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Examination of Problem Posing Abilities Using Computer Animations on Fractions in the 4th Grade Students*

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ABSTRACT

The purpose of this study is to determine the problem posing abilities of 4th grade students on fractions using computer animations. This work was conducted with twenty seven fourth grade students in a state school in Bingöl. As the data collection method problem posing data scale, semi-structured interview forms and some worksheets have been used. The study shows that computer animations help positively posing problems of students related to rational numbers. The students, who can not pose problems in "Right" category, make use of unit fraction and equal fractions and face the problems in the stage of create a problem. Also, students have diffucilty correlating between inputs and results. Students, who can pose problems in the "Right" category, can pose more complex and original rational problems and better understanding by using in rational operation such as addition, subtraction and modelling. Besides that, students expressed that they are willing to work with computers, especially in abstract subjects and computer animations help to improve the ability of problem solving.

Keywords: Animation, fourth grade primary school students, fractions, problem posing skills

Introduction

It is regarded that primary school students have more difficulty in comprehending mathematics courses in comparison to other classes. This difficulty results from the fact that the subjects in the mathematics curriculum are abstract for the students who are at the concrete operational stage, and the students cannot adapt themselves to the learning that they think they realise at school into their daily lives (Yıldız and Uyanık, 2004).

Especially, the subject of "fraction" which is included in the 4th-grade mathematics curriculum does not gain a place in students' daily lives and therefore students have difficulty in comprehending this subject (Albayrak, 2000). Students' being able to comprehend this subject entirely is possible with their facing various problem status and finding a solution for these problems (Ersoy and Ardahan, 2003). Besides, they need to be given an opportunity to pose problems that are similar to others.

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Posing a problem is approaching the problem-solving in another way, and posing a problem which includes the relationships in the problem that is solved refers that the relations in that problem are comprehended. In the students who succeed in posing a problem, the sympathy for mathematics course increases, fear towards the mathematics decreases and they do not overestimate the mathematical problems (Altun, 2012:102-103).

In the studies which were carried out with the Problem Posing Approach in mathematics teaching, it was concluded that this approach has a significant effect on increasing the ability of problem posing, mathematics teaching realized by problem posing approach affects the sympathy towards mathematics positively (Turhan, 2011), students' problem posing studies increase their success in problem-solving (Fidan, 2008; Şimşek, 2012); problem posing approach improves students' creativity, problem posing approach is more effective in increasing their academic success belonging to "Integral" theme than other teacher centred approaches (Akay, 2006).

Also, especially in the studies which have been carried out nowadays related to the achievement of "Problem Posing and Problem Solving in Fractions" which is included in primary school mathematics curriculum, it was determined that pre-service mathematics teachers do not focus on just one type of problem. They tend to pose all kinds of problems (Işık, Işık and Kar, 2011). Preservice elementary school teachers mostly pose the problems that they can solve with easy calculations. They can not pose the problems which also include different mathematical conceptions by adding new data to the open-ended status (Işık and Kar, 2012). Preservice mathematics teachers' ability to pose a problem related to the division of fractions is low; their ability to pose a problem in the division of fractions needs to be improved (Işık and Kar, 2012).

In a study that was carried out at the 7th grade, it was concluded that there are mistakes such as not being able to state fractional numbers with suitable units, fractions' being thought like natural numbers, not understanding the whole-part relationship that fractional numbers state. It was stated that the pre-service mathematics teachers have more difficulty in establishing the types of mistakes related to a contradiction in the unit and not establishing a whole-part relationship, in comparison to other types of mistakes (Işık, Kar, Işık and Güler, 2012). It was determined that most of the preservice mathematics teachers can write problem sentences including question root and related to their daily lives, they have more difficulty in posing a problem which requires subtraction compared to the addition of fractions, they have more difficulty in posing the problems which require multiplication than addition and subtraction with fractions, they make more mistakes in posing a problem related to multiplication with fractions including mixed fractions. They cannot establish a whole-part relationship in the problems that they pose related to the addition of fractions. They have unit contradictions, they assign natural numbers meaning to fractional numbers. They cannot reflect the operation of the question root, they give the answer to the posed problem sentence, they form the compound fractions with the statement of what percentage, they do not assign a value to the integral (Zehir, 2013).

A study was carried out by Cai and Hwang (2002) related to “Generalized and Generative Thinking in the US and Chinese Students’ Mathematical Problem Solving and Problem Posing”. This study investigated the US and Chinese 6th-grade students’ generalization skills in solving pattern based problems, their generative thinking in problem posing and the relationships between their performance on problem-solving and problem posing tasks. It was determined that Chinese students had higher success in problem-solving tasks than US students. It was thought that the reason for this difference was related to the students’ using different strategies.

In the study called as “The Use of Internet to Enhance the Mathematical Problem Posing Skills of Pre-service Teachers” which was carried out by Reda (2007), it was stated that the advent of the worldwide internet affected the education in many aspects regarding changing students’ learning and teaching ways. It was concluded that it is possible to change the beliefs of pre-service teachers in understanding the role of problem posing in mathematics education, and there are significant differences between the pre-service teachers who experienced the internet and those who did not, on behalf of those who experienced it.

Computer animations are the applications which gather students’ interests and increase the memorability and the effectiveness of learning. By this way, the number of the areas of learning with animations increase, and students become willing towards learning; students are enabled to enjoy the class (Gürbüz, 2007). Since reading, seeing and hearing are all involved in the animations learning occurs easily, and the information becomes permanent (Çelik, 2007; Gürbüz, 2008). Animations support different teaching strategies.

Based on this fact, via animation assisted problem posing activities students are expected to become more willing, enjoy the course, learn more easily, gain permanent knowledge, and succeed in problem solving and problem posing.

