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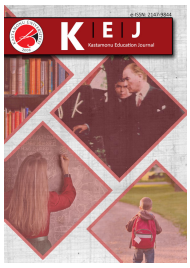

| Research Article / Araştırma Makalesi |

The Effect of Enriched Guide Book on Multigrade Class Students' Conceptual Understanding of "Get to Know the Matter" Sample

Zenginleştirilmiş Kılavuzun Birleştirilmiş Sınıflarda Öğrenim Gören Öğrencilerin "Maddeyi Tanıyalım" Konusuyla İlgili Kavramsal Anlamalarına Etkisi [1]

Tülay ŞENEL ÇORUHLU[2], **Huriye ADANUR**[3]

Keywords

1. Multigrade classes
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Anahtar Kelimeler

1. Birleştirilmiş sınıflar
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Abstract

Purpose: The aim of this study was to investigate the effect of the enriched guidebook about "Let's Get to Know the Matter" unit on students' conceptual understanding in the multigrade classroom.

Design/Methodology/Approach: The action research method was used in this study. This method focuses on the teacher solving the problem by developing strategies for the solution of the problem (Çepni, 2010). The sample group of the study is consisted of 3rd (six students) and 4th (eight students) grade students in a multigrade classroom and their teacher in Çat district of Erzurum province. Structured grid, interview questions and researcher's diary were used for data collection.

Findings: It can be observed that the enriched guided material significantly effects conceptual understanding of the students at third grade ($z = 2{,}201$, $p < .05$) and fourth grade ($z = 2{,}380$, $p < .05$) in the multigrade classrooms. It has been said that the active learning techniques and educational games used in the guidebook provide attention and facilitate learning by keeping students active.

Highlights: When the current literature is examined, it is seen that the number of studies focus on science teaching in multigrade classroom in our country is quite insufficient (Saraçoğlu, Böyük, & Tanık, 2012; Uçar, 1997). The research was carried out to fill this gap in the literature.

Öz

Çalışmanın amacı: "Maddeyi Tanıyalım" ünitesi kapsamında geliştirilen kılavuzunun birleştirilmiş sınıflarda öğrenim gören öğrencilerin kavramsal anlamaları üzerine etkisini araştırmaktır.

Materyal ve Yöntem: Çalışma kapsamında aksiyon araştırmasından yararlanılmıştır. Bu yöntem öğretmenin bir problem ile karşı karşıya kaldığı durumda problemin çözümüne yönelik stratejiler geliştirerek problemi çözmesi üzerine odaklanır (Çepni, 2010). Çalışmanın örneklem grubunu Erzurum ili Çat ilçesinde bulunan bir ilkokulun birleştirilmiş sınıfta öğrenim gören 3. (altı öğrenci) ve 4. sınıf (sekiz öğrenci) öğrencileri ile bu öğrencilerin sınıf öğretmeni oluşturmaktadır. Çalışmada veri toplama aracı olarak; yapılandırılmış grid, mülakat soruları ve araştırmacı günlüğünden yararlanılmıştır.

Bulgular: Geliştirilen kılavuzun birleştirilmiş sınıflarda üçüncü ($z = 2{,}201$, $p < .05$) ve dördüncü sınıf ($z = 2{,}380$, $p < .05$) seviyesinde öğrenim gören öğrencilerin kavramsal anlamaları üzerinde anlamlı etkide bulunduğu görülmüştür. Rehber kitapta kullanılan aktif öğrenme teknikleri ve eğitici oyunların dikkati sağladığı ve öğrencileri aktif tutarak öğrenmeyi kolaylaştırdığı söylenebilir.

Önemli Vurgular: Mevcut alan yazın incelendiğinde ülkemizde birleştirilmiş sınıflarda fen öğretimine yönelik çalışmaların sayısının oldukça yetersiz olduğu görülmektedir (Saraçoğlu, Böyük ve Tanık, 2012; Uçar, 1997). Araştırma literatürdeki bu boşluğu doldurmak için yürütülmüştür.

[1] This study, was carried out second author's master thesis, supervised by first author at Trabzon University in 2019 with the title of "The effect of the enriched student guide on the conceptual understanding of the subject of "Let's get to know the matter" of students studying in multigrade classes".

[2] **Corresponding Author,** Assoc. Prof. Dr., Trabzon University, Fatih Faculty of Education, Söğütlü/Akçaabat/Trabzon, TURKEY; tsenel@trabzon.edu.tr, https://orcid.org/0000-0002-0263-7844

[3] Teacher, Tekke Primary School, Gümüşhane, TURKEY; hadanur.14@gmail.com, https://orcid.org/0000-0003-4544-1769

INTRODUCTION

Multigrade classes; these are the classes in which students from different classes, especially in rural areas and villages, are multigraded and take part in a group due to reasons such as shortage of students, number of teachers and insufficient classrooms (Köksal, 2005; Öztürk, 2005; Şahin, 2007). Multigrade classroom practices are encountered in many countries outside our country. Greece, China, Austria, India, Vietnam and England can be given as examples of these countries (Little, 2001). According to the data of the Ministry of National Education (MoNE), only in Ankara in the 2016-2017 academic year; the number of students studying in public schools and private primary schools is 294,754 (MoNE, 2018). Multigrade classroom practices are frequently encountered in the villages of the provinces in the Eastern Anatolia region, where winter conditions are difficult, especially in our country. The harsh and difficult winters negatively affect to the transport system in some provinces such as Erzurum. Especially in villages where the population is low, multigrade class practices are frequently encountered. It is believed that the execution and conclusion of the study in Çat district of Erzurum province will be effective in providing an exemplary teaching and guiding teachers in the surrounding schools teaching in multigrade classes. There is a need for studies that will contribute to the learning processes of students studying in multigrade classes. Before graduating, primary school teacher candidates do internships at schools close to the education faculties and affiliated to the center in the 4th grade within the scope of "Teaching Practices I and II" courses (Acan, 2015). Unfortunenetaly, teacher candidates only take part in multi-class practices without having experience when they are assigned to the village in the first years of their profession after graduation. Pre-service teachers, who have never practiced in these classroom environments, gain theoretical knowledge with the 2-hour "Teaching in Multigrade Classrooms" course they have taken in the second semester of the 4th grade. Therefore, teachers who are newly appointed to the profession cannot be guided properly about the multigrade classes (Gürel, Çarpar, & Kartal, 2014). According to abovementioned information, there is a need for guiding guides that they can use while teaching in multigrade classes for teachers.

Although multi-grade classroom practices are so common in rural areas in our country, it is noteworthy that the number of applied studies on learning outcomes in multigrade classrooms is quite low (Öztürk, Akkan, Yılmaz, & Kaplan, 2015; Uçar, 1997). When the current literature is examined, it is seen that the number of studies (Saraçoğlu, Böyük, & Tanık, 2012; Uçar, 1997) conducted on science teaching in multigrade classes in our country is quite insufficient. When the studies on teaching in multi-grade classrooms are examined, it is striking that most of the studies focus on the determination of teachers' views on the applicability of curriculum in multi-grade classrooms (Adanur, 2011; Gelebek, 2011; Sınmaz, 2009; Şevki-Yıldız, 2009; Yılmaz, 2011; Yılmaz, 2014). Similarly, besides the determination of the problems encountered in teaching in multigrade classes (Abay, 2007; Dursun, 2006; Gözler, 2009; Kaya, 2005; Sağ, Savaş, & Sezer, 2009; Sumak, Sumak, & Gelebek, 2011; Yıldırım, 2008) studies to determine the current situation are frequently encountered. Applied studies that will guide primary teachers who examine the learning processes of students in multigrade classes and teach in multigrade classes are rarely given in the literature is seen (Altıntaş & Sidekli, 2017; Öztürk, et al., 2015). The applications made in the multigrade classrooms, especially within the scope of the science course, are limited, is noteworthy. It is clear that there is a need for studies that will contribute to science learning by increasing the conceptual understanding of students studying in multigrade classes in Science (Saraçoğlu et al., 2012). It is stated that education in multigrade classes is in the background compared to independent classes in ensuring student success (Oran, 2003; Veenman, 1996). The well-organized applications are able to to reverse this failing situation. Teachers have more duties and responsibilities in multigrade classes (Erdem, 2004; Elma, 2013; Palavan, & Göçer, 2017). It is clear that teachers teaching in multigrade classes need more resources and guide materials (Gelebek, 2011; Topal, & Efendioglu, 2021). It can be said that the study carried out from this point of view will guide teachers in presenting examples in science lessons in multigrade classes. Science course is taught as a separate course in the 3rd and 4th grades at the primary school stage in our country. In line with the study, an application was made in a school where the 3rd and 4th grades were included as a multigraded class. Within the scope of the "Let's Get to Know Matter" unit in the 3rd and 4th grade levels in the science course curriculum, the topics "Characteristics Qualifying Matter" and "States of Matter" were selected. It is clear that these topics are; to be important because it contains the concepts that will form the basis for the learning that will take place in the following years (Ayas & Özmen, 2002; Çalgıcı, Yıldırım, & Duru, 2020; Nakhleh, & Samarapungavan, 1999; Novick & Nusbaum, 1981; Mesh et al., 2019; Ozmen & Kenan, 2007; Uyanık & Serin, 2016).

Because more than one class will be taught at the same time in multigrade classes, the education-teaching process must be planned very well (Palavan & Göçer, 2017). Since the teacher cannot teach a subject to each class at the same time in the multigrade classes, he can manage the process by teaching the subject to one class and having homework work done in the other. Homework practices carried out with a group may cause the other group to get bored and withdraw mentally from the lesson or break away completely. So, educational games were used in the study in order to contribute to the students' learning with pleasure without getting bored. With these games, it is aimed that the group that does homework especially in the multigraded classes will both reinforce what has been learned and find the opportunity to complete the missing learnings through their peers. It is believed that the study will contribute to the primary teachers who will practice in multigrade classes. Scientists such as Lev Vygotsky, Jean Piaget and Jérôme Bruner refer to the importance of games for both mental and physical development of children. According to Gredler (2004), educational games provide the opportunity to apply the acquired knowledge in a new context. In this context,

educational games can be considered as important teaching tools that make learning both easy and fun. As a result of the literature review, it is striking that sufficient course materials cannot be provided in multigrade classes and traditional teaching methods are generally used. In addition, educational games such as drama and jigsaw puzzles are also used (Altıntaş & Sidekli, 2017; Öztürk et al., 2015). It is known that educational games have an important place in increasing student motivation and increasing interest in the lesson. Learning environments in which educational games are used generally offer students an important opportunity to attract attention and motivation, increase academic success and ensure permanence by attracting students' attention to the lesson (Arslan & Demirtaş, 2015; Kavasoğlu, 2010; Kaya & Elgün, 2015; Songur, 2006; Varan & Sulak, 2018).

