

The Effect of Teaching Fractions with the Interdisciplinary Approach on 1st Graders' Learning in Elementary School

Research Article

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ABSTRACT

Nowadays, the education environment growing individuals who will shape the society becomes a current issue with its new needs and quests. Interdisciplinary approach training individuals who transfer and analyze the information about a disciplinary approach to the other disciplines comes into prominence at this point. The purpose of this study was to examine the effect of interdisciplinary approach on mathematics themes learning by using students' views. In the study, the contents of different disciplines were brought together in an appropriate way and were planned. The activities which were prepared based on the students' level were applied in all courses one by one. In the study; in teaching fractions at the primary level, the activities were planned based on the interdisciplinary approach and the data obtained during the instruction process were presented in detail. In the study, case study method was used as a qualitative research design. The sample of the study consisted of 40 students studying in the first grade of a state school in Istanbul. Data was gathered with observation and semi-structured interview. In the analysis of the data, descriptive analysis method was used. Fractions were taught with appropriate activities for interdisciplinary approach during a week by homeroom teacher. The students were observed throughout the process, the observations were noted with their dates and were evaluated. At the end of the process, semi-structured interviews were conducted with ten selected students. In the research, it was found that the students found the courses that were processed with the interdisciplinary approach fun and that this approach made the subject easier to be learned.

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Keywords:

interdisciplinary approach; elementary mathematics education, fractions

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Introduction

Today, it is necessary to implement activities that will facilitate the learning of individuals, improve their thinking skills, and enable them to look at different aspects of an event or situation in the teaching-learning environment. Thus, it is crucial to apply activities which are based on more than one discipline in the teaching-learning environment. Due to the implementation of activities based on different disciplines in the teaching-learning environment facilitates the learning of the students, develops high-level thinking skills and gives a different viewpoint (Aybek, 2001). In the education system, plans should be made to ensure the growth of the students according to the changing world conditions, to establish connections among the disciplines and to transfer these connections in the field to the students. In these plans, other disciplines which will support the learning and teaching process in a discipline should be included in the process and the interdisciplinary teaching approach should be foregrounded (Arslantaş, 2006). The curriculums which were prepared was regulated based on interdisciplinary teaching approach. The themes with more comprehensive areas were determined instead of the units, and these themes were associated with different disciplines in the new programs (Acat & Ekinçi, 2005).

The interdisciplinary approach has been defined by different scientists in different ways. Yıldırım (1996) describes the concept of "interdisciplinary" as "presenting traditional subject areas in a meaningful way around certain concepts". According to Jacobs (1989), it is an approach that uses knowledge and methods of more than one discipline to examine a topic or concept. According to Yıldırım (1996), "the interdisciplinary approach does not mean to teach History, Geography, Mathematics or Music little by little within a class hour". This will be an artificial combination. Instead, the knowledge and the skills of different disciplines in teaching should be combined effectively and meaningfully around a common theme. According to Perkins (1994), the interdisciplinary concept accepts the richness of individual disciplines respectively, that they are interconnected, and that real-life problems have not always only one correct answer. Interdisciplinary (integrated) teaching is an approach that helps students combine, integrate, and analyze information in different areas and focus on synthesis-level thinking through concepts. This approach is important in terms of enlivening the teaching environment, encouraging students to use their creativity, and, most importantly, encouraging them to be involved in the courses and to ensure teaching (Aybek, 2001). Considering all these definitions, it can be said that the interdisciplinary approach is a program development approach which explains a centralized topic by associating it with the knowledge and skills of different disciplines.

When it is regarded in terms of student's roles, it is thought that interdisciplinary (integrated) teaching is an approach that helps students integrate the knowledge in different fields and makes them focus on thinking at the level of synthesis and analysis using concepts. This approach is of great importance in terms of boosting the teaching environment, ensuring that students use their creativity and, most importantly, encouraging them to become involved in classrooms (Aybek, 2001).

Teachers play important role in individuals' learning lives. If a teacher teaches disciplines separately and does not create connections between them, students may also consider disciplines as independent parts. If the teacher establishes interdisciplinary connections, students who model it, learn to associate disciplines. When the teacher does not believe in the effectiveness of the connections established between disciplines and does not actively participate in the production of the program designed according to the interdisciplinary approach, it is not possible for the interdisciplinary work to be successful (Diker, 2003). In the light of these ideas, considering the role of teachers in the successful implementation of interdisciplinary approach, it is important that the teachers have enough knowledge to implement this approach and that adopt a student-centered approach after appropriate education programs developed. It is also important that students' readiness levels should be appropriate. Taking all these factors into consideration, it is thought that this study,

which is designed with an interdisciplinary approach and prepared by taking the opinions of first grade primary school students, will contribute to the literature.