Rosli, Golsby and Capraro (2013) developed a performance rubric and stated that this rubric is an appropriate tool to examine students’ mathematical problem solving and problem posing skills. The problem-posing activities assisted with the animations that were designed for this study will be an assessment tool for students and teachers. Students will be more eager, and like the class, they will gain more permanent knowledge, they will improve their creativity by being supported with visual materials, and they will be successful in problem-solving and problem posing. These activities will help the teachers who want to teach with different strategies; the educational environments will be enriched with dynamic activities. It will guide the researchers who carry out the similar studies, and it will give the opinion as upgradeable examples. It is clear in the literature review that there is not any study in literature related to the problem solving and problem posing in fraction studies of the 4th-grade primary school students who play active roles in the educational process. This study has a vital importance regarding filling this deficiency.

Method

This study is a qualitative study and action research method was used in this study (Çepni, 2005:31). During this method, while gathering qualitative data is sufficient for examining some educational practices and for improving the practices, in some other situations using quantitative methods is beneficial (Glanz, 1999'dan cited by Çepni, 2005:31). Besides, since in the study that was carried out by teachers the sample group was small, it was aimed at improving the existing activities not generalizing the results, and it gave an opportunity to the researcher to perform the practice in his/her classroom as a teacher, this method was established as appropriate.

Study Group

The population consists of 4th-grade primary school students in Solhan district, in Bingöl province. The sample of the study consists of 27 students who study at 4/C in Martyr district governor Ersin Ateş Primary School in Solhan district, Bingöl province, in the 2015-2016 academic year. Since designed activities are suitable for this class both an application and as a subject, 4th-grade students were determined with random selection.

Data Collection

As a data collection tool, Problem Posing Data Scale (Güveli, 2015), Semi-structured Interview Form and problem posing worksheets consisting of 4 scenarios were used.

Problem Posing Data Scale

In the study, Problem Posing Data Scale was used with the aim of determining students' problem posing skills. Problem Posing Criteria which was developed by Güveli (2015), were benefitted in the study in to have certain criteria for the problem-posing process, to ensure the validity and the reliability of the study, to make researcher objective. Problem Posing Data Scale is presented below (Table 1).

Table 1. Problem Posing Data Scale

Classification	Criteria	Frequency(percentage)	Examples
True	Logical coherent Relevant In the type of intended problem No incoherency No incomplete sentence Intelligible No unnecessary data repetition No unnecessary sentence		
Partly True	Logical incoherent Related to a different subject Incoherent Unnecessary data Unnecessary sentence		
False	Not relevant Incomplete data Not in the intended type (common-verbal problem) Not intelligible		
Unsolvable			
No effort			

For these criteria which were developed by Güveli (2015), one expert stated his/her opinion, and its pilot study was applied to a class of 28. The problems which were posed by the students on the four designed scenarios were evaluated according to these criteria, and one table was created for each scenario, and the students' problems which represent the criteria were presented as an example.

Semi-structured interview forms

In semi-structured interview form technique, the researcher prepared the interview questions in advance; however, interviewees are provided with partial flexibility, and it enables the formed questions to be reorganized and discussed. In such kind of interviews, the individuals who are under investigation also have control over the research. Because of flexibility, this situation can be faced in qualitative research (Ekiz, 2013:63).

Semi-structured interviews combine both fixed alternative answering and deep investigation into the related area. This interview has advantages such as ease of analysis, giving an opportunity to the interviewee for self-expression, provide deep information when necessary (Büyüköztürk, et al.:152).

In this study, the data were collected by using semi-structured interview form, and the obtained data were made meaningful for the readers with the help of content analysis. After the researcher did the literature review, semi-structured interview form was designed. The questions in the designed semi-structured interview form were applied to a group of 28 students as a pilot study, after the arrangements which were seen as necessary by one Turkish teacher and one expert. The pilot study shows that semi-structured interview form is sufficient for the students, and the designed semi-structured interview form was applied to the selected sample. The interview questions in this study are as follows:

1-To you, what kind of differences are there between these lessons which are taught with animations and traditional lessons?

2-To you, what kind of benefits do these animations have for you as students?

3-Would you like to learn a lesson by this way? Why?

4-To you, in which other lessons can your teachers make you watch animations? Why?

Worksheets

Worksheets for each formed scenario were handed out to students. The data that were gathered from these worksheets were arranged for the readers and made meaningful. Within this regard, problem posing stages were established by being inspired from the problem-solving stages, which consist of four stages defined by Polya (Fidan, 2008; Güveli, 2015), problem posing skills were examined, and these skills were evaluated with Problem Posing Data Scale. The content of these stages was identified below. The stages which were adopted in the problem-posing study are like these:

Making a plan: This stage is the first stage of problem posing. It is the stage at which the relationship between the given, the intended and the unknown is determined. At this stage, students make plans intended to the problem that they will pose regarding the scenarios they watched.

Posing problem: At this stage, the statements which were designed at the planning stage, first stage, were turned into problem statements. At this stage, the relationship between the given and the unknown is established, and the problem sentence is written.

At this stage, students write problem sentences related to the unknowns based on what is given to them.

Solving problem: The solution of the problem sentence which is written at the second stage involves at this stage. At this stage, the operations to find out the unknowns are done based on what is given, and we aim at concluding. At this stage, students solve the problem that they have posted.

Organizing and defining the problem: At this stage, consistency between the problem sentence and problem-solving is considered, and existing deficiencies and mistakes are determined, and feedback is given related to the problem sentence that is written and the solutions. Problem sentence is corrected and rewritten. At this stage, students rewrite the problem sentence by correcting the factors such as mistakes, deficiencies and incoherency that they identify.

Implementation Process

During the implementation process of the research, the following steps were followed.

1-Implementation was administrated in 2015-2016 academic year, spring term, with 27 4^{th} grade students at Martyr District Governor Ersin Ateş Primary School, in Solhan district, Bingöl province, and it lasted 12 weeks (one week for book plan, two weeks for the pilot study, nine weeks for the implementation with computer animations)

2-According to the course book, the fractions subject was taught for one week time by preparing teaching plan related to the gains which are “determine a quantity’s amount as much as a proper fraction” two hours, “solve and pose the problems which require addition and subtraction operations” three hours.

3-Later on, four scenarios related to the problems in fractions subject were prepared and turned into animations. The worksheets that students will apply, and semi-structured interview forms that will identify the students’ opinions on that subject were prepared, and a pilot study was carried out for two weeks’ time.