In our country, there is no different curriculum for multigraded classes within the scope of Science course, and activities are planned in accordance with the current curriculum. An approach based on the students' active participation in the learning-teaching process and being responsible for their own learning has been determined in the Science course curriculum. While the teacher is in a stimulating role; the student is in the role of questioning the source of knowledge (MoNE, 2018a). In this context, it is thought that the guide prepared will be effective in realizing the principles specified in the program in multigrade classes. With this aspect, it is thought that the guide will guide the classroom teachers in achieving the goals set in the curriculum. In addition, suggestions will be made for the institutions that prepare the science course curriculum from the results obtained during the application. It is believed that if the program developers take these suggestions into account, it will contribute to more successful results in science courses in multigrade classes in the coming years.

The aim of this study is to investigate the effect of the guide developed within the scope of the "Let's Know the Matter" unit on the conceptual understanding of students studying in multigrade classes.

This study answer the following research questions:

1-What is the effect of the guide developed within the scope of the "Let's Get to Know the Matter" unit on the conceptual understanding of students studying in multigrade classes?

2-How are the reflections of the guide developed within the scope of the "Let's Get to Know the Matter" unit on the classroom environment?

METHOD

Action research was used in the study. This method focuses on solving the problem by developing strategies for solving the problem in a situation where the teacher is faced with a problem (Çepni, 2010). This method aims to make teaching in the classroom much more efficient by giving the teacher a researcher identity, focusing on school and classroom problems (Ekiz, 2003; Kindon & Elwood, 2009). As a matter of fact, this study emerged when the teacher who carried out the multigrade classroom practice identified a problem in the learning environment. Since the problem of the research is related to the process operating in the classroom environment, the best problem solving method was action research was thought. The literature on the problem was searched and the ways to solve the problem were determined. The application was made in line with the plan containing the determined solutions and the application process was reflected on the researcher's diary day by day due to the nature of the action research. Researcher diary is one of the data collection techniques used in action research (Ekiz, 2009). In line with the research process, the application was carried out with the necessary planning and the data were collected. Finally, the obtained results were shared and evaluated.

Sample

The sample of the study is six 3rd grade and eight 4th grade students studying in a multigrade class in a primary school in Çat District of Erzurum, and the teacher of this class.

Data Collection Tools

The data were collected using a structured grid, semi-structured interview and researcher diary. Structured grids are more reliable tools used to detect misconceptions than multiple-choice questions (Bağcan-Büyükturan & Çıkrıkçı-Demirtaşlı, 2012). The structured grid are able to measure meaningful learning, detect misconceptions and knowledge deficiencies in students (Bahar, Öztürk, & Ateş, 2002). Within the scope of the "Let's Get to Know the Matter" unit, 4 structured grids were prepared in order to identify the misconceptions of the students at the 3rd and 4th grade levels. Two of the structured grids were created for 3rd grade students and two for 4th grade students. At each grade level, four structured grids were developed, one from the "Characteristics Qualifying Matter" topic and two from the "States of Matter" topic related to the achievements. The developed grids were examined by a science educator and a chemistry educator who are experts in their field. The validity study of the grids was carried out as a pilot study with five 4th grade students. In the pilot study, the grids were finalized. In the first version of the structured grids, students are asked to select the appropriate boxes. In the "because" section under the question, the explanations why they chose those boxes were expressed. At the end of the pilot study, it was seen that more detailed information could not be obtained

in the statements written in the "because" section, and the students wrote the names of the visuals in the boxes in the answer. In addition, since it was determined that the "because" part required knowledge other than the acquisition, these parts were removed from the grid in the main application. The initial version of the structured grid 1 and 3 consists of 9 tiles. In the pilot application, it was determined that the object in a box was misunderstood by the students. By removing the box containing the relevant object from the grid, it was decided that the grid would consist of 8 tiles. A semi-structured interview was also used in the study. Interview questions are parallel to the questions on the grid. The pilot study of the questions was made with two students. Incomprehensible expressions were corrected, the parts of the questions that were out of the scope of the research and the questions that would lead to the same kind of conclusion were removed. Diaries written by researcher in order to both obtain data and transfer the process to the study are called researcher diaries (Ersoy, 2015). The researcher reflects their thoughts, hesitations and understandings throughout the process (Galili, 2014). Within the scope of the study, the researcher's diary was used as a data collection tool. In accordance with the nature of the action research, the observations reflecting the day of each day when the application took place were noted by the practice teacher in the researcher's diary.

Data Analysis

While analyzing the structured grid, the number of correct answers selected (A1), the total number of correct answer (A2), the number of incorrect answer selected (A3), and the total number of incorrect answer (A4) were determined separately for each question and in scoring (A1/A2)- (A3/A4) equation was used. The scores obtained with this formula range from -1 to +1. In order to evaluate the score out of 10 and to remove negativity, the score was added with 1 and the result obtained was multiplied by 5. In this way, the total scores obtained by each student from the grid were calculated. The scores of each student's pre and post-test were calculated separately. Each student's pre- and post-test scores were entered into the SPSS 22.0 package program. Non-parametric statistics were used. Within-group comparisons were made using the Wilcoxon Signed Rank Test (Kalaycı et al., 2005) were analyzed and then presented in the findings section in tabular form. In addition, Hedge's g values were calculated in order to determine the effect of the applications carried out in the 3rd and 4th grades. Hedge's g values are interpreted as low if they are 0.20 or less, moderate if they are between 0.20-0.80, and high if they are 0.80 and higher (Cohen, 1988 cited in Kansızoğlu, 2017, p. 829). While preparing the interview data, codes were given to each student according to their grade level. While third year students were coded as U1, U2,.., U6; fourth grade students were coded as D1, …, D7 and D8. In the analysis of the interview questions; full understanding, partial understanding, partial understanding with misconception, misconception and null/not understanding were analyzed in accordance with coding (Abraham, Grzybowski, Renner, & Marek, 1992).

Content analysis was used in the analysis of the data obtained from the researcher's diary. In this direction, the researcher's diary was read over and over again and the prominent titles were grouped. Depending on these groups, sub-categories were determined. One of the expressions belonging to the categories in the diary was selected and presented in the table as an example. The effects of the enriched guide developed within the scope of the "Let's Know the Matter" unit on the learning environment were determined through the advantages and disadvantages it offers to the classroom environment in terms of teachers and students. Then, the codes under the related themes were determined. The data obtained from the researcher's diary were analyzed in order to get an answer to the second sub-problem of the study.

Implementation Process

The implementation process was carried out in a 4-week science course, for a total of 12 hours. The lesson was taught with guides that facilitated the students to follow the prepared activities within the learning environment suitable for the investigative inquiry teaching strategy. Prepared guides include worksheets and educational games. The worksheet were composed of attention getting, active engagement, and evaluation sections. In the attention-grabbing part of the worksheet, fast tour and buzz 22, and in the active occupation part, experiments that will contribute to the students' collaborative work are included. In the last part of the worksheet, the snowball technique was used. In the process, educational games such as "What's wrong?", "Monopoly" and "Bingo" (Appendix 1) were used.

Findings

Under this section, the findings obtained from the pre-post test applications of the structured grid are given in order. Findings from structured grid 1 at the third grade level are presented in Table 1.

Table 1. Responses of third grade students to structured grid 1

	Pre Test			Post Test		
	Student correct answer	Student wrong answer	S.C.	Student correct answer	Student Wrong answer	S.C.
Flexible Matter	Rubber Band, Sponge	Lemon	U1, U2, U3, U6	Rubber band, sponge	-	U1, U2, U3, U5, U6
	Rubber Band, Sponge	-	U4	Rubber band	-	U4
	Rubber Band, Sponge	Grater, Iron bar, lemon, porcelain plate, spoon, polished wooden table	U5	-	-	-
Hard Matter	Grater, iron bar, porcelain plate, spoon, table	-	U1, U2, U3, U6	Grater, iron bar, porcelain plate, spoon, table	-	U1, U2, U3, Ü6
	Grater, iron bar, spoon, table	-	U4, U5	Iron bar, spoon, table	-	U4
				Grater, iron bar, porcelain plate, spoon, table	Lemon	U5
Fragile Matter	Porcelain plate	-	U4, U6	Porcelain plate	-	U1, U2, U3, U4, U5, U6
	-	Polished wooden table	U5	-	-	-
	Porcelain plate	Grater, polished wooden table	U2, U3	-	-	-
	-	Grater	Ü1	-	-	-
Scented Matter	Lemon	-	U3, U4, U6	Lemon	-	U1, U4, U5, U6
	Lemon	Sponge	U1	Lemon	Rubber band	U2
	Lemon	Rubber band	U2	Lemon	Rubber band, grater	U3
	Lemon	Grater, sponge	U5	-	-	-
Hard-Fragile-Smooth Matter	Porcelain plate	Groin	U3	Porcelain plate	-	U1, U2, U3, U4, U5, U6
	-	No HFS	U2, D4	-	-	-
	-	I don't know about the smooth matter.	U1, U6	-	-	-
	-	-	U5	-	-	-

S.C: stands for Student Code in all the tables

In the pre-test, 5 of the students expressed wrong answers as well as correct answers to the flexible matters. 5 of the students cited lemon as an example of flexible matters. In the post-test, it was seen that 5 students answered the question correctly, while another student expressed only the rubber band to the flexible matter. Four students who wrote completely correct answers to hard matter in the pre-test gave the same correct answers in the post-test. While one of the two students who left their friends by not giving the answer "porcelain plate" in the pre-test deleted one correct answer in the post-test, the other student gave all the correct answers but added an incorrect answer to them. Four of the students gave the correct answer "porcelain plate" in the pre-test to fragile matterss, but two of these four students chose two wrong answers in addition to the correct answer. In the post test, all of the students expressed the correct answer. All of the students gave correct examples of scented matters in both the pre-test and the post-test. In addition, while three of the students gave wrong answers to the question in the pre-test, the number of those who added wrong answers in the post-test decreased to two. In the pre-test, only one of the students chose the correct answer to the hard-fragile and smooth matter, but the same student gave an incorrect answer to that question. Two students did not answer the question, stating that they did not know what “smooth” was. Two students, on the other hand, stated that there is no sample of both hard, fragile and smooth matter in the table. One student left the question blank. In the post-test, it was observed that all of the students reached the correct answer.