When the literature is scanned, it is seen that there are many studies about the interdisciplinary approach. In the study conducted by Özkok (2005), the effect of the creative problem-solving teaching program developed on the basis of interdisciplinary approach on creative problem-solving skills was investigated and it was concluded that the creative problem solving teaching program based on the interdisciplinary approach had significant effect on this skill. In the research conducted by Coşkun (2009), the effect of teaching 8th grade mathematics course with interdisciplinary approach on mathematics achievement and critical thinking tendencies was examined. In his study, it was found that interdisciplinary teaching approach significantly affected the academic achievement of the students but did not significantly affect their tendency to think critically. In the study conducted by Yarımca (2010), it was found that it was revealed that the interdisciplinary approach in the implementations developed in secondary school visual arts course has more positive effect on art education compared to the traditional method. In the study of Arslantaş (2013), the effect of teaching based on the interdisciplinary approach in the fourth-grade visual arts course on the attitudes of the students towards the course was investigated. As a result of the study, it was concluded that the interdisciplinary approach had no significant effect on students' attitudes.

The purpose of this research was to examine the effects of the interdisciplinary approach on learning of mathematics subjects by using students' views and the observational results. The problem of the research was to examine the teaching of fractions with interdisciplinary approach, which is one of the subjects of mathematics course, from the point of students' view. The research was conducted in general to answer the following questions:

- (1) What are the general observations on the teaching processes in which the interdisciplinary teaching approach is applied in the teaching of fractions?
- (2) What was the effect of the mathematics course which was taught based on interdisciplinary approach, on students' academic achievement in teaching fractions?
- (3) What was the effect of the mathematics course which was taught based on interdisciplinary approach, on the affective situation of the students about the course or the subject matter in fractions?
- (4) What was the opinions of the students about the interdisciplinary teaching approach and the courses being taught?

Method

Research Design

In this study, case study method was used from qualitative research designs. The purpose of the case study is not directed to generalization, the situation is determined, and detailed examination is attempted (Anderson, 2005; Creswell, 2013) Since the performance of the students during the activities in the classes was analyzed in detail and the student opinions were described in depth at the end of the process, the study was designed as a descriptive case study.

Sample of Research

The sample of the research consisted of a group including 40 students. There were 21 male and 19 female students who are studying in the first grade of a public school in Istanbul in the academic year of 2016-2017. In determining the students, a homogeneous sampling method was used, which was one of the sample selection methods for the research. In the homogeneous sampling, a subgroup is examined by creating a sampling group. The group that formed the study sample was determined based on this method in terms of

being students of a low socio-economic school in general. The students were similar in terms of living standards, income levels of families, interests, needs, and readiness levels. At the same time there was similarities in terms of academic achievement, the level of interest and motivation in the course.

After all the activities were completed, semi-structured interviews were conducted with 10 selected students. Attention was paid to the participation of selected students in all activities, to express their thoughts comfortably and to be voluntary students. The semi-structured interviews were conducted by recording the students' voice with the consent of the parents.

Data Collection Tools

The data of the study were collected through observation and semi-structured interviews. Fractions were taught in Turkish, Mathematics, Science of Life, Games and Physical Activities, Art and Music courses during a week and the results of observations on each subject were noted. Applications were prepared within the framework of the activity plan prepared before the implementation and semi-structured interviews were conducted with the students and the data collection process was completed.

The observations and interviews in the research were carried out by the classroom teacher who was a researcher. In semi-structured interview technique, the researcher prepares interview questions prior to the interview. This technique can provide a certain degree of flexibility in rearranging questions during the interview for the researcher. Semi-structured interview questions prepared in the direction of the research problem were presented to 5 lecturers who were working in the Faculty of Education. Based on these feedbacks from the experts, the interview questions were reorganized. In the interview form, questions were first prepared based on the research problem. Subsequently, it was decided to collect the questions under three headings: Academic achievement, Affective Impact and Teaching method. Data gathering was carried out after the interview questions were made into a form suitable for primary school primary level. In interviews, student names were kept confidential and the interviews made with each student were collected by voice recording. The duration of the interview varied according to the student. The interviews were held in a school hall and one-on-one with the student.