4-The deficiencies determined in the pilot study were made up and teaching plans related to the gains “determine a quantity’s amount as much as a proper fraction”, and “solve and pose the problems which require addition and subtraction operations” which will involve 45-course hours were prepared. And fractions subject was taught during nine weeks.

5-In 4/C class in which the main implementation will be carried out, they studied for about five-course hours on writing problem sentences in fractions subject according to the problem-posing stages. Within this period, individual studies were done with the students who did not understand the subject.

6-The data obtained from the students' worksheets and semi-structured interviews were organised using Problem Posing Data Scale and content analysis. As a result of the collected data, various findings were obtained, and some suggestions were given.

Scenarios and Animations

In the 4th-grade primary school curriculum, four fraction problem posing scenarios related to the problem-posing gains involving in the fractions subject were built (Figure 1, Figure 2, Figure 3, and Figure 4). These built scenarios were organised by taking one mathematics education expert's opinion. Organized scenarios were turned into animations with Scratch program. Example scenarios which students will think over and pose and solve the problem are presented.

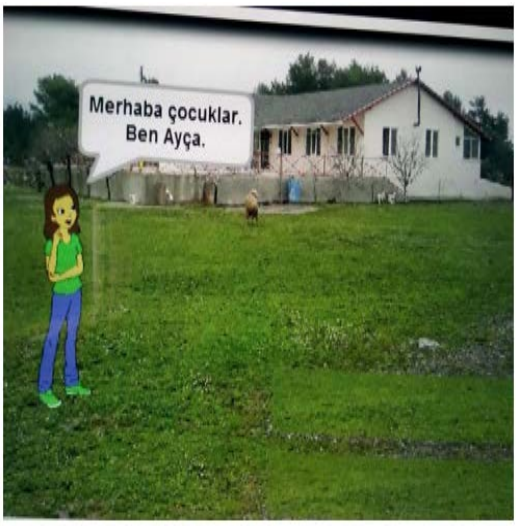

Figure1. Sample animation for scenario 1

Figure 2.Sample animation for scenario 2

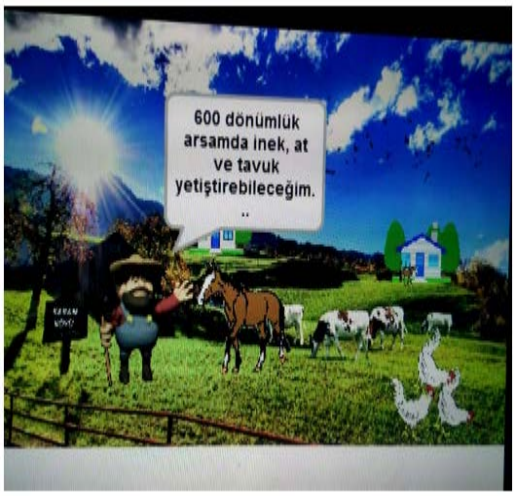

Figure 3. Sample animation for scenario 3

Figure 4. Sample animation for Scenario 4

Data Analysis

With the aim of determining 4th-grade primary school students' problem posing skills on fractions subject using computer animations, the frequency and percentage of the problems that they posed were regarded. Four implementations were administrated related to 4 scenarios.

The results of this implementation were categorised as "true", "partly true", "false", "unsolvable", and "no effort", and they were evaluated. As a result of this evaluation, "true" criterion was regarded as "good at problem-solving", "partly true" criterion was regarded as "have a moderate problem posing skill", "false", "unsolvable" and "no effort" were regarded as "weak problem posing skill". For each implementation, Problem Posing Data Scale was used, and four tables were designed. In this table, the percentages of the students' meeting these criteria were calculated, and the samples chosen from the students' posing problems related to the criteria were involved. Content analysis was applied to the data obtained from the semi-structured interview form by one expert and one researcher (Yıldırım and Şimşek, 2013:259). The data were collected via face to face interviews, and the interviews were recorded both audial and written. The recordings were transcribed and analysed by one expert and one researcher. From the formed codes, following formula was used to conclude reliability (Miles and Hubarman, 1994).

Agreement / (agreement +disagreement) = 0.80 was found.

The codes about which researcher and expert disagreed were worked on, and common codes were formed. The transcript of the recorded interviews was shown to the students to establish validity. Missing parts were reviewed, and the mistakes were corrected (Silvermen, 1993). The students in the research group are those who are at the medium socio-economic level regarding the country's conditions, who have the common features that they should have, and who are at the same age group, in the same environment and taught by the same teacher. During the interviews, they had a comfortable environment, and it was observed that they are sincere and honest. Although it is not imperative to generalise the results and conclusions of the study, they can be generalised to an implementation area which is suitable for this definition.

Findings

This part includes the data obtained from the data collection tools, the tables that were formed as a result of the data analysis and the results of the tables. Before the implementation phase of the research, four scenarios related to the fractions subject were created, and these scenarios were turned into animations. Practices had four-phase worksheets (planning the problem, posing the problem, solving the problem and organising and defining the problem) which were given to the students and the findings which were obtained by using Problem Posing Data Scale were presented in the following tables.

Scenario 1: “Miss Ayça is the youngest daughter of the Çiftçi Family and is responsible for the gardening. She knows that the family members like daisy, tulip, rose and jacinth. Miss Ayça who cleans the garden as soon as she goes to the village, starts thinking about how she should use 120 square metres area; however, she cannot find a solution. Come on children, let’s help Miss Ayça and pose fraction problems about which flower she should plant and how much of the area she should use, and let’s solve it together”. The findings related to this scenario are presented in Table 2.