Table 2. Responses of third grade students to structured grid 2

	Pre Test			Post Test		
	Student correct answer	Student wrong answer	S.C.	Student correct answer	Student wrong answer	S.C.
Solid Matter	Salt	-	U3, U4	Salt, flour, sponge	-	U3, U4, U5, U6
	Sponge	Olive oil, juice	U5	Salt, flour	-	U1
	-	Water vapor, natural gas	U6	Salt	Olive oil, juice	U2
	-	Olive oil, juice	U2			
	Salt, flour	-	U1			
Liquid Matter	Olive oil, juice	-	U2, U3, U4, U6	Olive oil, juice	-	U1, U3, U4, U5, U6
	Olive oil, juice	Water vapor	U1	Olive oil, juice	Salt	U2
	-	Sponge, natural gas	U5			
Gas Matter	Water vapor, natural gas, smoke from chimney	-	U2, U3, U6	Cloud, water vapor, natural gas, smoke from chimney	-	U3, U6
	Natural gas, smoke from chimney	-	U1	Water vapor, natural gas, smoke from chimney	-	U1, U2
	Water vapor, natural gas	-	U5	Natural gas, smoke from chimney	-	U4
	Natural gas	-	U4	Water vapor	-	U5

In the pre-test, none of the students answered the boxes with solid matters correctly. In the post-test, while four of the students expressed all the correct answers, it was seen that one student gave an incomplete answer and another student gave both incomplete and incorrect answers. Regarding liquid matters, four students answered the question correctly in the pre-test. One student gave correct answers but added his answer “water vapor” as liquid. One student also gave a completely wrong answer to the question. In the post test, five students answered the question correctly. While a student gave all the correct answers, he added "salt" to the liquid group. All of the examples given by the students to the gaseous matters in both the pre- and the post-test are correct examples. Students gave at least one correct answer to the question in the pre-test and post-test. The correct answer to the question was given by two students only in the post-test. Findings from structured grid 3 at the fourth grade level are presented in Table 3.

Table 3. Responses of fourth grade students to structured grid 3

	Pre Test			Post Test		
	Student correct answer	Student wrong answer	S.C.	Student correct answer	Student wrong answer	S.C.
Magnet Attraction	Paper clip, nail, pin	-	D1, D2, D3, D4, D5, D6, D7, D8	Paper clip, nail, pin	-	D1, D2, D3, D4, D5, D6, D8
Matters that Sink in Water	-	-	-	Paper clip, nail	-	D7
	Eraser, paper clip, nail, pin, stone	-	D7	Eraser, paper clip, nail, pin, stone	-	D2, D4, D5, D7
	Paper clip, nail, pin, stone	-	D5	Paper clip, nail, pin, stone	-	D1
	Eraser, pin, stone	-	D4	Eraser, stone	-	D3, D6, D8
	Eraser, stone	-	D1, D2, D8			
	Eraser	-	D6			
	-	Sponge	D3			
Matters that Absorb Water	Sponge	-	D1, D3, D5, D7, D8	Sponge	-	D1, D2, D3, D4, D5, D6, D7, D8
	Sponge	tree leaf	D2, D4			
	Sponge	Stone	D6			
Matters Floating in Water	Sponge, plastic plate, tree leaf	-	D7	Sponge, plastic plate, tree leaf	-	D1, D2, D5, D7
	Plastic plate, tree leaf	-	D1, D6, D8	Plastic plate, tree leaf	-	D3, D4, D6, D8
	Sponge, tree leaf	-	D4			
	Sponge	-	D5			
	Plastic plate	-	D3			
	Tree leaf	Paper clip, nail, stone, pin	D2			

While all of the students gave all the correct examples of magnetically attracted matters in the pretest, only one student missed one correct answer in the posttest. In the pre-test, only one of the students ticked all the correct boxes in the question for matters that sink in water. One student could not express any correct answer and gave one wrong answer. The other six students answered the question without giving any wrong answers and with at least one correct answer. In the post test, four of the students got all the correct answers, while the other four students gave at least two correct answers to the question. All of the students gave the correct answer to the matters that absorb water in the pre-test, but three students expressed one wrong answer next to these correct answers. In the post-test, all students answered the question correctly. In the pre-test, it is seen that all of the students gave at least one correct example of floating matters. One student answered the question correctly. While seven of the students did not use any wrong examples, one student added four wrong examples to their answers. In the post-test, four of the students answered the question correctly, while the other four students chose only "plastic plate" and "tree leaf" as the correct answer. The findings obtained from the structured grid 4 prepared at the fourth grade level are presented in Table 4.

Table 4. Responses of fourth grade students to structured grid 4

	Pre Test			Post Test		
	Student correct answer	Student wrong answer	f	Student correct answer	Student wrong answer	f
Solid Matter	Flour, ice	-	D1	Flour, lentils, ice	-	D2, D1, D4, D8
	Lentils, ice	-	D5	Lentils, ice	-	D5
	Flour	-	D3	Flour, lentils, ice	Cloudy	D3
	Flour, lentils, ice	Cloud, smoke from chimney	D8	Flour, lentils	Olive oil	D6, D7
	Flour, lentils	Milk, smoke from chimney	D2			
	-	Natural gas, smoke from chimney	D4			
	-	Cloud, smoke from chimney	D6			
	-	Olive oil, smoke coming out of the chimney	D7			
Liquid Matter	Milk, olive oil, water	-	D1, D3, D5, D6, D8	Milk, olive oil, water	-	D1, D3, D4, D5, D8
	Milk, water	-	D7	Milk, olive oil, water	Ice	D2
	Olive oil	-	D4,	Milk, water	Ice	D6, D7
	Olive oil, water,	Ice	D2			
Gas Matter	Natural gas, smoke from chimney	-	D1, D2, D3, D7	Natural gas, cloud, smoke from chimney	-	D1, D2, D4, D5, D6, D8
	Natural gas	-	D5, D8	Natural gas, smoke from chimney	-	D3, D7
	Cloudy	-	D4			
	Natural gas	Flour, lentils, ice	D6			
Examples of Different States of the Same Matter	Water, ice, cloud	Smoke from chimney	D7	Water, ice	-	D4, D5
	Water, ice, cloud	Milk	D2	Ice, water	Flour	D2
	Water, cloud	-	D4, D5	Water, ice	Olive oil	D3
	Ice	Lentil	D3	Ice	-	D7
	Ice	Smoke from the chimney, lentils	D1	Water	Flour	D1
	-	-	D6, D8	-	-	D6, D8

Students who chose all correct answers in solid matter were not found in the pre-test. While three of the five students who answered the question correctly did not use any wrong answers, three students could not answer the question correctly. In the post-test, six students answered the question completely correctly, while one of the two students chose all the correct answers, but added "cloud" to them as solid matter. The other student, on the other hand, expressed two of the three correct answers in total, but gave an incorrect example of solids with an answer of "olive oil". Regarding the subject of liquid matters, 5 students answered exactly the correct answer in the pre-test. While two students each expressed two correct answers, one student gave two correct answers and one wrong answer. In the post test, five students responsed exactly the correct answer, while three students added "ice" to the liquid. There were no students who gave the correct answer to gaseous matters in the pre-test. Only one of the students reached the correct answer "cloud". Except for one student, there were not any student who gave a wrong answer to the question. There were six students who responsed exactly the correct answer in the posttest. There was no wrong answer among the students, and two students could not reach the correct answer "cloud". As an example of different versions of the same item, two students in the pre-test and one student did not answer the question in the post-test. In the pre-test, there were two students who gave only correct examples to the question. While four of the seven students who answered the question gave both correct and incorrect answers to the question, three of them did not give any wrong answers. There were no students who answered the question correctly in both the pre-test and the post-test. The findings obtained from the semi-structured interview questions at the third grade level are presented in Table 5.

Table 5. Responses of third grade students to interview questions

		Sample Student Statement	Pre Interview	Post Interview
Flexible	Complete understanding	Rubber band, sponge (U5)	U1, U2, U3, U4	U1, U2, U3, U4, U5
	Partial understanding with misconception	Rubber, nylon ruler, sponge, cotton (U6)	U6	U6
	Null-Not understanding	Gas (U5)	U5	-
Fragile	Complete understanding	Glass, eyeglass, lamp, plate, glass (U6)	U1, U2, U3, U4, U6	U1, U2, U3, U4, U5, U6
	Partial understanding with misconception	Glass, ruler, table (U5)	U5	-
H-F-S Matter	Complete understanding	Jar, glass (U3)	-	U1, U2, U3, U4, U5, U6
	Misconception	Door (U3)	U3	-
	Null-Not understanding	I don't know straight. (U1)	U1, U2, U4, U5, U6	-
Making rough matter smooth	Complete understanding	By rubbing with sandpaper. And the carpenters cut the overhangs of the trees and smooth them out. (U1)	-	U1, U2, U3, U4, U5, U6
	Partial understanding	The heater is rough. To be smooth, there should be no protrusions. Its surface must be flat. (U4)	U3, U4	-
	Null-Not Understanding	I don't know straight. (U5)	U1, U2,U5, U6	-
Solid	Complete understanding	It is solid. (U1)	U1	U1, U2, U3, U4, U5, U6
	Misconception	It is liquid. (U4)	U3, U4, U5, U6	-
	Null-Not understanding	It is not an example to any of them. (U2)	U2	-
liquid (Water)	Complete understanding	Liquid (U1)	U1, U3, U4, U6	U1, U2, U3, U4, U5, U6
	Misconception	Solid (U5)	U2, U5	-
Gas matter (water vapor)	Complete understanding	Gas (U3)	U2, U3, U4, U5	U1, U2, U3, U4, U5, U6
	Misconception	Liquid (U6)	U6	-
	Null-Not understanding	It is not an example to any of them. (U1)	U1	-
Hazardous matters and safety	Complete understanding	Bleach can damage our hands. It can burn or crack our hands. (U3)	U1, U2, U3, U4	U1, U2, U3, U4, U5, U6
	Misconception	So that you don't get any germs from where you wipe it. (U6)	U5, U6	-
The absence of security measures against dangerous matters	Complete understanding	We can drink, and if we do, we are poisoned. So we should put it in the container it is in or write a warning on it and keep it in the locked cabinet. So that the kids don't get it. (U2)	U1, U2, U3, U4	U1, U2, U3, U4, U5, U6
	Null-Not understanding	We pour it into the food, so the food turns totally wet. (U5)	U5, U6	-

H-F-S: stands for Hard-Fragile-Smooth in all the tables

In the pre interview, it was observed that four students gave correct examples of flexible matters. One student answered with a misconception at the level of partial understanding, and another student at the level of null/not understanding. In the last interview, while five students gave correct examples, one student gave both correct and incorrect examples. In the pre interview, five of the students gave correct examples of fragile matters, while one student gave examples of partial understanding with a misconception. In the last interview, all of the students gave examples of fragile matters at the level of complate understanding. It was observed that the students had difficulty in giving examples of hard-fragile and smooth-surfaced matters. In the pre-test, five students stated that they could not answer the question because they did not know the smooth matter. One student's answer contained a misconception. In the post test, all students answered the question at the level of complate understanding. Four of the students stated that they did not know the concept of "smoothness" in the pre-interview. It was observed that two students

knew what the concept of smooth was, but did not have an idea about how to make a matter smooth. In the last interview, it was seen that all of the students gave the correct example and the first answer that came to their mind was "sandpaper". In the pre interview, only one of the students gave the correct answer by saying that flour is solid. It was stated that four students had misconceptions, and one student answered at the level of not understanding. In the last interview, all of the students gave correct answers. In the pre interview, four of the students said that water is liquid, while two students said that water is solid. In the last interview, all of the students gave answers at the level of complate understanding. In the pre interview, four of the students answered water vapor as gas, one student said "liquid" and one student answered "none". In the last interview, all of the students answered the question at the level of complate understanding. Data obtained from semi-structured interviews at the fourth grade level are presented in Table 6.