Implementation

Activities related to fractions are prepared in accordance with the following achievements and with interdisciplinary approach:

- (1) It shows that whole, half and quarter on models
- (2) It explains the relationship between half and quarter.

The processes performed in different disciplines were as follows:

In mathematics, students did some operations by using concrete objects. Students were asked to cut the papers of the same size given by folding them in half. They were asked to fold the two halves obtained in this way to get quarters. The whole, half and quarterly visuals remained hanging on the board during the course. Then they created half, whole and quarters of the fruits they brought with them and examined them. Then, they were provided to investigate the fruits they brought with them by creating half, whole and quarters. Both events were conducted to find out the relationship between half, whole and quarter. Then, by group work, they first painted the pizza visual on the worksheets, then cut them whole, half and quarter, and pasted them on colored cardboards. The works were exhibited on the class board after the group names were written on them. In the next lesson, they followed a short animation of the use of information in daily life, appropriate to the level of interest. They made activities such filling the gap in the video, matching, finding the half-quadrant of the given objects, finding the whole, the half or the quarters of the objects and answering to the questions

of how many quarters were equal to the whole and how many halves were equal to quarters. It was aimed to support the subject with homework and worksheets.

They wrote a story related to the subject in Turkish class. Half, whole, and quarter of the words in the story were underlined. The students wrote these underlined words in sentence by creating meaningful and regular sentences. Then they answered the five Ws of the story. In addition to these, filling gap statements were given. The students completed the sentences by finding the words to be written in the blank. In the introduction to science course, an activity was organized in the Healthy Life Unit that would be suitable for "Healthy foods and drinks". According to this, images of healthy and unhealthy foods were affixed to the board. The shapes of the food were prepared in half, whole, quarter. Three groups were formed by writing half, whole and quarter on the other side of the board. The students selected the images of meat and milk products, which were beneficial for health, and the images of fruits and vegetables. They placed the selected images in the appropriate section according to their half, whole and quarter formations.

In the game and physical activities class, students were divided into 3 groups. They jumped in and out of colored circles arranged in three rows to the ground. At the point they reached by jumping, they collected half, whole and quarter of their images pre-made with colored papers. Group 1 collected half of images of all shapes, group 2 collected quarter of images of all shapes, group 3 collected whole of images of all shapes. The group that collected the most visuals from the given period won the game. During visual arts, they painted the same color by finding the other half of objects given half of different images. They also painted and cut objects in the given images to form halves and quarters. Similarly, they found the other half of the fruit image given the half and glued it together and got it whole. The works were exhibited at the activity corner.

In the music class, rhythms were formed separately for the concepts of the whole, the half and the quarter. Some materials were prepared for this beforehand. They were:

- (1) Plastic bottles with some rice or beans in it.
- (2) Two wooden spoons to make a sound by hitting each other.
- (3) Metal clothes hanger and metal rod.

When the whole picture was shown to the students, one of the groups made a sound by shaking the bottles. They did it once. When the half image was displayed, the other group made a sound by hitting the spoons. They did it twice. When the quarter picture was shown, another group of students made a sound by hitting the metal clothes hanger with metal bars. They did it four times. In addition to this, they also held different rhythms by clapping their hands. Throughout all the courses, the students were observed in terms of the performances they exhibited, and the observational results were noted. The students also did book activities in the class. At the end of the courses, the homework and worksheets were given to support the learning of the subject.

Analysis of Data

In the study, the descriptive analysis and content analysis methods were used in the analysis of data collected through interviews. According to Yıldırım and Simsek (2011), descriptive analysis is conducted to present the findings to the reader in an organized and interpreted way. The interview and observation results of the study were analyzed within itself. While the answers to the questions on the interview form were analyzed, they were also covered under three headings as Academic Achievement, Affective Impact and Teaching Method. During the presentation of the qualitative data, the label of "St1, St2, St3, St4, St5, ..." were used for the ten selected students. When creating the tables, the different answers given by the students for each question were taken into consideration. Therefore, it was seen that the number of some answers was

more than 10, which was the number of samples. To contribute to the realism of the study and to interpret it in a descriptive manner, during the interviews, direct quotations were included in the dialogues between researchers and students.

