 15.38 afterwards. The second STEM training group, Experimental group 2 (where classes were taught by the researcher), had the science achievement mean score of 10.36 prior to the experiment, which rose to 15.92 afterwards. The science pre and post test mean scores of the control group, which followed the regular curriculum specified by the Ministry of Education, were 9.13 and 10.31, respectively. Considering that the highest possible score from the test is 20, it may be stated that the science achievement test mean scores of both experimental and control students increased in the post test.

Table 2 shows the results of the two-factor ANOVA performed to identify whether the increase in the science achievement posttest scores of experimental and control students differed significantly.

Table 2 shows that there was a significant difference in the science achievement of two STEM experimental groups and the control group from the beginning to the end of the experiment, $F(2, 65)= 17.20$, $p<.05$. In other words, a significant increase was observed in student achievement in all three groups. This finding shows that teaching via STEM activities and via ministry endorsed textbooks have different effects on increasing science achievement. The Bonferroni test conducted to see the groups that differed showed that a significant difference existed between Experimental group 1 and the Control group in favor of the former, and also between Experimentalgroup 2 and the Control group in favor of the former. It may therefore be stated that STEM training, offered by a researcher or class teacher, improves scienceachievement more than regular instruction.

Mathematics Achievement Test Results of the Groups. Mathematics achievement Test (MAT) results of experimental and control groups are presented in Tables 3 and 4.

Table 3. *Mathematics Academic Test (MAT) Mean Scores and Standard Deviations*

Groups	Pre- Test			Post- test		
	N	*M*	*sd*	*N*	*M*	*sd*
Experiment 1	21	7.76	2.14	21	9.23	2.44
Experiment 2	25	7.00	2.23	25	9.12	2.48
Control	22	8.09	2.65	22	7.04	2.93

When Table 3 is examined by considering that the highest possible score from the mathematics achievement test is 13, it may be seen that the mean scores of Experimental group I (taught by the class teacher) increased from 7,76 in the pretest to 9.23 in the posttest. The mean scores of Experimental group II (taught by the researcher) increased from 7.00 in the pretest to 9.12 in the posttest. In the control group (taught with the ministry endorsed textbook), students' mathematics achievement pretest mean score was 8.09, which later regressed to 7.04 in the post test. According to this, while STEM training caused an enhancement in the mathematics achievement of experimental students, regular classes with a ministry endorsed textbook in the control group led to a regression.

Table 4 shows the results of the two-factor ANOVA performed to identify whether the increase in the mathematics achievement pretest and posttest scores of experimental and control students differed significantly.

As can be seen in Table 4, the mathematics achievement of experimental and control students changed from the beginning of the experiment to the end. There was no

Table 4. *Mathematics achievement test (MAT) pre test- post test ANOVA results*

Source of the Variance	Sum of Squares	*sd*	Mean Square	*F*	*p*	Significant Difference
Between groups	549.316	67				
Group(Experiment1/ Experiment2/ Control)	18.701	2	9.350	1.14	.324	
Error	530.615	65	8.163			
Within groups	366.585	68				
Measurement (Pretest- Posttest)	24.446	1	24.446	5.70	.020	
Group*Measurement	63.723	2	31.862	7.43	.001	E1-C; E2-C
Error	278.416	65	4.283			
Total	915.901	135				

Table 5. *Experimental students' views about STEM training before and after the experiment*

Before the experiment		During the experiment		After the experiment	
Statements	*f*	Statements	*f*	Statements	*f*
From the book	6	The street lamp was difficult	6	It is fun	24
Teacher centered (lecturing, etc.)	5	I liked group work	5	We did projects	8
Boring	4	We decided together	5	We learned	8
No projects	4	We helped each other	4	I would like to learn with STEM	7
Q&A	3	The street lamp was easy	3	I learned both science and mathematics	6
Individual study	2	The purifying device was easy	3	I liked it	5
No research	1	We had discussions	3	Experiments	5
Sitting alone	1	Electrical circuits was difficult	3	Memorable	5
Writing	1	We did research	3	We became brighter	4
No fun	1	The purifying device was difficult	3	I wanted to be an engineer	4
No experiments	1	It is fun	3	Learning other courses	4
		Individual is better	3	Integrating mathematics and science	3
		We were excited	3	We became brighter	3
		We worked like engineers	3	I wanted to be a scientist	3
		Group work is better	2	We advanced greatly in mathematics, science, technology	3
		Electrical circuits was easy	2	Group work	3
		Sound pollution model	1	We made designs, we learned	2
		Device that boosts sound	1	Our manual skills improved	2
		We connected the cables wrong	1	Spending a long time on topics	1
		Sound pollution model	1	Improving mathematics	1
		Group work was easy and fast	1	I felt happy	1
				I felt as if I was working in a lab	1

significant difference between experimental and control group students' total mean scores in mathematics achievement pre and post tests $F(2, 65)= 1.14$, $p>.05$. Regardless of group, a significant difference seems to exist between students' mathematics achievement test scores $F(2, 65)= 5.70$, $p<.05$. As the study aimed to test the effects of practices used in experimental and control groups on mathematics achievement, the common effects of repeated measurement factors on mathematics achievement was significant $F(2, 65)= 7.43$, $p<.05$. Therefore, STEM training may be said to be influential in increasing students' mathematics achievement.