Table 6. The fourth grade students' answers to the interview questions

		Sample Student Statement	Pre interview	Post Interview
Swimming / sinking in water	Complete understanding	The nail sinks. (D5)	D3, D4, D5, D8	D1, D2, D3, D4,D5, D6, D8
	Misconception	Floating. Because it's iron. (D6) Because the nail is light, it floats. (D2)	D2, D6, D7	-
	Null-Not Understanding	The nail sinks. It has grams and water attracts light things. (D1)	D1	-
Absorbing - not absorbing water	Complete understanding	No, it does not absorb. (D8)	D1, D3, D6, D8	D1, D2, D3, D4,D5, D6, D8
	Misconception	Yes, it sucks. It goes into the water and gets wet. Water gets inside. (D7)	D2, D4, D7	D7
	Null-Not Understanding	Yes, it sucks. I saw it. (D5)	D5	-
Gas state of matter	Complete understanding	It is an example of a gaseous state. They cannot be caught, they spread everywhere. (D4)	D1, D3, D4, D6, D7	D1, D2, D3, D4,D5, D6, D8
	Misconception	It is solid. Because they have a certain shape. (D8)	D2, D5, D8	D7
Examples of different states of the same matter	Complete understanding	Water turns into steam and turns into gas. It turns into a solid when it freezes. (D4)	D1, D2, D3, D5, D6, D7	D1, D2, D3, D4,D5, D6, D8
	Partial understanding with misconception	If we boil the milk, it can be yogurt. If we put the oil in the refrigerator, it will freeze. (D8)	D8	-
	Null-Not Understanding	I do not know. (D4)	D4	-

In the pre interview, four of the students said that the nail will sink in the water and answered at the level of complate understanding, while three students were found to have misconceptions. One student answered at the null/not understanding level. In the last interview, all of the students answered the question correctly. In the pre interview, four students answered the question correctly by stating that tree leaves would not absorb water, while the answers of three students contained a misconception. One student answered at the null/not understanding level. In the last interview, seven students answered at the level of complate understanding, while one student gave an answer containing a misconception. Since all of the students answered the questions about the solid and liquid states of matter at the level of complate understanding both in the pre-interview and in the post interview, the data related to these questions were not reflected in the table. In the pre interview, five of the students gave the cloud as an example of the gaseous state of matter, and answered the question at the level of full understanding, while three students answered with a misconception. In the last interview, while seven students answered the question at the level of complate understanding, one of them had an answer containing a misconception. In the pre interview, six of the students gave examples of different states of the same item from their environment at the level of complate understanding, one student did not answer the question, and one student answered with a misconception at the level of partial understanding. In the last interview, all of the students gave examples reflecting their complate understanding level to the question. The Wilcoxon Signed Ranks Test results of the Structured grid pre-post test scores applied to the third and fourth grades are shown in Table 7.

Table 7. Wilcoxon signed-ranks test results of structured grid

3 . grade	Post test-Pre test	N	Mean Rank	Sum of Rank	z	P	Hedges's g
	Negative rank	0	,00	,00	2,201*	0,028*	1,754
	Positive rank	6	3,50	21,00			
	Equal	0					
4. grade	Post test-Pre test	N	Mean Rank	Sum of Rank	z	p	Hedges's g
	Negative rank	1	1,00	1,00	2,380*	0,017*	1,204
	Positive rank	7	5,00	35,00			
	Equal	0					

* On the basis of negative ranks , * p<.05

Analysis results show that there is a significant difference between the pre-post test scores of the structured grid applied in the third (z = 2.201, p<.05) and fourth (z = 2.380, p<.05) grades. It can be stated that the enriched guide developed within the scope of the "Let's Get to Know the Matter" unit has a great impact on the conceptual understanding of students studying in multigrade classes. In addition, Hedge's g values for the third and fourth grades seem to have a great effect (See Table 7). Considering that the applications performed at both grade levels are above the value of 0.80 Hedge's g value, it can be said that they have a great impact. Reflections of the guide developed within the scope of the "Let's Get to Know the Matter" unit on the learning environment; the codes are presented by extracting the advantages and disadvantages offered to the teacher and the student. Direct statements from the diary around each code are presented in Table8.

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Table 8. Findings from the researcher's diary

		Codes	Expressions from the diary
Teachers	Advantages	Functionality of the guide	The fact that the materials were the same made it easy for me as I was constantly going to both classes. (1st Day)
		The environment is suitable for the preparation of new events	Since the 3rd graders finished the activity, I gave them the task of drawing a table (semantic analysis table). We drew a table with the properties of matter. They drew a picture of an item suitable for each feature. (2rd Day)
		Ensuring classroom discipline	It made the discussion progress well in both classes. There was no noise or hum in the classrooms. Students take turns housing. (4th Day)
		Ensuring class dominance	During the experiment, the sander made a lot of noise. The students enjoyed the event very much. 4th graders found the activity of melting chocolate with hot water interesting. However, the sanding noise lesson in the time it took until the chocolate melted was irritating. (3rd Day)
		Easing the teacher's burden	The game was played comfortably with two classes. Although it did not progress with the features that exactly characterized the matter, the activity managed to draw their attention to the matter. The characteristics expressed by the students were beautiful. The students did not say fragile, but said glass. For example, does it have glass? - Hour. -Not. - Smart board. – Not bright… Hard outside and soft inside? ... I had to keep the time longer than I initially anticipated. We determined an object to reinforce what was learned in the activity. All students took turns saying a property of the object. Made of wood, hard… (1st Day)
		Being open to alternative activities	Time left at the end of the lesson. We created a replay game. We stuffed a lot of objects into one bag. Everyone put in something. In turn, each person touched an object in the bag. The person who touched it described its features and asked the others to guess. Hard, soft, rough, brittle, smelly, inedible… Students have a lot of fun. During this process, 4th graders who got bored of bingo joined us and reinforced the previous topics. (5th Day)
	Disdvantages	Time management	Grade 4 completed their worksheets and joined us. I especially got those who finished the worksheet to join us. Otherwise, these students may distract other students by talking. (1st Day)
		Lack of time	There were students who rubbed the sandpaper on both sides of the board. They did it not because they didn't understand, but because they liked it so much. It was necessary to follow the students during the experiments. (3th Day) Managing the snowball event was difficult. Although the children answered the guiding questions I asked, they could not write their answers meaningfully on paper. This was due to the lack of time. (3th Day)
		Distraction	The students mostly needed my guidance. If students finish their activities and then have free time, they can engage in different extracurricular work. I told them they could watch their classmates when they finished their activity. When I realized that they had finished, I developed the activity to include them. (1st Day)
		Unforeseen disruptions	Monopoly can actually be played with 6-8 people, but I think I should have divided my 4th graders, who are 8 people in total, into two separate groups. (6th Day)
		Noise problem	Both classes playing games at the same time caused noise. I tried to keep the Monopoly group quiet so that only the next person and the cashier could speak. They went on like this for a while. Then they start making noise. I noticed that they were discussing the answer to the question. … Students playing bingo were also impressed by their voices, and they raised their voices as well. Both classes enjoyed the games very much. But there was a constant hum in the classroom. I thought that since they are in the game, the sound doesn't affect them much. However, I saw that both classes were uncomfortable with the sound. In particular, 3rd graders were more disturbed than 4th graders (6th Day)
		Weakening of classroom control	Activities were better understood and held. But while experiments were being conducted in both classrooms at the same time, I was at their head and could not explain. Only when they are under my watch; They were able to experiment and generate ideas and come to conclusions. If I had the experiments done first in one class and then in the other, I could observe them too. If there was an empty classroom, much better quality activities could be done. (4th Day)

Students	Advantages	Increasing interest and participation in the course	The students were very active in the experiment. They did the experiment themselves and saw the results. They looked at the results again and again. They were able to repeat any part of the experiment they wanted. (1st Day)The students played bingo over and over. Everyone got their own card, and in each game, the students received different papers. Students played this game several times without getting bored. (5th Day)
		Positive effect of peer teaching	While the 3rd graders were thinking about the riddle, I gave the 4th grade bingo. They liked it very much and played well. They tried to convince each other while placing some items in places suitable for the properties of the item. His explanations were also good. Sometimes they got help from me too. (5th Day)
		Ensuring a collaborative working environment among students	They always proceeded individually while writing the estimates for the questions on the paper. I encouraged students to work together. Then, the students did the activity together. (1st Day) The 4th graders were more cohesive after the previous studies. We did the pre-activity in the form of snowballs. They came up with good ideas. They made the task sharing more balanced. (4th Day)
		Gaining self-confidence	I rotated the papers in front of them in each round. While those who knew said the features suitable for the new objects, U5 said what he remembered from theirs. Ü5 grasped the logic of the game because of the constant mentioning of the properties of the objects. They asked me about some issues in the game that they could not understand, I reminded them. I played one round. I pulled paper and helped U5 to find a feature. While Ü5 was not fully involved in the game at the beginning of the game and only wanted to draw cards from the bag for his friends, he always wanted to place cards in the following rounds. (6.G).
		Maintaining motivation	Moved to the first bankrupt bank (U2). Although he iswas not good at math, he could control money. He was not upset that he went bankrupt. He also loved the safe. (5th Day)
		Providing attention	At the end of the lesson, we did the joint repetition with a fast lap. They liked it very much. They followed carefully the game. (4th Day)
		Active participation	I explained bingo to 3rd graders. I found it very useful. They began to rapidly enumerate the properties of matter. (6th Day)
		Preferring to work individually	3rd graders were good, but they did not prefer to study in pairs. It was difficult for them to get their friends to talk. (5th Day)
		Express themselves in writing	My other three students were already students who had trouble reading and understanding on their own, or writing even if they understood (1st Day). The writing sections on the worksheets bored the students. When I asked them these questions, they answered, but some of them could not write even though they could know and explain well. Activity sections such as riddles and experiments were good and they liked it. (5th Day)

Table 8 shows that the guide provides convenience to the teacher in terms of being functional, relieving the burden of the teacher and ensuring classroom discipline. On the other hand, it also has disadvantages due to some reasons such as lack of time, dispersion of classroom control, and noise problems. The activities of the enriched guide are beneficial in increasing class participation, providing motivation and self-confidence, facilitating the applicability of peer teaching and establishing a collaborative working environment among students can also be seen.