Results

Findings of sub-problems of the research were given under the heading.

(1) Findings about sub-problem 1 (What are the general observations on the teaching processes in which the interdisciplinary teaching approach is applied in the teaching of fractions?):

Students were observed over a period of one week during the course, and their impressions of learning, interest, motivation, and desire were noted. As Yıldırım (1996) pointed out, one of the aims of using interdisciplinary approaches in learning environments was to give individuals various forms of thinking. With this study, it was shown that a subject belonging to a mathematics course could be taught together with the achievement of other courses. It was also possible for students to transfer this course to other courses. Students engaged in different activities that addressed cognitive, emotional, psychomotor areas learned to think in a variety of ways and to look at events from the perspectives of different disciplines. At the same time, it was observed that students with low attendance level were very eager to participate in the activities. This showed that they could express themselves comfortably in the activities of the courses that were processed in accordance with their readiness level. In general, learning of the subject acquisitions by all students was led to the conclusion that learning in lessons taught with this approach was easier and more effective. Another research result supports these findings. In the graduate thesis study conducted by Özhamamcı (2013), the opinions of teachers about interdisciplinary teaching practices in primary and secondary school curricula were taken. Because of the research, it was stated that while interdisciplinary practices in teachers, primary and secondary school curricula were mostly useful, the most useful aspect of the practice by the teachers was that it helped the students understand the subjects better. Because of the research, it was stated that while interdisciplinary practices in primary and secondary school curricula were mostly useful, the most beneficial aspect of practice by teachers was that they helped students understand the subjects better. In mathematics courses, they had a very enjoyable time with painting, cutting and pasting activities. It was observed that all students performed their duties in a pleasant way and cooperatively. At the same time, it was observed that the students gave a collective and correct answer to the questions directed to them. The number of attendances which was less in the beginning increased as the courses progressed. For example, the students answered correct to the question of "How many pears are obtained from all three pears." Towards the end of the course, it was observed that some students responded by developing different strategies. For example: "4 halves of a loaf of bread, how many quarters of a loaf of bread are they?" a student answered the question as "8". When he was asked how he found it, he replied, "by counting 2 by 2". The result of the observation was that the students showed that they developed different solutions to the problems. In Turkish class, the story about the subject was written and the five Ws of the story were answered. It was seen that students who liked to write showed more interest in the course. In the papers given to the students, there was a space filled word activity and it was seen that the attendance was high. The wrong answers given to the questions in the beginning decreased in later time and the students with lower academic achievement could answer the questions correctly. In Science of life class, students classified the foods as whole, half and quarter by choosing beneficial foods for health. It was observed that the children's requests to participate in the activity were at a very high level. The children placed the healthy food they chose correctly to the appropriate section. In addition, it was observed that the students who were not able to take turns during the activity were upset. Some students also showed some undisciplined behaviors, which were also among the results of the observations. In this case, it was achieved that the crowded classes could have difficulties in implementing this approach. In music class, students were asked to keep rhythm using different materials. It was observed that this course was interesting,

and participation was high. Accordingly, it was seen that the use of materials belonging to different disciplines prolonged the interest and motivation period of the course, and that there was a strong and lasting effect on the learning of the subject which was taught with interdisciplinary approach. As a matter of fact, Coşkun (2009) stated that for the interdisciplinary teaching approach to be effective, teaching materials should be used. In the Visual Arts course, most of the students observed that half of the given visuals were easily found in the other half of the visual and that they were painted the same color. After cutting out the images and painting them, they brought them together as a whole. In this study, it was observed that the level of interest of the students was not as high as the level of cutting and gluing activity performed by cooperating in mathematics course. It was observed that students were more willing to do group work and found group work more fun.

In the game and physical activities class, students were divided into three groups and gathered visuals, consisting of half, whole, and quarters, jumping through circles. It was observed that the game was held in a race atmosphere, accompanied by applause and slogans of the students. All the children easily adopted to the rules of the game and enjoyed a lot. Based on the observation, it can be stated that the teaching of play is a permanent influence on children's learning because of the positive contribution of having fun and developing psychomotor. As Erdoğan (2008) stated in his research, for years, children's teaching about mathematical concepts has been supported by games in daily life and these games have contributed to children's cognitive, emotional and psychomotor development. In this regard, mathematics can be made more meaningful and useful for children.