Table 2. Students’ problem posing skills related to the first scenario (narrative)

Classification	Criteria	Frequency(%)	Examples
True	Logically coherent Relevant In the type of intended problem No incoherency No incomplete sentence Intelligible No unnecessary data repetition No unnecessary sentence	13(%48,1)	Miss Ayça will arrange the garden as soon as she goes to the village. Since Miss Ayça knows that the family members like daisy, tulip, rose and jacinth, she will plant tulip in the half of the 3 times of (1/5) a fifth of the 120 square meters area, rose in the 2/4 of the rest of the area, daisy in the 1/3 of the rest of the area, jacinth in the 2/3 of the area. In this case, what fraction is more than the greatest area where she will plant jacinth?
			Miss Ayça will plant roses in the ¼ of the 120 square metres area, tulip in the 5/1 of the area, daisy in the 1/6 of the area and jacinth in the ¼ of the area. What number is the ten more and 30 less than the rest number?
Partly true	Logically incoherent	1(%3,7)	Miss Ayça will plant daisy in the ½ of the 120 square metres area, rose in the ½ of the area, jacinth in the ½ of the area, and tulip in the rest of the area. Then, in how many square metres did Miss Ayça plant tulips?
	Related to a different subject	-------	------
	Incoherency	3(%11,1)	Miss Ayça planted daisy in the 1/6 of the 120 square metres area, rose in the 1/5 of the area, tulip in the 1/8 of the area, and jacinth in the 1/4 of the area. How many square metres were left?
	Unnecessary data	6(%22,2)	Miss Ayça will plant daisy, tulip rose and jacinth in her 120 square metres garden. Miss Ayça will plant daisy in the ¼ of her garden, tulip in the ¼ of the garden, rose in the ¼ of the garden and jacinth in the ¼ of the garden. Then, how many square metres is the area where she planted tulip and jacinth?
	Unnecessary sentence	2(%7,4)	Miss Ayça will plant daisy, rose, jacinth and tulip in a field. Miss Ayçawill plant daisy in the ¼ of the field, rose in the ¼ of the field. She will plant jacinth in the 1/3 of the rest of the field. She will plant tulip in the rest of the field. Then, how many square metres of the field did she plant tulip?

Table 2. Continued

False	Not relevant	-------	-------
	Missing Data	1(%3,7)	Miss Ayça is the youngest daughter of Çiftçi family. She has got 120 square metres farmland. She will plant tulip in it's 1/5, daisy in its ¼, and jacinth in its 1/10. How many square metres of the garden will she plant a rose?
	Not in the intended type (common-verbal problem)	-------	-------
	Not intelligible	-------	-------
Unsolvable		1(%3,7)	Miss Ayça will plant tulip in the ½ of the 120 square metres field, jacinth in the ½ of the field, rose in 30 less than the rest of the field. Then, how many square metres is a total of the field that she will plant daisy and rose?

As can be seen in the table, since 13 students (%48,1) met all the criteria and posed true problems, they were determined as “having a good problem posing skills”. 12 students (%44,4) did not meet some of the criteria and posed partly true problems. So they were determined as “having a moderate problem posing skills”. 1 student (%3,7) posed a false problem, so determined as “having a low problem posing skill”. 1 student (%3,7) posed an unsolvable problem.

Scenario 2: “Mr Mustafa is the owner of a carpenter shop by the sea. The orders in the carpenter shop have increased very much this month. Within this month 360 tables have been manufactured in the workshop. Mr Mustafa knows that the number of the tables which have been manufactured is not sufficient for all the orders. Therefore, he is doubtful about how much of the orders given by Child Furniture, Home Furniture, and Table Furniture he can deliver. Because, unless he can deliver any order, joint ventures will be ended. Come on children, let’s help Mr Mustafa and pose and solve problems about how many tables Mr Mustafa can send to which partner”. The obtained findings related to this scenario are presented in Table 3.

Table 3. Students’ problem posing skills related to the second scenario (narration)

Classification	Criteria	Frequency (%)	Examples
True	Logically coherent Relevant In the type of intended problem No incoherency	14(%51,8)	Mr Mustafa sends 2/9 of the 360 tables to Child Furniture, sends ½ of the half of the rest to Home Furniture, and the rest of them to Table Furniture. Then, what fraction are the three times of the total number of the tables that Mr Mustafa sent to Masa Furniture and Child Furniture?

	No incomplete sentence Intelligible No unnecessary data repetition No unnecessary sentence		Mr Mustafa will send two times of the ¼ of the 360 tables to Table Furniture and will send the rest to Home Furniture. Then, what is less than the number of the tables that he sent to Child and Table Furniture?

Table 3. Continued

Partly true	Logically incoherent	---	-------
	Related to another topic	---	-------
	Incoherent	5(%18,6)	Mr Mustafa will send 1/20 of the 360 tables that he has manufactured to Child Furniture, ¼ of them to Home Furniture and 1/30 of them to Table Furniture. Mr Mustafa distributes the rest of the tables among his 20 employees. How many tables does an employee take?
	Unnecessary data	6(%22,2)	Mr Mustafa sent 1/30 of the 360 tables manufactured by his employees to Child Furniture, 1/60 of them to Home furniture, and 1/10 of them to Table Furniture. In this case, what fraction is the five more of the half of tables sent to Home furniture and Child Furniture?
	Unnecessary sentence	---	-------
False	Not relevant	---	-------
	Missing data	2(%7,4)	Mr Mustafa will send 1/10 of the 360 manufactured tables to Child Furniture at first, 1/10 of them to Home Furniture and 1/10 of them to Table Furniture. Accordingly, how many tables will he grant to Turkish Education Foundation?
	Not in the intended type (common – verbal problem)	---	-------
	Not intelligible	---	-------
Unsolvable		---	-------

As can be seen in the table, 14 students (%51, 8) met all the criteria and posed true problems and defined as “having a good problem posing skills”. 11 students (%40,8) did not meet some of the criteria and posed partly true problems so defined as “having a moderate problem posing skills”; and two students (%7,4) posed false problems and defined as “having a low problem posing skills”.

Scenario 3: “Grandpa Furkan is a darling 70 years old grandpa who lives in Karan village, in Solhan district, Bingöl province. Grandpa Furkan wants to build a farm in which he can raise cows, horse and chicken in his land. Grandpa Furkan cannot decide on which animal he should raise in how much of the 600 square meters land, and if his indecision continues he cannot benefit from his land this year. Come on children, let’s help grandpa Furkan and pose and solve fraction problems about how much of his land

he should separate for which animal". The findings obtained about this scenario are presented in Table 4.