DISCUSSION

When the tables containing the answers given in the structured grid at the third grade level are examined, it is seen that the students do not know the concept of smooth matter in general and they have misconceptions about fragile and flexible matter (Table 1). This may be due to the fact that students did not encounter issues such as roughness or smoothness in previous classes. In addition, students can often hear wrong characterizations about fragility and flexibility. Such characterizations can cause misconceptions in students. When we look at the tables containing the fragile and flexible matter questions, it is noticed that the answers given by all of the students to the post-test on both subjects are at the level of complate understanding. Likewise, when the students were asked to choose both hard, fragile and smooth matters in the pre-test, none of the students could express the correct answer at the level of complate understanding. Similar findings were also encountered in the interview data (Table 5). However, while two students answered that they did not know what a smooth matter was, in the post-test, all of the students answered correctly by separating all the correct boxes from the wrong ones. These results show us how effective the structured grid is in detecting students' knowledge deficiencies and misconceptions (Bahar et al., 2002). It was understood from this evaluation that we made at the third grade level that the structured grid is a correct tool for primary school students to detect misconceptions. It is clear that in the post-test, the students significantly overcame their misconceptions, and in the final interview, the answers of all students succeeded in entering the category of complete understanding. This success has been achieved thanks to the manual's ability to keep the process entirely in one-on-one contact with the student and learning materials. In the researcher diary, the teacher said, “They are very active in the experiment. They do and see. They look again and again. They can repeat any part of the experiment they want.” statement helps students to understand their effectiveness in the process more easily. That statement also overlaps with Altıntaş and Sidekli's (2017) study in that the games included in the prepared guide lead to the conclusion that the use of different teaching materials and active games in the course enables exploration by having fun. When the last applications were compared, it was seen that the students gave more correct answers to the interview questions. It is possible that there are two reasons for this. First, it may be that a significant part of the interviews were conducted outside the classroom environment, and thus, the students felt more comfortable answering the questions. Secondly, the interview questions may stem from the freedom of the student to choose any and the most correct answer that comes to mind. “What matter is it?” In the worksheet titled, students can use salt, water, It can be said that they comprehend the basic properties of the states of matter by making use of two glasses and a balloon. In line with the instructions in the worksheets, the students' realization of the activities with their groupmates in order may have enabled them to have information about the properties of solid-liquids and gases. In recent applications, the worksheets used in the process may have been effective in replacing students' answers containing misconceptions with scientific truths (Chong et al., 2013). Educational games such as monopoly and bingo used in the study can be shown as a reason for better consolidation of the knowledge in the subject by ensuring that the students can be entertained at the same time without boring (Babayiğit & Gültekin, 2019; Basun & Dogan, 2020; Boz, 2018a; Boz, 2018b; Hanbaba & Bektaş, 2007). As a matter of fact, the information about primary school 3rd and 4th grade students played the games with pleasure in the process (Table 8) was obtained from the researcher's diary data.

The students first obtained scientific information about the concepts by making experiments with their groupmates with the worksheets, and then they made the scientific information they obtained through educational games permanent and made it their own. When the questions are examined on a subject-based basis, it is seen that the fourth grade students answered the matters attracted by the magnet correctly in both the pre-test and the post-test (Table 6). It can be thought that the reason for this is that they had previously learned about the force applied by the magnet to the objects from the "Effects of Force" unit. It is seen that misconceptions about objects such as floating-sinking objects and absorbing-not absorbing water have been eliminated to a great extent (Table 3). When we look at the state of matter, although some misconceptions were detected in the pre-test and pre-interview in the fourth grade, it is seen that the misconceptions decreased very significantly after the intervention. In this case, it is obvious that worksheets are separated more effectively than traditional methods in terms of involving students in activities throughout the course with active learning techniques, keeping the student in one-on-one interaction with the experiment materials, providing opportunity to continue their learning in a real-life environment with games. As a matter of fact, it is possible to reach similar studies in the literature that find the use of worksheets in teaching to be more effective in reducing misconceptions than traditional methods (Akkaya & Durmuş, 2010; Coştu et al., 2003; Demircioglu et al., 2004; Gonen and Akgun, 2005).

When the answers given by the third grade ($z = 2.201$, $p<.05$) and fourth grade ($z = 2.380$, $p<.05$) students in the pre-test and post-test were examined in the structured grid, hence a significant difference was observed in favor of the post-test, it was concluded that the activities in the guide facilitate learning and increase conceptual understanding. Hedge's g values were calculated in order to determine the effect of the practices carried out at the 3rd and 4th grade levels within the scope of the

study. The fact that the values obtained from both grade levels are above 0.80 indicates that the practices are quite effective. The high calculation of the effect values in both groups can be explained by the use of worksheets, active teaching techniques and educational games together, and the positive effects of students on each other's learning by sharing information in cooperation (Karataş et al., 2018; Yıldız et al., 2020). When we focus on the situations in which this effect arises in the classroom environment, the enriched guide can be seen as the most important variable. When the researcher's diaries are examined, it is stated that the students like to read the instructions on the paper themselves and repeat the section they want. The fact that the student is satisfied with the way he/she shapes his/her own learning situation and can add what he/she wants to the activities can be interpreted as making them more self-confident (Table 8). When the pre-test and post-test result analyzes of both classes were compared, it was seen that the effect of the applications made in the 4th grades was higher than the applications made in the 3rd grade. This result may be due to the fact that 4th grade students accept each other more quickly and work more collaboratively (5th Day). It is possible to say that 3rd grade students do not prefer to work with them in some questions because they find some of their friends slower than themselves in situations that require cooperation, and therefore they choose to work individually (Felder & Brent, 1996).It is noteworthy that the students who lagged behind their friends academically did not want to participate in the game at first, but when they watched and understood the game, they joined the game, and later on, they could confidently and quickly count the answers directed to them. When this situation is interpreted in the light of the researcher's diary observations, especially the bingo game comes to mind. It is seen that bingo allows students to count the properties of the items accurately and quickly, as it is aimed, and serves its purpose in this respect. Students playing the game over and over again without getting bored; It overlaps with many studies in which teaching through games increases interest and participation in the lesson (Karamustafaoğlu & Kaya, 2017). In the fast tour technique used during the lesson, students should be careful not to use their friends' answers; It can be said that it is beneficial for students in terms of following their friends and not leaving the lesson. In addition, since the quick tour requires the students to answer the questions quickly, it required the students to avoid much scrutiny for the correctness of the answer in their minds, and it was seen that this gave them courage over time. In this respect, it can be said that active learning techniques help students in building self-confidence; this situation contradicts the conclusion of Lunenberg and Volman (1999) that active learning techniques lead students to a more passive attitude in the lesson. Considering that in the buzz 22 technique, students tend to study separately in the first days, but gradually listen to and share each other's answers in the following days, it comes to mind that students in multigrade classes are more directed to individual work. While the snowball technique was particularly beneficial for shy students in terms of creating tiny steps to share their ideas and knowledge with a community, the teacher had difficulty in managing two different classes at the same time was understood. Especially for primary school students, without rushing the newly learned techniques, without causing an environment of confusion, teaching gradually and under the control of the teacher is important for the student to understand the technique well and not to have a negative attitude towards the lesson (3rd Day). It is striking that the application mostly supports collaborative learning. It is seen that students get used to collaborative work over time. A statement regarding this in the researcher's diary is as follows: “The 4th graders were more consistent after previous studies. We did the pre-activity in the form of snowballs. They came up with good ideas. They made the task sharing more balanced (4th Day).” This statement can be associated with the results obtained from the analysis of the structured grid in the study.

It can be said with the data obtained from the researcher's diary that monopoly and bingo are liked by the students, that the students internalize the information more easily in the games and thus they can remember it more easily. This situation coincides with Coşkun et al.'s (2012) study on educational games facilitating learning and increasing academic achievement.

Educational games provide advantages in developing positive attitudes towards the lesson, gaining self-confidence, and reinforcing the knowledge they have learned, as well as disadvantages for both students and teachers in the classroom environment has been determined. Having several playgroups in the classroom at the same time created noise over time and made it necessary for the teacher to try to maintain classroom discipline besides following the playgroups. Similarly, Çangır's (2008) study coincides with the conclusion that the use of educational games increases the interest and participation in the lesson, while creating disciplinary problems and tiring the teacher. The teacher's "What's wrong?" played on the first day of the practice. The fact that the game can be played with both classes at the same time eases the flow of the lesson, indicating that a single game that can cover all students in the class alleviates the burden of the teacher. The game with several groups at the same time keeps the students active, but makes it difficult to dominate the class. However, students show that they become aware of more information with games, they are more willing to learn, the learned information is more permanent and they learn a lot from their friends. As a matter of fact, in the literature, educational games help concept teaching, increase interest in the lesson, reduce anxiety, and thus facilitate learning (e.g. Karamustafaoğlu & Kaya, 2017; Yıldız et al., 2020).

The tools and materials in the experiments in the guide were chosen from the materials that students frequently use in daily life, making it easier to internalize the learned information by establishing a connection with daily life has been seen. Likewise, although care was taken to ensure that the experimental materials of both classes were as identical as possible so that their attention would not be diverted to each other, even the fact that the type of the activity was different was enough to divert the student's attention to the other class (Table 8, 4th Day). This showed the difficulty of keeping two different student groups active simultaneously and independently in a classroom. The guide used in the study kept the students active throughout the entire course. However, due to the different individual speeds of the students, some students were left empty from time to time. At this

point, additional worksheets containing different types of activities were needed for students to work individually without interfering with their friends' work. This situation brought to mind the difficulty of all students being active with the same activities at the same time in multigrade classes.

Looking at the literature, one of the most important problems encountered in multigrade classrooms is that the use of materials is not at the desired level and teachers need a guide to assist teaching in multigrade classrooms (Alpaltun, 2012; Gelebek, 2011). It is seen that the developed guide provides an advantage in terms of increasing conceptual understanding in multigrade classes, as it is enriched with active learning techniques and includes educational games (Table 7). The effectiveness of the educational game varies according to the subject, student level and the determined game (Usta et al., 2018). The fact that the guide prepared in this framework is effective in increasing conceptual understanding reveals that the activities in the guide are suitable for the subject and the level of the student. With this aspect, the study can be accepted as an example for the guides to be prepared from now on. Active learning techniques are not just a method; it includes many different methods such as cooperative learning and problem-based learning. In this respect, the activities in the prepared guide may have provided an enriched learning environment to the students and increased their success in the classroom.

CONCLUSION AND RECOMMENDATIONS

The guide prepared within the scope of the study contributed significantly to the conceptual understanding of students studying in multigrade classes. In this direction, it has been seen that active learning techniques and educational games used in the guide provide attention and facilitate learning by keeping students active. In eliminating the misconceptions of the students, the learning environment provided by the guide made it easier for the student to internalize the knowledge since it included the student in the one-to-one learning environment. The study could be carried out with activities that would keep the multigrade students, who are disadvantaged in spending time with their teacher, active throughout the whole process, and the success expected from the students in line with the study topic was achieved with a significant difference.