(2) Findings about the sub-problem 2 (What was the effect of the mathematics course which was taught based on interdisciplinary approach, on students' academic achievement in teaching fractions?):

Some questions were asked to investigate the extent to which the achievements of the course covered by the interdisciplinary approach were earned by the student and the effect of the approach on learning.

Table 1. Frequency values of answers to questions related to the effect of mathematics course with interdisciplinary approach on academic achievement of students

Questions		Responses	Frequency
Question 1: What did you learn about the fractions? Can you give examples?	What to learn about fractions	Half, whole, quarter	9
		Creating a half from the whole and a quarter from the half	3
	Samples	Rhythm in music course	3
		Creating a whole, a half, quarters from papers	3
		Pizza slices	1
		Shape collecting game	1
Question 2: Where can you use this information in your daily life? Why did you choose to use this part?	Where it can be used	Splitting fruit / food, cutting pie	14
		Drawing pictures, creating different shapes	4
		Using the flashlight	1
	Reason	I love the fruits	3
		The first thing that comes to mind is the food	1
		It is fun to split the foods	1

	Cutting and pasting in mathematics	6
Question 3: What were the activities that were interesting in the courses and in which courses did these activities take place?	Healthy foods in Intro to Life course	5
	Game and games in the Physical Activities course	5
	Writing a text in Turkish	1
	I didn't have any difficulties	9
Question 4: Were there any difficulties in any studies for you?	The painting activity that we made in group in mathematics course	1

The first question asked for the review of the academic achievement of the students was, "What have you learned about the fractions? Can you give examples?". When the answers given by the students were examined, it was seen that they could easily refer to the basic concepts about the subject of the course; in other words, they gained awareness about what the subject concepts were. In fact, all the students seemed to have responded in this direction.

"I learned "Half, whole, quarter" which is the answer of St1 coded student. When we divided into two, we were getting a half. When half of the half was divided into two, we were getting quarter. "I learned the whole and half quarter, which is the answer of the St2 coded student. For example, in music class, everyone had something in their hands. When he /she showed the whole, we were shaking bottles. When he / she showed the half, we were hitting the spoons. When he showed the quarter, we were making ring sound by hitting the hangers."

These expressions can be as an example. Some students also gave some examples of what they learned about the courses. For example, St4:

"We learned the whole, the half, the quarter. We cut the papers and made the whole, the half, the quarter forms. I did the same thing from the pizzas, "he said, cutting the papers and making a half, a whole, a quarter"

and St6 said that:

"I learnt Half, whole, quarter. During games and physical activities, we gathered these shapes and played games. In the music class you showed all, half, quarter. We also had a rhythm."

They gave examples of the activities in the Games and Physical Activities and Music courses. Taking these into consideration, it can be said that the interdisciplinary approach is a more permanent and learning-facilitating effect on learning.

The second question asked about academic success is "Where can you use this information in your daily life? Why did you choose to use this part?". When the answers to this question are examined, it is seen that most of the students can use the concepts related to fractions for cutting and slicing related to foods in daily life such as dividing fruit/food and cutting pie. For example, St1 coded student expressed his opinion in this subject:

"For example, if there is a place selling pie, I can ask him to cut half pie. I can go to another vendor and say quarter or whole food. Because I can break them. I can divide them as half, whole and quarter."

St4 coded expressed his opinion that

"For example, if we have an apple, my mother can cut it in half, two halves of apples. I can share them with my friend and me. I can also create half, whole, quarter of the leaves of the fallen tree in the fall."

Most students preferred to use fractions in foods that were more appropriate in terms of dividing, sharing, cutting in daily life. This can be interpreted as the fact that students use the knowledge they learn to meet their basic needs, which is the most useful part of their daily life. One of the answers to this question is that these concepts can also be used for purposes such as painting, creating different shapes. 21% of the students responded in this way. For example, the answer of the coded St6 as follows:

"While painting, I can combine half, whole and quarter shapes. I can draw. I visualized them as shapes. That's why I wanted to use it in this part."

One of the students interviewed was able to work on these concepts by answering in a different direction expressed his opinions that:

"I turn on my flashlight at home. I'm making half a quarter light with it. I'm showing them off with my hand. I can do something else, as well. I used fruits and vegetables. Sometimes I could make pizzas that my father ordered me. Because I can make half, half, quarter from them"

As can be seen from these statements, students can easily transfer to daily life. Evaluation studies are also supporting this situation. At the end of the process, it was observed that the number of students who answered the questions correctly compared to the first courses increased. In addition, students with low achievement level were more willing to participate in the class. This showed a significant contribution to academic success.