Qualitative findings on experimental students' STEM training views

This section presents the findings of focus group interviews with 12 experimental students with different achievement levels who were selected by criterion sampling. The aim of conducting focus group interviews was to support other findings pertaining to the experiment, and to reveal the strengths and weaknesses of the experimental process from the students' perspectives. Data from the interviews were analyzed based on the questions. Student views about what their previous classes were like, their opinions on classes based on STEM activities, and the easy and challenging parts of the activities can be seen in Table 5 as views before, during and after STEM training. Their thoughts about interdisciplinary education, group work and what they would like their future training to be like are presented in Figure 1 through Figure 3.

Table 5 shows that the experimental students were previously taught via books (6) and teacher-centered approaches (5). In this experiment, students voiced opinions about the activities (Street lamp, purifier, electric circuits, etc.) and particularly emphasized in-class practices. While 12 students referred to the activities as challenging, 8 claimed that they were easy. In addition, they frequently stated the positive opinions that they liked group work (5), made joint decisions (5) and cooperated with each other (5). This shows that particularly group work created a positive effect on students during STEM activities.

After the experiment, students mostly referred to the activities as fun (24). They also mentioned projects (8), having learned (8), wanting to learn with STEM in the future (7) and learning both science and mathematics at the same time (6). One commonly emphasized concept after the study was doing experiments. In addition, some students emphasized that they may choose engineering as a future career both during and after the experiment. This suggests that STEM training encourages students to steer towards technical sciences as a profession.

Below are examples of student responses from different achievement levels.

> *" …previously our science and mathematics courses only involved writing. Now we do projects, and feel like we're working in a lab…" (Ramazan)*

> *"…during activities we had fun and learned and became brighter." (Berat)*

> *"…it was more fun. We built models and prepared presentations. We learned how to make presentations. We learned how to work like an engineer." (Sıla)*

Figure 1 below shows findings from student responses to the question "How did you feel integrating science with mathematics?"

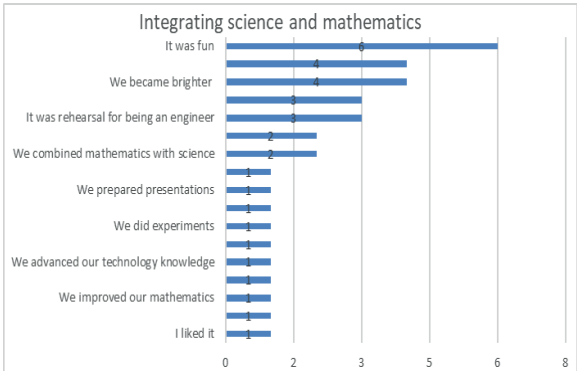

Figure 1. Student Views about Integrating Science and Mathematics

As can be seen in Figure 1, experimental students stated that integrating science and mathematics enabled them to have discussions during the process, have fun, felt better, and encouraged decision-making. They also stated that they practised engineering and improved their technology skills.

Below are sample responses from students with different achievement levels about integrating science and mathematics courses.

> *"...I really liked it because it made me appreciate maths more. I had more fun." (Kemal Mert)*
>
> *"I liked it. I mean combining it with science... you don't even realize it. It worked for me." (Açelya)*
>
> *" Previously we focused on a single topic. Now we feel like we learn maths in science class, and science in maths class." (Ramazan)*

Findings about student responses to the question "How did you feel about group work during activities?" are presented in Figure 2.

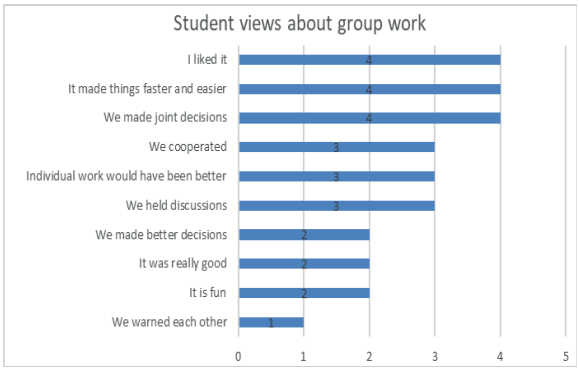

Figure 2. Student Views about Group Work

Students stated that they mostly enjoyed the environments of STEM training; they completed activities faster and easier; and made joint decisions in the process. At the same time, they emphasized cooperation and class discussions. However, some students also said that individual work would be better (3). Overall, it is possible to state that group work had a positive effect on learning.