Table 4. Students' problem posing skills related to the third scenario (narration)

Classification	Criteria	Frequency (%)	Examples
True	Logically coherent Relevant In the type of intended problem No incoherency No incomplete sentence Intelligible No unnecessary data repetition No unnecessary sentence	16(%59,3)	Grandpa Furkan is a darling grandfather who lives in Karan Village. He will raise chicken in 1/5 of his 600 square meters land, a cow in 2/6 of this land and horse in 2/7 of the left. He will make a worker plough the rest of it by paying 100TL per 1000 square meters. In this case, how much does Grandpa Furkan pay to the worker?
Partly true	Logically incoherent	2(%7,4)	Grandpa Furkan will raise cow, horse and chicken on his farm. Grandpa Furkan will raise horse in 1/10 of his 600 square meters land, a cow in 1/15 of this land, and chicken in 1/20 of this land. Grandpa Furkan will sell 40 more of 2 times of the left part to Mr Ömer. How many square meters land did Grandpa Furkan sell to Mr Ömer?
	Related to different subject	------	-------
	Incoherent	5(%18,5)	Grandpa Furkan will build a farm on his 600 square metres land. He will separate 16/40 of this land to raise chicken, 20/25 of the land to raise horse and the remaining part to raise a cow. Regarding the fact that he fitted two chickens, one horse and one cow into every 1000 square meters, how much does he earn if he sells each chicken for 30TL, each horse for 1000 TL, and each cow for 1500TL?
	Unnecessary Data	3(%11,1)	Grandpa Furkan will separate 1/60 of his 6000 square meters land for cows, 1/30 of it for chickens and 1/50 of it for horses. In this case, what fraction are two times of 30 more of the land that Grandpa Furkan separated for chicken and horses?
	Unnecessary sentence	------	-------
False	Not relevant	------	-------
	Missing data	1(%3,7)	Grandpa Furkan is a 70 years old darling grandfather. Grandpa Furkan separated ¼ of his 6000 square meters land for horses, 1/5 of it for cows, and its 1/10 for chickens. Then, how many square meters land did grandpa Furkan give to Grandpa Recep?
	Not in the intended type (common-verbal problem)	-----	-------
	Not intelligible	------	-------
Unsolvable		------	-------

As can be seen in the table, 16 students (%59,3) met all the criteria and posed true problems, so they were determined as “having good problem posing skills”. 10 students met some of the criteria and posed partly true problems so that they were determined as “having a moderate problem posing skills”. And one student (%3,7) posed a false problem and determined as “having a low level of problem posing skills.

Scenario 4: “Mr Hamza is the headman of Kesir Village. Only means of living in the village they live in is a fishery. By fishing families make a living, he does the necessary retrofits in the village, and a sum of money is laid aside to be used for organisations such as engagement, wedding ceremony, and seeing soldiers off. The people of the Kesir Village have earned 6000TL from the fishery. However, but Mr Hamza cannot decide on how much of this money he should allocate for a living, for retrofits, and for saving. If this indecision continues, the disturbance will rise in the village. Come on children, if you were in Mr Hamza’ shoes, what kind of planning would you make? Now- let’s pose and solve the fraction problems”. The findings related to this scenario are presented in Table 5.

Table 5. Students’ problem posing skills related to the fourth scenario (narration)

Classification	Criteria	Frequency(%)	Examples
True	Logically coherent Relevant In the type of intended problem No incoherency No incomplete sentence Intelligible No unnecessary data repetition No unnecessary sentence	14 (%51,8)	Mr Hamza will allocate 1/5 of the 6000TL that he has for living expenses, 2/4 of the remaining money for retrofits, and half of the left money for saving. Mr Hamza will divide the left money equally among three families. How much money comes to each family? Mr Hamza has allocated ¼ of 6000TL for living expenses, its 1/5 for retrofits, and its 1/6 for saving. What fraction is five more of 3 times of ½ of the total money that he allocated for living, retrofit and saving?
Partly true	Logically incoherent	-------	-------
	Related to a different subject	-------	-------
	Incoherent	4(%14,8)	Mr Hamza is the headman of the Kesir Village. He allocates 1/6 of 6000TL that he earns for their living expenses, half of the 1/4 of the money for retrofits and the left for saving. He saves to buy a land with that money. If the land costs 10,000TL, how much does Mr Hamza need?
	Unnecessary data	7(%26)	Mr Hamza will allocate ½ of 6000TL that comes from the fishery, its ¼ for retrofits, and its ¼ for saving. Accordingly, How much did Mr Hamza allocate for retrofits?
	Unnecessary sentence	-------	-------

Table 5. Continued

False	Not relevant	-------	-------
	Missing data	-------	-------
	Not in the intended type (common- verbal problem	-------	-------
	Not intelligible	2(%7,4)	Mr Hamza allocated 1/6 of 6000TL for living expenses, its 1/6 for retrofits and its 1/6 for saving. How much did Mr Hamza allocate?
Unsolvable	------	-----	---------

As can be seen in the table, since 14 students (%51,8) met all the criteria and posed true problems, they were determined as “having a good problem posing skills”. Since 11 students (%40,8) did not meet some of the criteria and posed partly true problems, they were determined as “having moderate problem-solving skills”, and since two students (%7,4) posed false problems, they were determined as “having a low problem posing skills.

Table 6 presents the findings related to “To you, what kind of differences are there between the courses taught with these animations and the courses taught in classical ways?” question which is involved in the semi-structured interview form.

Table 6. Findings related to the differences between the courses taught with animations and the courses taught classically

Category	**Code**	**f**
Differences	Easier Learning	6
	More Beneficial	6
	Enjoyable	4
	Interesting	3
	Visualization	3
	Being Visual-Audial	3
	Envisioning	2
	Reinforcement	1
	Improving Visual Intelligence	1
Advantages		
Advantages of Learning	It establishes meaningful learning	5
	It appeals to more than one senses	4
	It makes difficult subjects easier	2
Advantages of Skills	It improves Reading Comprehension Skills	1
	It improves visual intelligence	1
	It improves creativity	1
Advantages of Motivation	It increases interest	1
	It gives practicality	1
Advantages of Usefulness	Its being used in all lessons	1
	It enables repetition	1

According to most of the students, the differences between the courses taught with animations and classical courses taught in the class are making learning and understanding the subject easy, providing more advantages (n=6).