The difficulties faced by the academically weaker students in conveying their observations and thoughts on the subject on paper was the most challenging situation in the guide. In such cases, the students made a connection with the lesson and did not break away from the lesson thanks to active learning techniques. This result revealed the effectiveness of active learning techniques in providing learning. Due to the different individual speeds of the students, the students who finished the activity early sometimes participated in the activity of the other class, and sometimes they were directed to a different activity. Such cases have shown that it may be necessary to prepare additional activity sheets, especially for multigraded classes. While educational games provide an advantage to students in providing student attention, increasing motivation, improving self-confidence and facilitating learning, they have tired students and teachers because they cause noise in the classroom environment. It has been understood that educational games are a very important material in concept teaching. It can also be said that especially multigraded classes help him to have the opportunity to learn a lot from his friends with these games.The following recommendations can be made within the scope of the study.

The number of studies aiming to increase the quality of teaching in multigrade classrooms can be increased and the disadvantaged situation of students in multigrade classrooms can be minimized. In order to carry out common lessons in the multigraded classes, the duration of the lessons allocated to the subjects can be equalized and the achievements can be brought closer to each other, especially for the Science lesson. In this way, it can be facilitated for teachers to conduct the lesson with more than one class and in connection with each other.

Active learning techniques can be expanded in the Science course and other courses, contributing to the multi-faceted development of students. In this way, time-disadvantaged students in multigrade classes can be enabled to continue their lessons more efficiently. By benefitting from its remarkable, motivating and self-confidence features, many games can be adapted to lessons and brought into teaching thanks to educational games. With learning together with the game, student adaptation can be increased and the level differences between students can be minimized. Resource books, guides, and learning materials for multi-grade classrooms can be obtained for students. In this way, the workload of teachers can be reduced and it can be ensured that they can use their energies more healthily and efficiently.

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Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Examples of author contribution statements

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

The Ethics Committee Document numbered 82554930-400/3437 and dated 21/09/2017 obtained from Karadeniz Technical University used in the study is attached.

REFERENCES

Abay, S. (2007). *Birleştirilmiş sınıflarda sosyal bilgiler öğretimindeki sorunlar [Problems in teaching social studies in multigrade classes],* [Unpublished master thesis]. Ondokuz Mayıs University. [In Turkish]

Abraham, M. R., Gryzybowski, E. B., Renner, J. W., & Marek, A. E. (1992). Understanding and misunderstanding of eighth graders of five chemistry concepts found in textbooks. *Journal of Research in Science Teaching, 29,* 105-120.

Açan, M. (2015). *Birleştirilmiş sınıfta ilk okuma yazmayı öğrenme ve öğretme sürecinin betimlenmesi: bir durum çalışması [Describing the process of beginning reading and writing instruction in a multigrade class: A case study],* [Unpublished master thesis]. Gazi University. [In Turkish]

Adanur, Z. (2011). *Birleştirilmiş sınıflarda yapılandırmacı yaklaşımın uygulanabilirliğinin öğretmen görüşleri açısından değerlendirilmesi: Trabzon ili örneği* [*Applicability of constructivist approach in joint primary classes from the views of primary school teachers: A sample of Trabzon*], [Unpublished master thesis]. Karadeniz Teknik University. [In Turkish]

Alpaltun, K. (2012, Mayıs). *Birleştirilmiş sınıflı okullarda görev yapan sınıf öğretmenlerinin öğretim materyalleri konusunda karşılaştıkları sorunlar ve çözüm önerileri [Problems faced by classroom teachers working in multi-class schools about teaching materials and solutions].* 11. Ulusal Sınıf Öğretmenliği Eğitimi Sempozyumu'nda sunulan bildiri [Paper presented at the 11th National Primary Teacher Education Symposium], Recep Tayyip Erdoğan University, Rize. [In Turkish]

Altıntaş, S., & Sidekli, S. (2017). Çarpma işlemi öğretiminde Napier çubukları kullanımı: Birleştirilmiş sınıflar [The effects of napier sticks used in multiplication teaching on learners' academic success in multigrade classes]. *Eğitim Kuram ve Uygulama Araştırmaları Dergisi* [Journal of Educational Theory and Practice Research]*, 3*(2), 14-21. [In Turkish]

Arslan, N., & Demirtaş, Z. (2015). *Oyun destekli öğretimin 5. sınıf temel geometrik kavramlar ve çizimler kazanımlarının öğretiminde öğrenci başarısına etkisi.* VII. Ulusal Lisansüstü Eğitim Sempozyumu'nda sunulan bildiri [Paper presented at the VII. National Postgraduate Education Symposium]*,* Sakarya University, Sakarya. [In Turkish]

Ayas, A., & Özmen, H. (2002). Lise kimya öğrencilerinin maddenin tanecikli yapısı kavramını anlama seviyelerine ilişkin bir çalışma [A study on high school chemistry students' understanding of the concept of the particulate nature of matter]. *Boğaziçi Üniversitesi Eğitim Dergisi [Boğaziçi University Journal of Education], 19*(2), 45- 59. [In Turkish]

Aycan, S., Türkoğuz, Ş., Arı, E., & Kaynar, Ü. (2002, Eylül 16-18). *Periyodik cetvelin ve elementlerin tombala oyun tekniği ile öğretimi ve bellekte kalıcılığının saptanması [*Teaching the periodic table and elements with the bingo game technique and determining their retention in memory]. *V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi'nde sunulan bildiri [Paper presented at the 5th National Science and Mathematics Education Congress],* ODTÜ, Ankara. [In Turkish]

Akkaya, R., & Durmuş, S. (2010). İlköğretim 6. sınıf öğrencilerinin cebir öğrenme alanındaki kavram yanılgılarının giderilmesinde çalışma yapraklarının etkililiği [The Effectiveness of Worksheets on Overcoming Misconceptions Related to Algebra Learning Domain of Sixth Grade Elementary School Students]. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi [Dumlupınar University Journal of Social Sciences], 27*, 7-26. [In Turkish]

Bağcan-Büyükturan, E., & Çıkrıkçı-Demirtaşlı, N., (2012). Çoktan seçmeli testler ile yapılandırılmış gridlerin psikometrik özellikleri bakımından karşılaştırılması [Comparison of multiple choice tests and structured grids in terms of psychometric properties]. *Eğitim Bilimleri Fakültesi Dergisi [Journal of the Faculty of Educational Sciences], 45*(1), 395-415. [In Turkish]

Bahar, M., Öztürk, E., & Ateş, S. (2002, Eylül 16-18). *Yapılandırılmış grid metodu ile lise öğrencilerinin Newton'un hareket yasası, iş, güç ve enerji konusundaki anlama düzeyleri ve hatalı kavramların tespiti.* V. Ulusal Fen Bilimleri ve Matematik Kongresi'nde sunulan bildiri [Paper presented at the 5th National Science and Mathematics Congress], ODTÜ, Ankara. [In Turkish]

Başün, A. R., & Doğan, M. (2020). Matematik eğitiminde uygulanan oyunla öğretimin akademik başarı ve kalıcılığa etkisi [The effect on academic success and permanence of teaching with game applied in mathematics education]. *Disiplinlerarası Eğitim Araştırmaları Dergisi [Journal of Interdisciplinary Educational Research], 4*(7), 155-167. [In Turkish]

Bayat, S., Kılıçaslan, H., & Şentürk, Ş. (2014). Fen ve teknoloji dersinde eğitsel oyunların yedinci sınıf öğrencilerinin akademik başarısına etkisinin incelenmesi [Analysing the effects of educational games in science and technology course on seventh grade students' academic achievements]. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi [Abant İzzet Baysal University Journal of the Faculty of Education], 14*(2), 204-216. [In Turkish]

Boz, İ. (2018a). İlkokul 4. sınıf matematik dersinde oyunla öğretim yönteminin akademik başarıya etkisi (The effect of teaching by game to academic success in primary school 4th class mathematics. *Uluslararası Ders Kitapları ve Eğitim Materyalleri Dergisi [International Journal of Textbooks and Educational Materials], 1*(1), 27-45. [In Turkish]

Boz, İ. (2018b). İlkokul 4. sınıf Türkçe dersinde oyunla öğretim yönteminin akademik başarıya etkisi [The effect of teaching with games method on academic success in primary school 4th grade turkish lesson]. *Journal of Social Sciences and Education, 1*(1), 61-75. [In Turkish]

Chong, V. D., Salleh, S. M., & AiCheong, I. P. (2013). Using an activity worksheet to remediate students' alternative conceptions of metallic bonding. *American International Journal of Contemporary Research, 3*(11), 39-52.

Coştu, B., Karataş, F. Ö., & Ayas, A. (2003). Kavram öğretiminde çalışma yapraklarını kullanılması [Using worksheets in teaching concepts]. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi [Pamukkale University Journal of Education Faculty], 2*(14), 33-48. [In Turkish]

Coşkun, H., Akarsu, B., & Kariper, İ. A. (2012). Bilim öyküleri içeren eğitsel oyunların fen ve teknoloji dersindeki öğrencilerin akademik başarılarına etkisi [The effects of educational games based on science stories on students' academic achievements in science and technology classroom]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi [Journal of Ahi Evran University Kirsehir Education Faculty], 13*(1), 93-109. [In Turkish]

Çalgıcı, G., Yıldırım, M., & Duru, M. K. (2020). 5. sınıf öğrencilerinin madde ve hal değişimi konusunda kavram yanılgılarının oyunlaştırma ile giderilmesi [Elimination by gamification the 5th grade students' misconceptions about the matter and phase change]. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi [Necatibey Faculty of Education Journal of Electronic Science and Mathematics Education], 14*(2), 1278-1310. [In Turkish]

Çepni, S. (2010). *Araştırma ve proje çalışmalarına giriş [Introduction to research and project work],* (5. baskı). Celepler Press. [In Turkish]

Dursun, F. (2006). Birleştirilmiş sınıflarda eğitim sorunları ve çözüm önerileri [Educational problems and solutions in multi-grade classrooms]. *Sosyal Bilimler Araştırmaları Dergisi [Journal of Social Sciences Studies], 2,* 33-57. [In Turkish]

Ekiz, D. (2003). *Eğitimde araştırma yöntem ve metotlarına giriş: Nitel, nicel ve eleştirel kuram metodolojileri [Introduction to research methods and methods in education: Qualitative, quantitative and critical theory methodologies].* Anı Press. [In Turkish]

Elma, C. (2013). Birleştirilmiş sınıflı okullarda görev yapan öğretmenlerin yönetim ve eğitim sürecinde karşılaştıkları sorunlar [Problems of teachers working at multigraded schools in management and education processes]. *Fırat Üniversitesi Sosyal Bilimler Dergisi [Fırat University Journal of Social Sciences], 23*(1) 75-87. [In Turkish]

Erdem, A. R. (2004). *Birleştirilmiş sınıflarda öğretim [Teaching in multigrade classes].* Anı Press. [In Turkish]

Ersoy, A. (2015). Doktora öğrencilerinin ilk nitel araştırma deneyimlerinin günlükler aracılığıyla incelenmesi [Investigation of Phd students' initial qualitative research experiences via their diaries]. *Pegem Eğitim ve Öğretim Dergisi [Pegem Journal of Education and Training], 5*(5), 549-568. [In Turkish]

Felder, R. M. & Brent, R. (1996). Navigating the bumpy road to student-centered instruction. *College teaching, 44*(2), 43-47.