Below are the views of students from different achievement levels about group work

> "Group was a good idea, everybody chipped in their ideas. If they *were good, we used them. If not, we didn't. We decided together." (Esra)*
>
> *"Individual work instead of group work would be better as everyone would do something unique." (Asude)*
>
> *"I loved group work. I wouldn't be able to do this on my own. My group mates helped me. Their ideas helped with the model." (Berk)*

Figure 3 shows the findings about responses to the question "What would you like your future courses to be like? Why?"

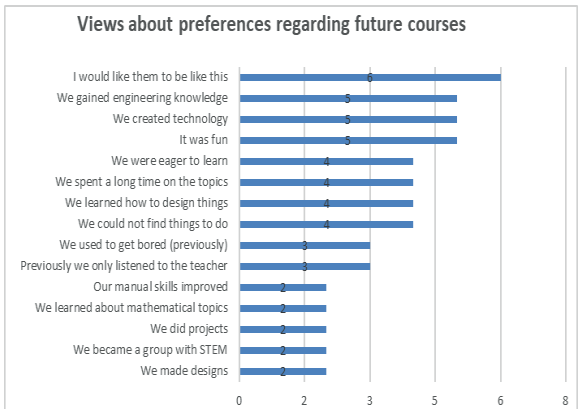

Figure 3. Student views about how they would like their future courses to be

As can be seen inFigure 3, students frequently stated that they would like their future courses to be similar (to STEM activities). They also emphasized processes such as having more time to deal with the topics, making designs, creating projects, engaging in activities for manual skills development. In addition, students emphasized being active as opposed to merely listening and stated that the instructional process should be enjoyable.

Below are sample responses from students with different achievement levels about how they would like their courses to be in the future.

> *"I had a lot of fun. We remember better when we do things and it's more fun." (Mükremin)*
>
> *"I'd want future courses to be similar. We learned both science and mathematics. Meanwhile Turkish also came into play, such as reading. Sometimes social studies also came into play. Therefore we can do it, and it's fun." (Kemal Mert)*
>
> *"I'd want all courses to be like this because we learn more and we have fun with the projects." (Mustafa)*

It may be stated that experimental students with different achievement levels generally have positive views about STEM practices, enjoy interdisciplinary problem solution and project-based work, can learn more easily, may choose engineering as a career in the future, and would like to see STEM-like activities in their future science and mathematics courses.

Results and Discussion

This study was conducted to identify the effects of STEM training on elementary pupils' science and mathematics achievement levels and find out their views about STEM. There were two experimental groups and a control group. In the first and second experimentalgroups, STEM activities were implemented by the class teacher and the researcher respectively, while the control group followed the regular instructional program. The present study started with equivalent experimental and control groups, as documented by their science and mathematics pre test results. At the end of the study, both science and mathematics achievement scores of the experimental and con-

trol groups differed significantly, in favor of the experiment group. This finding mirrors those of previous studies (Ceylan, 2014; Judson, 2014; McClain, 2015; Olivarez, 2012; Pekbay, 2017; Wade- Shepherd, 2016; Yamak, et al., 2014; Yıldırım and Altun, 2015).

When science and mathematics achievement are examined separately, it is evident that the increase in science achievement was higher than that in mathematics for both experimental and control groups at the end of the study. This may have been because experimental students were not used to the interdisciplinary approach, and may have at times perceived the course as purely science despite the links between the two subject areas. Based on researcher observations, the limited treatment of topics only in the mathematics course in the control group, and the lack of a context may have resulted in a lower mathematics achievement level in this group. However, it may still be argued that treating different disciplines together must influence student achievement. Wade-Shepherd (2016) attempted to identify the effects of a STEM curriculum on secondary school students and found that students who received STEM training had significantly higher science and mathematics achievement scores than those who received traditional instruction. Having also studied secondary school students, Olivarez (2012) concluded that a STEM program elevates success in mathematics, science and reading.