Some of the students state that the difference between the courses taught with animations and the courses taught classically results from its being enjoyable (n=4). Some students stated that the difference between the courses taught with animations and the courses taught classically is based on its being interesting, visualization, and its being visual-audial (n=3). Some other students express that the difference between the courses taught with animations and the courses taught classically is animations envisioning the subject (n=2). One of the students states that the courses taught with animations reinforce the subject and improve the visual intelligence (n=1).

Most of the students state that the courses taught with animations ensure meaningful learning compared to classical courses taught in the classroom (n=5).

Some of the students express that the courses taught with animations are useful regarding appealing more than one sense (n=4). Some students indicate that the courses taught with animations make difficult subjects easier compared to classical courses taught in the classroom (n=2). One of the students states that the courses taught with animations are more effective than classical courses taught in classroom in terms of improving reading comprehension skills, visual intelligence, being able to be used in all courses, increasing students' interest, giving students practicality, improving students' creativity and providing students to review the subject (n=1). Some of the student opinions related to these codes are presented below:

"Classical courses taught in the classroom are both difficult and easy, but the courses taught with animations are a bit easier". (S1)

"The courses taught with animations are more interesting compared to the classical courses taught in the classroom. Students are interested in courses with animations more than the classical courses taught in the classroom. Animation helps students to visualise the text or the questions in their minds. Since in classical courses students content themselves with just listening, they are not interested in classical courses much." (S3)

"I think, this courses taught with animations are different from classical courses taught in the classroom. These animations help people to improve their visual intelligence and pose problems with visuals. These animations are very different from typical and classical courses. There are subjects which are taught typically and which are taught only with books in classical courses; however, there are more interesting and enjoyable things in animations." (S5)

"Although both are good, comprehension is easier when the animation is done. I used to calculate while I was thinking about the places of the numerator and denominator. Now, I calculate it mentally." (S7)

“We read and understand better. It is visualised, so we pose and solve problems more easily. This situation is necessary for us to read better and improve understanding, and we have a better education.” (S8)

“In animations, we can do it both visual and audial. But in other courses, the subject is not taught with visuals (pictures).” (S9)

“With animations, we understand better than we do in classical courses. We learn the lesson more comfortably.” (S11)

Table 7 presents students’ answers related to the question “To you, what kind of benefits may these animations have for you as students?” included in the semi-structured interview form.

Table7. The findings that animations provide for students

Category	Code	f
Benefits of the animations for students	Better Understanding	8
	Problem Posing	5
	Useful	4
	Envisioning	3
	Thinking Ability	2
	Visualization	2
	Improving visual intelligence	1
	Contribution to Courses	1
	Association	1
	Enjoyable	1
It's effect on teaching the lesson		
	Making the Subject Understandable	9
	Saving Time	6
	Gaining New Skills	4
	Increasing the Participation and Interest in lesson	4

According to most of the students, the benefit that these animations provide for students is its enabling students to understand the subject better (n=8). Some of the students state that the benefit of these animations that they provide for students is its enabling them to pose problems (n=5). Some students express that the benefit of these animations is its being used for courses (n=4). Some students imply that the benefit of the animations is envisioning the problems in students’ minds (n=3). Some of the students indicate that these animations’ benefit which they provide for students is improving students thinking ability and visualising the subject (n=2). One of the students states that these animations’ benefit for students is improving the visual intelligence, contributing to the courses, association with the courses, and making courses enjoyable (n=1).

Most students express that the animations contribute to the courses to be understandable (n=9). Some students stated that these animations save time to complete the subject in time (n=6). Some of the students indicate that animations enable students to gain some abilities such as thinking ability and contribute to the teaching the lesson by

increasing the students' participation and interest (n=4). Some student opinions related to these codes are presented below:

"Animations provide students to comprehend the subject and learn it better by envisioning it. We can understand the content of the text by thinking thoroughly about the subject, and we can do what is expected of us in a better way." (S3)

"These animations can be useful for us to improve our visual intelligence, posing a problem with visuals, and posing problems. Besides, it increases the connection between us and lessons by helping us to learn the lesson more enjoyable." (S4)

"We used to have difficulty in posing rational problems; however, thanks to these animations we have no difficulty in posing better problems cleverly." (Ö12)

"Now, we can pose fraction problems and pose them better. We couldn't pose and solve the problems before, but thanks to these animations, now we can pose and solve problems. It helps us very much." (S15)

"Animations enable us to understand better in our minds. It has helped us more especially in envisioning them in our minds." (S16)

"I think these animations have such benefits for us: With these animations, we understand more and learn to pose more problems. Maybe, we can pose problems in 10 minutes." (S17)

Table 8 presents the findings related to students' answers that they gave to the question "Would you like to learn the lesson by this way? Why?" including in the semi-structured interview form.

Table 8. Findings related to the eagerness to learn the lesson with animations

Category	Code	f
The Reasons Why Students Want to Learn the Lesson with Animations	Understand More Easily	8
	Useful	5
	Enjoyable	4
	Enabling Problem Posing	2
	Increasing the Participation in Lesson	1
	Saving Time	1
	Interesting	1
	Envisioning	1
The Reasons Why Students do not Want to Learn Lesson with Animations	Not Being Suitable for All Subjects	1
	Waste of Time	1

It implies that most of the students think that enabling students to understand the subject better is among the reasons of students' eagerness to learn the lesson with animations (n=8). Some of the students state that animations' being enjoyable is among the reasons of their eagerness to learn the lesson with animations (n=4). Some students express that the reason for their eagerness to learn the lesson with animations is it's enabling them to pose problems (n=2). One of the students lists the reasons of students' being eager to learn with animations as being interesting, giving the opportunity to

envision the problem in their minds, increasing the participation in the lesson, and saving time (n=1). Only one student states that animations are not suitable for all the subjects and they cause waste of time.