The third question asked about the effect of the interdisciplinary approach on academic success was "What were the activities that attracted attention from the courses and what courses were those courses?" When the answers given to this question were analyzed, it was seen that the activities performed in Mathematics, Science of Life, Game and Physical Activities courses were mentioned as the most interesting activities. In response to the activity in the Mathematics course, the St6 coded student said:

"You have put the food that is useful and harmful to health on the table. We chose those that were useful to health. This event was made in the Life Information course. "

As a result of the activity in Science of Life course and the student and with the expression St7 coded that:

"We had cut and pasted Pizzas quarter, whole, half. We did this activity in Mathematics class. We played half, all, quarters. We did this in the Game and Physical Activities course."

These are examples of the answers given in relation to the activity in Mathematics course is related. St1 coded student said that:

"Half, whole, quarter objects attracted my interest. You pasted pictures on the board in Intro to Science class. We chose half, half, quarter. These were good food for our health. In math, we cut pizzas and pasted them on the card. We cut them half, half, quarter. Then we put it on the Board. We wrote half, half, quarter in the text in Turkish. We wrote sentences."

The answer can also be interpreted as the fact that the activities performed in all classes attract the attention of the student.

The students generally mentioned the name of the course before the activity and then explained the activity. In general, they remembered and explained the activities of almost in every class, but they remembered the activities of the classes in which there was food in the visuals and which they cut and pasted. It was also observed that the courses such as Mathematics, Games and Physical Activities, which were made as group work, were more detailed and easier to remember. It was observed that the studies that were used in the visuals, the teamwork were realized and learned could be transformed into a reality, increased the interest and motivation of the students in the course.

St3 coded student said:

"The pizza activity we did in mathematics. We finished quickly because it was a team work. We did not talk about anything other than the course. We did healthy food activities in Introduction to science course. You wrote the whole, half a quarter on board."

In his statement, that states that they did not speak anything except the lesson, was considered important in terms of showing that the interest in the course was high. St8 and St9 students were also interested in the "Games and Physical Activities" course.

"We tried to gather quickly half, whole, and quarters by jumping. It was a lot of fun." and "We were also interested in Game and Physical Activities courses. We had gathered and counted half, whole, and quarter."

From here, it was seen that children were able to acquire the skills of transferring and transforming what they learned into life through fun activities.

The fourth and final question asked in relation to academic achievement is "was there a study that forced you to be among the activities?" All but one of the students did not answer that the events were not compelling. Students in general found that the activities in the courses were easy. Only St3 coded expressed his opinion that:

"I was a little tired when I was painting. This activity was an activity that we made in groups. We were painting pizzas in a math class."

Regarding this answer, it was considered normal for the students to be able to find tiresome activities for psychomotor skills due to age, developmental status or other individual differences.

(3) Findings about Sub-problem 3 (What was the effect of the mathematics course which was taught based on interdisciplinary approach, on the affective situation of the students about the course or the subject matter in fractions?):

Some questions were asked to investigate the affective effects of the students' achievements related to the course covered by interdisciplinary approach on Mathematics course or fractions that were taught. Table 2 below shows frequency values of the findings of this sub-problem.

The first question asked them to investigate the impact of the students on their emotional state was: 'Did you enjoy studying fractions in different classes? Why?' In the answers given, all the students stated that they were pleased that the subject of fractions was taught in different courses. St4 and St5 on this subject, respectively, said,

"Yes. Because it's just boring when you do it in math. I understand better when it happens in all classes.", and "Yeah. Because when we do all classes, we learn better. "

They stated that they understood better when the subject was handled in all classes. The ability to transfer things learned from a course to other courses was moving the preliminary information into action. Children easily remembered that they learned this method and they used it in different areas. 50% of the students said that they liked this method because they learned and had fun.

Table 2. Frequency values of answers to questions related to the effect of mathematics course with interdisciplinary approach on students' affective situations related to the course or work subject.