An increase in the science achievement of the experimental group both within and across groups was also the case in Wendell and Rogers' (2013) study with elementary school pupils. They found that a curriculum based on engineering design enhanced elementary school pupils' science knowledge. Similarly, another study conducted with high school students concluded that the academic performance brought by STEM increased students' science and mathematics achievement (Wosu, 2013). Yet another study by Vollstedt et al. (2007) at the secondary school level aimed to enhance student knowledge in STEM fields by using robots, and found an increase at the end of the study in the fields of science, mathematics, engineering, robotics, and computer programming. Ricks (2006), as a result of his study during a summer camp based on STEM activities, also concluded that they advanced secondary school students'science knowledge.

While no STEM studies at elementary school level have been conducted in Turkey, those conducted in other educational levels in the country obtained parallel results to those of international studies. Yamak et al. (2014) used STEMactivities in a project over the summer term, and found that these activities enhanced secondary school students' science achievement. Similarly, different studies conducted with secondary students showed that instruction with STEM activities was found to enhance students' science achievement (Ceylan, 2014; Yıldırım, 2016). Therefore, the findings of the present study are parallel to those listed above.

Considering students' mathematics achievement, even though their achievement in this field may have been lower than that in science, the mean scores of the groups still differed significantly. By the end of the process, the mathematics achievement of Experimental I, Experimental II and control group students differed significantly, in favor of the first two groups. Instruction built upon STEM based activities in the experimental group increased students' mathematics achievement. In the control group, on the other hand, students'achievement levels decreased. The Elementary School Mathematics Education Program states that students should be able to make links between their own lives and mathematics and construct mathematical meaning through concrete experiences (MEB, 2015). In this study, experimental students were exposed to real life problems in the activities, made links with their previous knowledge to solve the problems, and learned through concrete experiences. Observations of the control group, however, showed that classes in this group were taught in an abstract way, by not making many associations. This may have led to an increase in experimental students' achievement while it resulted in a decrease in that of the control group. Similarly, aiming to explore the effects of STEMtraining on 4th graders' mathematics achievement, McClain (2015) concluded that the mathematics achievement of students at STEM schools was significantly higher than that of students in other schools. Judson (2014) also concluded that STEM training increased elementary school students' mathematics achievement. The fact that mathematics achievement in this study was not as pronounced as science achievement, coupled with the findings of Kager (2015) and Tolliver (2016), suggests that the influence on mathematics achievement was not as significant.

The views of experimental students on STEM training showed that they generally felt positive, enjoyed the practices and developed a positive attitude towards STEM fields. This may be attributed to the fact that classes were learner-based and students actively participated in the sessions and created things. The results were similar both at the elementary school (Saleh, 2016) and secondary school levels (Kager, 2015; Pekbay, 2017). Despite these positive views, Talbot (2014) found that extracurricular STEM activities with elementary school pupils did not change much in their attitudes. This may have been because those pupils also participated actively in other courses and found this to be common practice.

The experimental group students who learned with STEM activities stated that they advanced both their mathematics and science knowledge. Worker and Mahacek (2013) concluded that after-school STEM training involved students actively in science, engineering and technology, and strengthened their conception of science and mathematics in the design process. The students in their study stated that they might choose engineering as a future career. Tseng, et al. (2013) wrote that extracurricular programs might encourage students to become interested in engineering fields as a future profession, and that the knowledge to be gained in these programs would benefit them in their future careers. Şahin (2013) also stated that students who participated in science fairs and STEM clubs tended to more commonly choose STEM areas after their secondary education. Similarly, Apedoe, et al. (2008) concluded that STEMtraining encouraged students to consider engineering as a future profession. Studies in Turkey likewise showed that students wished to go into these fields in the future (Baran, et al., 2016; Gökbayrak and Karışan, 2017; Gülhan & Şahin, 2016).

In the interviews, experimental students stated that they wished to see more STEM activities in their future courses. This finding is in line with Gökbayrak and Karışan's (2017) results. They also found that 6th graders wanted to have more STEM activities and found such courses to be more motivating and mentally challenging. The findings of this study revealed that classes based on problem solution and project-based integrated STEM activities enhanced elementary school pupils' science and mathematics achievement, and enabled them to sense these fields as a whole. At the same time, it was found that students got bored when they did not actively participate in courses; they enjoyed classes based on STEM activities; and they

might choose one of these fields for their future careers. Therefore, it appears that STEM training may be particularly beneficial at the elementary school level. Considering the positive effects of STEM training and the problems that the teacher experienced throughout the study, it is recommended that class teachers receive both pre-service and in-service training on how to use STEM activities. In addition, considering the significant effect of integrated STEM training at elementary school level (Becker & Park, 2011; Murphy and Mancini- Samuelson, 2012;Lamb, et al., 2015) and the lack of such studies in Turkey, it would be useful to emphasize STEM training studies in elementary schools. Future studies may also focus on the effects of STEM training on higher level thinking skills.

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