Some student opinions about these codes are presented below:

“I would like to watch a lesson in this way. Because it makes me comprehend the lesson more easily. Besides, I would like to learn the lesson by this way since animations contribute to people much more in the educational area.” (S3)

“Yes. I would like. Because it is enjoyable.” (S4)

“Yes. The lessons can be more interesting by this way. Besides, it can be helpful to learn in different ways and with different methods; and understand the lesson in different ways and with different methods.” (S5)

“Yes. Because it is very enjoyable.” (S6)

“No. Because if we always watch animations, we cannot understand all the subjects well and it can hinder our courses. In the lessons in which we fall behind, we may get low points.” (S7)

“Yes. Because ıt has more advantages that ordinary courses and we learn in a better way and we learn much.” (S8)

“Yes. Because it makes us understand better and envision it.” (S9)

“I would like to learn the lesson by this way; because I learn the fractions by this way when I don’t understand them.” (S11)

“Yes. Because it is enjoyable to learn the lesson on the smart board and I want to participate more.” (S12)

Table 9 presents the students’ answers related to the question “To you, in which other courses can your teachers make you watch animations? Why? İncluding in semi-structured interview form.

Table 9. Findings related to the courses in which animations will be watched

Category	Code	f
Various Lessons in which Animations can be used	Science	8
	Social Studies	7
	Turkish	4
	All lessons	2
	English	1
	The lessons that we don’t understand	1
Reasons		
	Better Understanding	4
	Subjects’ being suitable for animations	4
	Envisioning	2
	Problem Posing	2
	Useful	2
	Memorability	1
	Enjoyable	1
	Visualization	1
	Important	1

Most students stated that besides Mathematics, Science is the lesson in which animations can be watched (n=8). Some students imply that Social Studies is the lesson in which animations can be watched beside Mathematics (n=7). A certain number of the students express that Turkish is the lesson in which animations can be watched apart from Mathematics (n=4). Some students stated that it is appropriate to watch animations in all lessons except for Mathematics (n=2). One student expresses that animations can be watched in English lesson and in the lessons that they do not understand (n=1).

Most students think that providing a better understanding of the subject and the subjects' being suitable for animations are among the reasons for teaching the lessons with animations (n=4). Some of the students state that envisioning the subject, enabling to pose the problem, being useful is among the reasons of teaching the lessons with animations (n=2). One of the students list the reasons for teaching lessons with animations as animations' enabling memorability, being fun, visualising the subject, being important (n=1). Some student opinions related to these codes are presented below:

"Our teacher can make us watch Turkish lesson with animations. Because we can envision the texts in Turkish lesson and we can do it better. Watching the wars with animations in Social Studies lesson can be more beneficial for us."(S3)

"In Science lesson, our teacher can make us watch animations because they can be helpful in skeleton and muscle health system subject. Also, in Social Studies lesson, animations on National Struggle Period can be used." (S4)

"I think in every lesson they can be watched. Because problems can be posed with every lesson." (S5)

"They can be watched in all lessons because all lessons are vital for us. These lessons not only serve us now but also they will serve us in other times." (S7)

"Maybe in English because it can enable us to understand the words better. I can understand the words since they enable us to envision." (S9)

"In Social Studies lesson. Because there are some subjects to be taught with a smart board and I understand National Struggle subject better in these lessons." (S12)

Discussion and Result

According to table 2, it is seen that totally 3 students (%11,11), 2 students (%7,4) who posed problem in "unnecessary data" criterion of "partly true" category, 1 student (%3,7) who posed problem in "incomprehensible" criterion of "false" category, divided the given number into equal parts in order not to exceed the number given in the animation scenario (for example, in order the result not to exceed 120 square meters, they will plant daisy in ¼ of the land, rose in its ¼, tulip in its ¼ and jacinth in its ¼). In this situation, it can be indicated that the students who couldn't pose a problem in "true" category, tried to benefit from unit fractions and equal fractional numbers to make it easy to pose problems which are matching the criteria in the "true" category.

While in table 2 and table 5, there is no student in "missing data" criterion of "partly true" category, two students (%7,4) in table 3, one student (%3,7) in table 4 posed

problems in “missing data” criterion. In this case, it can be claimed that students have problems in practising what they think in planning stage which is one of the problem-posing stages of the students.

According to table 2, it is determined that there are 6 (%22,2) students who posed a problem in “unnecessary data” criterion of the “true” category,6 (%22,2) students who posed problems in “unnecessary data” in “partly true” category according to table 3. There are 3 (%11,1) students who posed problems in “unnecessary data” in “partly true” category according to table 4, and 7 (%26) students who posed problems in “unnecessary data” of the partly true category according to table 5. In this case, it is clear that they have difficulty in associating the given and desired in the problems that students wrote.

It is established that according to table 2 there are 13 (%48,1) students who met the criteria in “true” category and posed problems. There are 14 (%51,8) students who met the criteria in “true” category and posed problem according to table 3. There are 16 (%59,3) students who met the criteria in “true” category according to table 4. And there are 14 (%51,8) students who met the criteria in “true” category and posed problem according to table 5. As a result, it can be said that the students who posed problems in “true” category can pose more original and complex problems.

It is pointed out that according to table 2, 2 (%7,4) students who met the criteria in “true” category and posed a problem, 1 (%3,7) student who met the criteria in “true” category and posed problem according to table 3. There is one student who met the criteria in “true” category and posed problem according to table 3, used the terms such as “times, more, less” in posing fraction problems with the help of computer animations and were able to blend them with number problems. However, it was observed that they made mistakes in solving problems related to “left land”. In this case, it can be said that students were not able to correctly correlate whole-part in fraction problems in the problems that they posed related to “left land”. This result supports the study carried out by Kazak (2012). In the study that was carried out by Kazak (2012), it was established that students could not correlate whole-part in fraction problems.