Questions	Responses	Frequency	
Did you enjoy studying fractions in different classes? Why?	Did you like it?	Yes	10
	Reason	Because, we both enjoy and learn	5
		We learn better	3
		We did different things	2
What courses did you like to study? Why?	Course liked	All courses, more than one course; because it was so much fun	6
		Math class; because the events were so beautiful	3
	Reason	PE class; because we played games	1
		Because it is fun	9
		Because we both enjoy and learn	1
		Because we do group work	1

Which event did you like most, why did you like it?	Activity	Playing game	5
		Cutting and pasting activities	3
		Healthy food activities	2
	Reasons to like	Very fun	8
		We did group work	3
Which one would you choose if these activities weren't done?	Other activities to choose	I like these foods	2
		Cutting and pasting pizza activity	3
		Healthy food activities	2
		Rhythm Activity	2
How did you feel during the events, and did you encounter anything that would make you unhappy?		others	3
		I felt so good/so happy	10
		There was no unhappy incident.	8
What course did you feel better/express yourself in? What made you feel good?	The course that you express yourself well	I was a little upset when I lost the game	2
		Game and Physical Activities Courses	5
	Reason	Math course	3
		All courses	1
		Introduction to Life	1
Do you prefer to study alone or with your friends?		It's fun, it's easy, and we need to move	9
		Because, there are more activities	1
		Studying with my friends, doing a part of a study are very nice and more enjoyable	10
		When I was alone, I felt alone, it was boring	10
		It's easier together	4

In this regard St1's answer was that:

"Yes. Because we are both entertained, and we are studying."

St3's answer was

"Yes. Because they were all different and colorful activities. We painted. I had a lot of fun."

St8 said:

"Yes. Because Running in the Game and Physical Activities course was fun to jump. I like it."

These views suggested that children who felt happy at the activities could be more adoptable to learning. When they are in the audience, it is often not possible to draw attention to the interests of many learners at the same time. Based on this data, it was concluded that the method was very useful in the effective course teaching especially in crowded classrooms. The second question asked to examine the affective impact of the "In which activities of the courses did you like to do? Why?". They said that 60% of the students liked studying in more than one class because they found them fun. St2 said that:

"I liked the studies in all the courses. Because all of them are very nice and fun."

And the St3 student also said:

"I liked the studies in all the courses. Because they were all fun. In mathematics we also had teamwork. "

They expressed that they liked what was done in all the courses because they had fun. When Table 2 is investigated, it is seen that most of the students show fun as a reason. It suggests that a priority should be given to create fun learning environments for children in primary school age. At the end of the research it was observed that the students had great pleasure in doing things together. St4 said:

"I like the Turkish course. We wrote a story. We answered questions about it. "

The question of "What else did you like to study?", he added:

"Mathematics and Science of Life course. Because I had a lot of fun, and my friends and I did something with great effort, and we learned."

This statement is important because it suggests that group work contributes positively to both psychomotor, social and academic development.

The third question asked about the affective situation was, 'Which activity did you like most, what was the reason for it? Which one would you choose if this wasn't happened?'. When the answers were investigated, it was observed that 50% of the students liked the activity of playing games. Accordingly, students found the activities that required teamwork and motivated psychomotor skills more enjoyable. In this regard, St6's opinion was as follows:

"I liked the activity in the most Gaming and Physical Activities course. We jumped through the circles. We collected half, whole, quarter objects. Because it was so beautiful. Winning was not important. Fun was more important. If this activity was not held, I would select the event in the Music course. Half, whole and quarter showed rhythms. It was not so important to win; it was important to have fun."

It is thought that this may be the reason for learning and having a good time together. This is important in terms of seeing the benefit of the playing activity, which is an important part of the child's world, in the courses.

The diversity of activities is important in ensuring that they can be addressed to different levels of interest. Thus, the subject can be learned easily in another course that will appeal to the level of interest, even if it is not sufficiently understood in a course. St2 said,

"I liked the activity most in the Game and Physical Activities class. Because it was fun to play games. If it was not for this activity, I would choose Mathematics. The cut and paste activity was very nice." St1 said, "I like most Mathematics. Because we cut, paste and we paint. We build half, whole, quarter objects. We brought the fruit and showed them as half, whole, quarter. If this activity was held I would choose Turkish. Because I like to write. We wrote a story in that course. We took a quiz about half, whole, quarter."

St10 said,

"I liked Introduction to Life the most. Because I love healthy fruit vegetables too. If we did not do that, I would choose the pizza activity."