Galili, S. (2014). Cooperative learning by teacher trainers as a tool for improving teacher training in heterogeneous elementary school track classes. *American Journal of Educational Research, 2*(8), 568-576.

Gelebek, M. S. (2011). *Birleştirilmiş sınıf öğretmenlerinin yapılandırmacılık temelli yeni ilköğretim programının birleştirilmiş sınıflarda uygulanmasına ilişkin görüşlerinin incelenmesi: Kilis ili örneği [Examining the opinions of multigrade classroom teachers on the implementation of the constructivism-based new primary education program in multigrade classrooms: The case of Kilis].* [Unpublished master thesis]. Gaziantep University. [In Turkish]

Gönen, S., & Akgün, A. (2005). Isı ve sıcaklık kavramları arasındaki ilişki ile ilgili olarak geliştirilen çalışma yaprağının uygulanabilirliğinin incelenmesi [The investigation of applicability of worksheet was developed about relationship between heat and temperature concepts]. *Elektronik Sosyal Bilimler Dergisi [Electronic Journal of Social Sciences], 3*(11), 92-106. [In Turkish]

Gözler, A. (2009). Birleştirilmiş sınıflı okullarda görev yapan öğretmenlerin yeni ilköğretim programına yönelik görüşleri [Opinions of teachers working in multi-class schools on the new primary education program]. *e-Journal of New World Sciences Academy, 4*(3), 815-832. [In Turkish]

Gredler, M. E. (2004). Games and simulations and their relationships to learning. In D. H. Jonassen (Ed.). *Handbook of research on educational communications and technology* (pp. 571-581). NJ: Lawrence Erlbaum Associates.

Gürel, N., Çapar, D., & Kartal, S. (2014). Birleştirilmiş sınıf uygulamalarına ilişkin öğretmen görüşleri: Nitel bir araştırma. *International Journal of Human Sciences, 11*(1), 1056-1076. [In Turkish]

Hanbaba, L., & Bektaş, M. (2007). The effects of the teaching by games method on achievement and attitudes in the social studies course. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi [Abant İzzet Baysal University Journal of the Faculty of Education], 12*(1). [In Turkish]

Kalaycı, Ş. (Ed.). (2005). *SPSS uygulamalı çok değişkenli istatistik teknikleri [SPSS applied multivariate statistical techniques].* Asil Yayın Dağıtım [Asil Broadcast Distribution]. [In Turkish]

Karataş, F. Ö., Cengiz, C., & Çalışkan, B. (2018). İşbirliğine dayalı ve çalışma yaprakları ile desteklenmiş öğrenme ortamında gerçekleştirilen öğretimin öğrencilerin akademik başarıları üzerine etkisi [The effect of instruction based on cooperative learning environment supported with worksheets on students' academic achivement]. *Araştırma ve Deneyim Dergisi [Journal of Research and Experience], 3*(1), 1-16. [In Turkish]

Karamustafaoğlu, O., & Kaya, M. (2017). Eğitsel oyunlarla "yansıma ve aynalar" konusunun öğretimi: Yansımalı koşu örneği [Teaching the subject of "reflection and mirrors" with educational games: Example of reflexive running]. *Journal of Inquiry Based Activities, 3*(2), 41-49. [In Turkish]

Kavasoğlu, B. E. (2010). *İlköğretim 6, 7 ve 8. sınıf matematik dersinde olasılık konusunun oyuna dayalı öğretiminin öğrenci başarısına etkisi* [*The effects of game based teaching of probability on the achievement of mathematics lessons students of 6th, 7th, 8th grades*]. [Unpublished master thesis]. Gazi University. [In Turkish]

Kaya, S., & Elgün, A. (2015). Eğitsel oyunlar ile desteklenmiş fen öğretiminin ilkokul öğrencilerinin akademik başarısına etkisi [The influence of instructional games in science teaching on primary students' achievement]. *Kastamonu Eğitim Dergisi [*Kastamonu Journal of Education]*, 23*(1), 329-342. [In Turkish]

Kaya, K. (2005). *Birleştirilmiş sınıflar ile bağımsız sınıflarda ilk okuma yazma öğretiminde karşılaşılan sorunların karşılaştırmalı incelemesi (Kayseri ili örneği)* [*A comparative research on the problems of teaching how to read and write in multigrade classes and independent classes*]. [Unpublished master thesis]. Kayseri Erciyes University. [In Turkish]

Kindon, S., & Elwood, S. (2009). Introduction: More than methods reflections on participatory action research in geographic teaching, learning and research*. Journal of Geography in Higher Education, 33*(1), 19-32.

Köksal, K. (2005). *Birleştirilmiş sınıflarda öğretim [Teaching in multigrade classes].* Pegem A Press. [In Turkish]

Little, A. W. (2001). Multigrade teaching: Towards an international research and policy agenda. *International Journal of Educational Development, 21,* 481-497.

Lunenberg, M. L., & Volman, M. (1999). Active learning: Views and actions of students and teachers in basic education. *Teaching and Teacher Education, 15*(4), 431-445.

Meşin, M. Z., Koçak, N., Koçak, A., & Şahin, M. (2019). 2007–2017 yılları arasında Türkiye'de gazlar konusunda kavram yanılgıları ile ilgili yapılan çalışmalar: Bir içerik analizi [Studies on misconceptions about gases conducted in Turkey between 2007-2017: A content analysis]. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi [Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education], 13*(2), 620-650. [In Turkish]

MEB (2018). Eğitim istatistikleri [Education statistics.] Ankara İl Milli Eğitim Müdürlüğü [Ankara Provincial Directorate of National Education]. https://ankara.meb. gov.tr/www/egitim-istatistikleri/icerik/24 [In Turkish]

Nakhleh, M. B., & Samarapungaven, A. (1999). Elementary school children's beliefs about matter. *Journal of Research in Science Teaching, 36*(7), 777-805.

Novick, S. V., & Nussbaum, J. (1981). Pupils' understanding of the particulate nature of matter: A cross-age study. *Science Education, 65*(2),187-196.

Oran, T. (2003). *Birleştirilmiş ve bağımsız sınıflarda öğrenim gören 5. sınıf öğrencilerinin sosyal bilgiler dersi bilişsel hedeflerine ulaşma düzeyleri [Levels of achievement of social studies course cognitive goals of 5th grade students studying in multigraded and independent classes]*. [Unpublished master thesis]. Atatürk University. [In Turkish]

Özmen, H., & Kenan, O. (2007). Determination of the Turkish primary students' views about the particulate nature of matter. *Asia-Pacific Forum on Science Learning and Teaching, 8*(1), 1-15.

Öztürk, H. İ. (2005). *Birleştirilmiş sınıflarda öğretim [Teaching in multigrade classrooms].* Lisans Press.

Öztürk, M., Akkan, Y., Yılmaz, G. K., & Kaplan, A. (2015). Birleştirilmiş sınıflı bir okulda drama yöntemiyle kesir öğretiminden yansımalar: Bayburt örneği [Reflections from fractions instructions with drama method in multi-grade school: A case of Bayburt]. *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi [Journal of Mustafa Kemal University Institute of Social Sciences], 12*(31), 371-394. [In Turkish]

Palavan, Ö., & Göçer, V. (2017). Sınıf öğretmenlerinin birleştirilmiş sınıflarda karşılaştıkları problemler (Malatya il örneği) [Problems faced by classroom teachers in multi-class classrooms (Malatya sample)]. *Kırıkkale Üniversitesi Sosyal Bilimler Dergisi [Kırıkkale University Journal of Social Sciences], 7*(2), 69-96. [In Turkish]

Sağ, R., Savaş, B., & Sezer, R. (2009). Burdur'daki birleştirilmiş sınıf öğretmenlerinin özellikleri, sorunları ve ihtiyaçları [Characteristics, problems and needs of multigrade class teachers in Burdur]. *İnönü Üniversitesi Eğitim Fakültesi Dergisi [Journal of İnönü University Faculty of Education], 1*, 37-56. [In Turkish]

Saraçoğlu, S., Böyük, U., & Tanık, N. (2012). Birleştirilmiş ve bağımsız sınıflarda öğrenim gören ilköğretim öğrencilerinin bilimsel süreç beceri düzeyleri [Science process skill levels of primary school students studying in multigrade and independent classes]. *Türk Fen Eğitimi Dergisi [Turkish Journal of Science Education], 9*(1), 83-100. [In Turkish]

Songur, A. (2006). *Harfli ifadeler ve denklemler konusunun oyun ve bulmacalarla öğrenilmesinin öğrencilerin matematik başarı düzeylerine etkisi [The effect of mathematics succes level of the students of subjects of the explanations with letter and equations learning with games and word puzzle].* [Unpublished master thesis]. Marmara University. [In Turkish]

Sınmaz, A. G. (2009). *Birleştirilmiş sınıf öğretmenlerinin yeni ilköğretim programının uygulamasına ilişkin görüşlerinin değerlendirilmesi (Düzce ili örneği) [Evaluation of multigrade classroom teachers' views on the implementation of the new primary education program: Düzce Sample].* [Unpublished master thesis]. Abant İzzet Baysal University [In Turkish].

Sumak, S. M., Sumak, A. E. G., & Gelebek, M. S. (2011). Birleştirilmiş sınıflarda karşılaşılan sorunlar ve öğretmenlerin bakış açısından olası çözüm önerileri (Kilis Örneği). *Gaziantep Üniversitesi Sosyal Bilimler Dergisi, 10*(3), 1221-1238. [In Turkish]

Şahin, Ç. (2007). *Birleştirilmiş sınıflarda öğretim [Teaching in multigrade classes].* Pegem A Press. [In Turkish]

Şevki-Yıldız, S. (2009). *2005 Hayat bilgisi dersi öğretim programının birleştirilmiş sınıflarda uygulanabilirliğinin öğretmen görüşlerine göre değerlendirilmesi (Nitel bir araştırma) [Evaluation of the applicability of the life studies course curriculum in multigrade classes according to the opinions of teachers (A qualitative study)].* [Unpublished master thesis]. Afyon Kocatepe University. [In Turkish]

Uçar, G. (1997). *Birleştirilmiş sınıflar fen bilgisi dersi ışık ünitesinde öğrenci başarısına öğrencilerin çalışma alışkanlıkları ve öğretmenlerin ders işleme yöntemlerinin etkisi* [The effect of students' study habits and teachers' teaching methods on student success in the multigraded classroom science lesson light unit]. [Unpublished master thesis]. Marmara University. [In Turkish]

Usta, N., Işık, A. D., Taş, F., Gülay, T., Şahan, G., Genç, S., …Küçük, K. (2018). Oyunlarla matematik öğretiminin ortaokul 7. sınıf öğrencilerinin matematik başarısına etkisi [The effect of teaching mathematics with games on the mathematics achievement of secondary school 7th grade students]. *İlköğretim Online [Elementary Education Online], 17*(4), 1972-1987. [In Turkish]

Uyanık, G., & Serin, M. K. (2016). Sınıf öğretmeni adaylarının bazı temel fen konularındaki kavram yanılgılarının belirlenmesi [Identification of primary school teacher candidates' misconceptions about some basic science subjects]. *Amasya Üniversitesi Eğitim Fakültesi Dergisi [Journal of Amasya University Faculty of Education], 5*(2), 510-538. [In Turkish]

Varan, S., & Sulak, S. E. (2018). İlkokul 4. sınıf öğrencilerinin zihinsel sözlüğünü geliştirmede eğitsel oyunların etkisi [The effect of educatıonal games on improvıng the mental lexicon of primary school 4th grade students]. *Elektronik Sosyal Bilimler Dergisi [Electronic Journal of Social Sciences], 17*(67), 1109-1119. [In Turkish]

Veenman, S. (1996). Effects of multigrade and multi-age classes reconsidered. *Review of Educational Research,* 66(3), 323- 340.