It was concluded that there are13 (%48,1) students who met the criteria in “true” category and posed problem according to table 2. There are 14 (%51,8) students who met the criteria in “true” category and posed problem according to table 3. There are 16 (%59,3) students who met the criteria in “true” category and posed problem according to table 4. And there are 14 (%51,8) students who met the criteria in “true” category and posed a problem according to table 5. They used more different fractional numbers in the fraction problems which they posed with the help of computer animations. In that case, it can be claimed that the students who posed problems by the problem-posing criteria involved in “true” category, understood posing problems with fractions subject better.

It was determined that in posing problems with the help of computer animations, they were able to associate fraction problems more with problem types such as number problems, age problems, field problems, and money problems. In this case, it can be stated that the students who posed problems with the computer animations which are suitable with the criteria in “true” category, can more easily associate the knowledge that

they have just learnt with their prior knowledge. In the first implementation that was realised, it is clear that 13 (%48,1) students who met the criteria in “true” category were able to pose problem according to table 2. In the last implementation, 14 (%51,8) students who met the criteria in “true” category according to table 5 were able to pose a problem. In that case, when the difference between the first and last implementation was considered, it can be implied that at the end of the problem posing and solving activities with computer animations the students concentrate on both reading of fractions, understand and reinforce reading fractions, ordering in fractions, addition in fractions, subtraction in fractions, painting the codes of the given fraction, and modelling of fractions better. This result supports the study that was carried out by Uygun (2008). In the study that was done by Uygun (2008), it was determined that fraction programme which was designed with computer enables students to comprehend the subject better.

It was concluded that among four implementations that were applied, the number of the students who posed correct problems related to the 3rd scenario is 16 (%59,3) and the highest rate of posing a correct problem is in table 4 of 3rd scenario. In this case, it can be argued that students can pose problems easily when they face a problem situation which is closely related to their daily lives in their inner circle.

As it can be seen in table 2, there is 1 (%3,7) student who posed problem in “logically incoherent” criterion, there are 3 (%11,1) students who posed problem in “incoherency” criterion, 6 (%22,2) students who posed problem in “unnecessary data” criterion, 2 (%7,4) students who posed problem in “unnecessary sentence” criterion, 2 (%7,4) students who posed problem in “unsolvable” criterion. There are 5 (% 18,6) students who posed a problem in “incoherent” criterion, 6 (%22,2) students who posed a problem in “unnecessary data” criterion, 2 (%7,4) students who posed a problem in “missing data” criterion, in the criteria according to table 3. There are 2 (%7,4) students who posed problems in “logically incoherent” criterion, 5 (%18,5) students who posed problems in “incoherent” criterion, 3 (%11,1) students who posed problem in “unnecessary data”, 1 (%3,7) student who posed problem in “missing data” in the criteria according to table 4. There are 4 (%14,8) students who posed problems in “incoherent” criterion, 7 (%26) students who posed a problem in “unnecessary data”, 2 (%7,4) students who posed problems in “unintelligible” criterion in the criteria according to table 5. In this case, it is arguable that as problem-solving studies are done with the help of computer animations, students’ types of error decrease depending upon the increase of their experiences.

When all the tables are regarded, it is seen that the number of the students who posed true problems increased in the second implementation compared to the first implementation. It increased in the third implementation compared to the second implementation, and there is a decrease in the fourth implementation compared to the third implementation. However, it was higher than the rate in the first implementation, while there are 2 (%7,4) students who posed unsolvable problems in the first implementation, there is no student who posed unsolvable problems in the next implementations. In this case, it can be enounced that problem-solving studies with fractions with the help of computer animations improve students’ problem posing skills

positively. In the study which was carried out by Turhan (2011), it was determined that mathematics studies which are carried out by using Problem Posing Approach increase the students' problem posing skills. This result has parallels with the result of the study that was carried out by Turhan (2011).

As a result, it was revealed that the studies of problem posing with fractions improve students' problem posing skills. And the students who cannot pose problems in "true" category, try to benefit from unit fractions and equal fractional numbers to ease problem posing the criteria in "true" category. It was observed that in the problems that students write, they have problems in associating the given and desired ones. The fraction program which was designed on the computer enables students to understand the subject better; students can pose problems easily when they face the problem situations which are related with their daily lives in their inner circle. And as problem-solving studies are done with the help of computer animations, students' types of error decrease depending upon the increase of their experiences. These results support the result of the study which was carried out by Korkmaz and Gür (2006) and which concluded that the problems about problem posing could be removed with well-planned practices. Uygun (2008) stated in his study that fraction program which was designed with a computer enables students to comprehend the subject better. Besides, in a study which was carried out by Karakış (2014), the software designed on fraction subject increases students' success, and the practices affect students' mathematics lesson success and attitudes in a positive way.

When the data obtained from the interviews done with students are considered, it was established that computer animations contribute to the mathematics lesson. And they are beneficial for students on posing a problem with fractions, students are eager to learn the lesson with animations, and it is useful for students to use animations when the subject is difficult for them and when the lesson or subject is abstract for them. These results have parallels with the studies which were carried out by Çelik (2007), Gürbüz (2008) and Genç (2013) and whose results show that the education given with animations enables students to interpret the lesson easily. It helps them to make research on the course or subject, enables them to understand the lesson more easily, increases their motivations (Gürbüz, 2007). It ensures permanent learning, speeds up the learning, increases the students' thinking ability, and enables students to follow the subject with pleasure, concretises the abstract subject. And it removes complexity, prompts students to learn.

Suggestions

It is suggested that on problem-solving and problem-posing point, different studies can be carried out related to the students who posed true problems but solve them incorrectly with different grades and on different subjects,

To determine the effect of computer animations related to problem posing and problem-solving on the student attitude, interest, success and motivation,

To determine the learning difficulties, and misconceptions that students encounter in problem-solving and problem-posing subject,

To determine the benefits of computer animations by associating them with different gains in different courses and different subjects,

To organise courses for teachers about computer animations, software etc.

To ensure the use of computer animations more especially in teaching difficult and abstract subjects such as mathematics and make learning permanent by teaching it enjoyable and concretely,

To prepare educational animations that will be compatible with the smart board within this scope by MNE, and to be presented to the use of teachers with a guide.

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