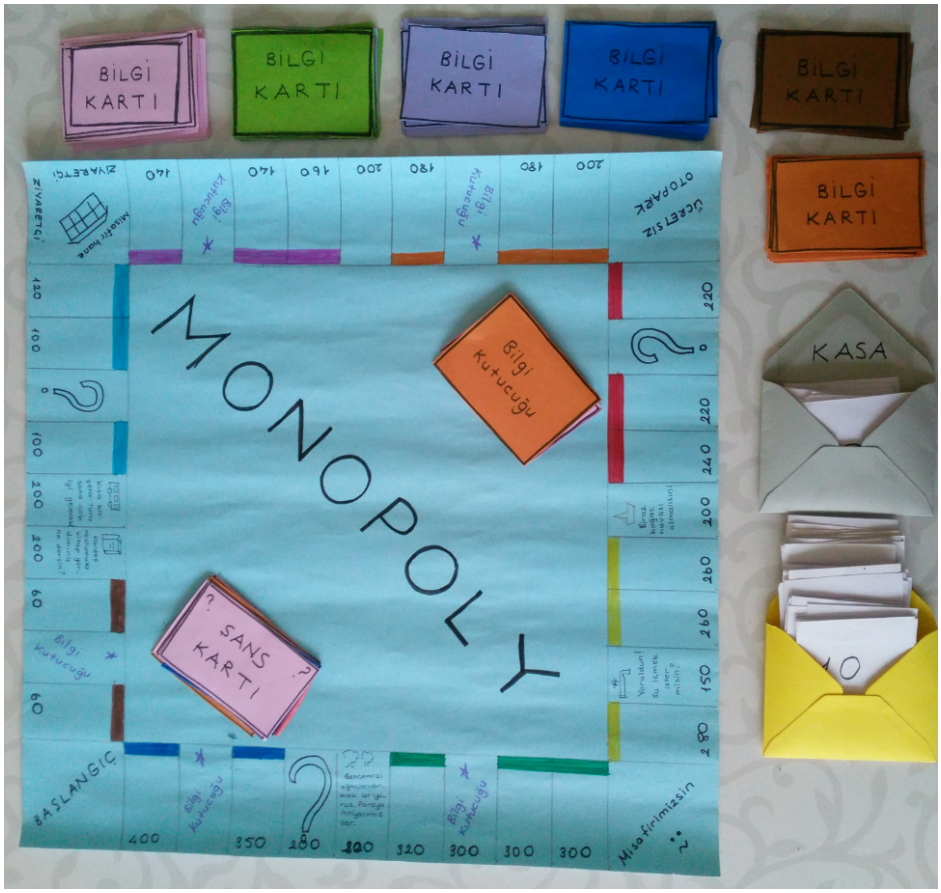
Yıldız, E., Ağgül, Ö., Çalıklar, Ş., & Şimşek, Ü. (2020). Eğitsel oyun ve işbirlikli öğrenmenin 6. Sınıf öğrencilerinin akademik başarılarına, sosyal becerilerine ve öğrenme motivasyonlarına etkisi [The effect of educational games and cooperative learning on students academic achievements, social skills and learning motivations]. *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi, 8*(6), 1703-1716. [In Turkish]

Yılmaz, A. H. (2014). *Türkçe dersi öğretim programının birleştirilmiş sınıflarda uygulanabilirliğinin öğretmen görüşlerine göre değerlendirilmesi [Assessment of applicability Turkish studies curriculum in multigrade classes according to teacher views*]. [Unpublished master thesis]. Afyon Kocatepe University. [In Turkish]

Yılmaz, M. (2011). *2005 sosyal bilgiler dersi öğretim programının birleştirilmiş sınıflarda uygulanabilirliğinin öğretmen görüşlerine göre değerlendirilmesi: Nitel bir araştırma [Assessment applicability of 2005 social studies curriculum in multigrade classes according to teacher views: A qualitative research].* [Unpublished master thesis]. Afyon Kocatepe University. [In Turkish]

Yıldırım, M. (2008). *Birleştirilmiş sınıflı ilköğretim okullarında ses temelli cümle öğretimi yöntemi ile ilk okuma yazma öğretimi sırasında karşılaşılan güçlükler [The fundamental difficulties encountered at the primary schools within the multigraded classes during the primary reading-writing teaching by the sound founded sentence tutoring Method].* [Unpublished master thesis]. Çukurova University. [In Turkish]

Appendix 1. Examples of Educational Games Used in Practice (Monopoly 3rd Grade)



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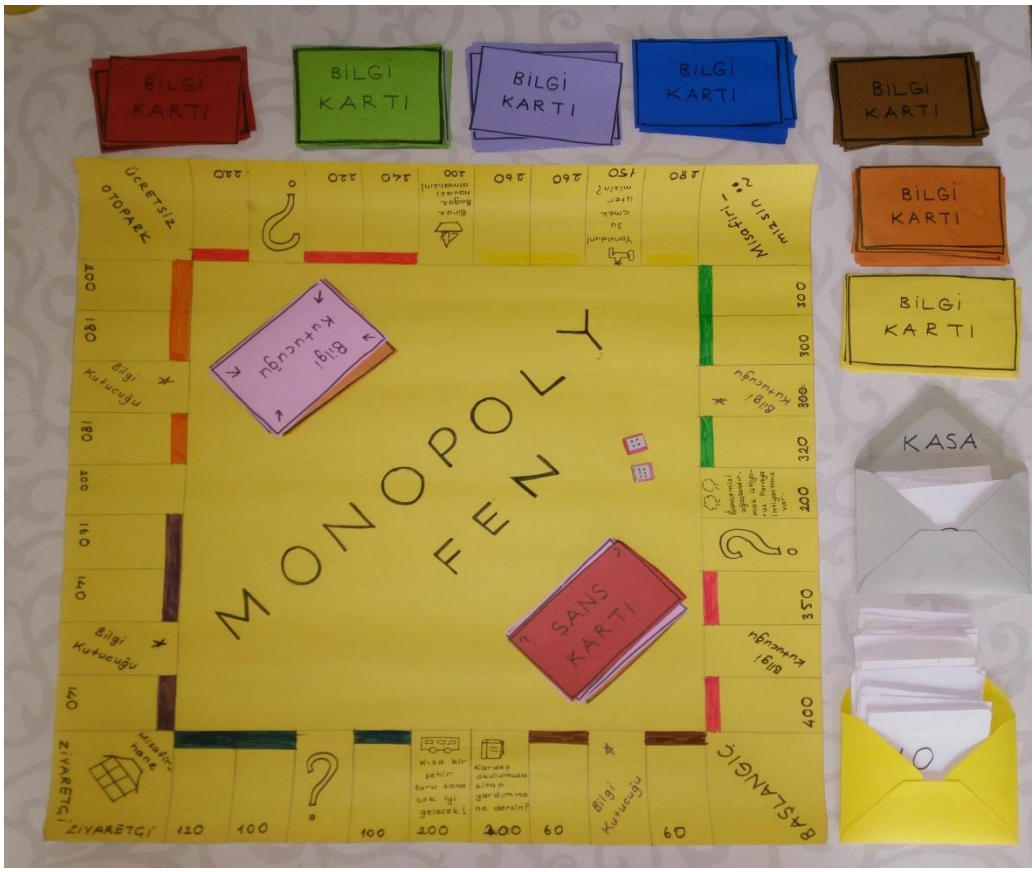
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MONOPOLY
FEN
Bilgi Kutucuğu
ŞANS KARTI
KASA
ÜCRETSİZ OTOPARK
Misafirin - misafir
Bilgi Kutucuğu
Bilgi Kutucuğu
Bilgi Kutucuğu
ZİYARETÇİ
BAŞLANGIÇ
Misafirhane
Kısa bir şehir turu sana çok iyi gelecek!
Kardeş dayanışma kitap yardımına ne dersin?
ZİYARETÇİ 120
100
100
200
200
60
60


MONOPOLY
FEN
ŞANS KARTI
BAŞLANGIÇ

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TOMBALA
Ayna
mont
odun
masa
limon
mermer
cam bardak
parfüm
plastik cetvel
oğaç kabuğu
pamuk
nane
ev terliği
cam
kurabiye
tahta
papatya
elma
sürahi
oyuncak ayıcık
çakıl taşı
fayans
ıslak mendil
gofret
portakal
kolonya
silgi
porselen tabak
Yastık
sünger
plastik cetvel
taş
ayna
cam şişe
gül
çikolata


TOMBALA
Ayna
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odun
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cam bardak
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plastik cetvel
oğaç kabuğu
pamuk
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ev terliği
cam
kurabiye
tahta
papatya
elma
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oyuncak ayıcık
çakıl taşı
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ıslak mendil
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portakal
kolonya
silgi
porselen tabak
Yastık
sünger
plastik cetvel
taş
ayna
cam şişe
gül
çikolata

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TOMBALA
plastik tabak
Suda batar
Mıknatısla çekilmez
Suyu emmez
sünger
Suyu emmez
Mıknatısla çekilir.
mıknatısla çekilmez
Suda yüzer
Suda yüzer
dikiş iğnesi
Mıknatısla çekilmez.
peçete
Suyu emmez.
dikiş iğnesi
mıknatısla çekilmez
Suda yüzer.
Tahta kalem
taş
Mıknatısla çekilmez
Suyu emmez
sünger
Suyu emmez
vida
Mıknatısla çekilmez
kağıt
Suda yüzer
çay kaşığı
mıknatısla çekilmez
Suyu emmez
kağıt havlu
Suyu emmez
demir çubuk
plastik cetvel
Suda yüzer
Suda yüzer
Suda batar
Suyu emmez
peçete
Suyu emmez
Mıknatısla çekilir
Mıknatısla çekilmez
Suda yüzer
cam bilye
Mıknatısla çekilmez
Suyu emmez
kumaş parçası
Suyu emmez
Mıknatısla çekilir
Kumaş parçası
Suda yüzer