It was concluded from the answers that students liked the activities of different courses and had a good time in the lessons. Students especially expressed their like for the activities in the Game and Physical Activities classes, because they enjoyed learning. The fourth question asked to investigate the affective effect is " How did you feel during the activities? Did you encounter any event that would make you unhappy? " All of the students said that they felt happy during the activities. Two of the students gave examples of a situation in which they felt unhappy. St2 and St7 in this regard, respectively said:

"I felt very good. I came across a situation that would make me unhappy. Losing in the game and physical activities course. And I felt so happy at the activities. Yeah. I came across a situation that would make me unhappy."

It is thought that it is one of the most important reasons for students to feel good about themselves during all the activities and to have a high level of learning. It was concluded that students felt comfortable and participated in different activities in an environment where they were active, the level of learning was high. Game and physical activities are among the results of the course which enables students to be in the

mood of competition. The fifth question asked about affective efficacy was " Which course did you express / feel better? What was the reason for feeling good? " 50% of the students said that they felt better at the Games and Physical Activities course. Ninety percent of the students showed that as a reason for it, the course needs to be fun, easy, and active. As an example, St2 student responded to the question that,

"I felt better in the Game and Physical Activities course. Because I laughed too much."

St2 continued to answer to the question of 'What did you laugh at?'

"I laughed at your jumping, it was fun. It was good to be moving. I felt good."

The answers from St3 and St6 were also the same. St3 student expressed better in Game and Physical Activities course. Because we both learned and played sports in this course, St6 student felt better in" Game and Physical Activities course. Because St6 said that it was beautiful to play. These statements of the students suggested that they liked the activities which required physical movement more and at the same time they expressed themselves better in the activity of the Games and Physical Activities course. St4 stated that,

"I expressed myself better in Turkish courses. I had fun while writing. I love to write articles."

He expressed himself better in Turkish course. For this student who loved writing, the course addressed his interests with text-writing activity and meaningful sentence-making studies. From the statement of St1 "*I felt good in all courses because we are writing, making sentences, cutting and pasting, playing, coloring and watching videos*", it was thought that she may feel well in all the courses because she can express herself in different forms with different activities in the courses. Accordingly, the fact that different expressions for different courses indicate that the interdisciplinary approach can address the interests, desires and needs of each student. The sixth and final question asked to students about affective efficacy was " Do you prefer to work alone or with friends? ". In the answers to this question, all the students said that they preferred to work with their friends. When students acted cooperatively in a group, they were both more entertained, and they realized that duties went faster and easier. Regarding of it, the opinions of St2 and St3 were as follows respectively:

"It was more fun working with my friends. It was nice to work with someone else."

The answer to the question of 'What was the good part of it?' was that:

"It was better when we had friends with us. We helped each other, it made works easier. I did not feel very well when I was working alone. I had group work in the music and had fun. I made painting alone. I do not like to do something alone.'. 'Working with my friends was more fun. When we shared the responsibilities, works were easier to do. We colored, cut, cleaned up all together. Also, we gave a name to our group. Our team was Star Team. Everything was up to me when I was alone, so I felt a little sad."

As it was seen from St2 and St3, they addressed that sharing responsibilities was more enjoyable, and it facilitated the works. In this case, St1 said:

"Working with my friends was more enjoyable. We cut and pasted all together in Math. All of us took responsibility. We worked together. We had fun. In Physical Education class, we played adding half, whole and quarters game. The groups made addition more was winning. In Music class, when you showed the whole, they were beating out using spoons. When you showed half, we were shaking the bottles. When you showed quarters, they were beating out hangers by using metal rod. We had great time. When I worked alone, I felt bad because I was alone."

This statement suggests that students prefer group work, rather than work alone, because they can do better when they are active.

(4) Findings about the sub-problem 4 (What was the opinions of the students about the courses being taught based on the interdisciplinary teaching approach?):

Some questions were asked to investigate the thoughts of the students about teaching courses with interdisciplinary approach. Table 3 shows frequency values of the findings of this sub-problem.

Table 3. Frequency values of pupils' responses to questions about the courses being taught based on interdisciplinary teaching approach

Questions		Responses	Frequency
Do you want to do other courses in this way in the future? What is the reason?	Response	I want	10
	Reason	Both I am learning and enjoying	7
		I am learning better	3
If you were a teacher, how would you teach the course?		I would use your method	4
		The activities of cutting, pasting, coloring and playing	6
		It was easy and fun	10
How did handling fractions with this method affect your learning?		We learned easier by cut and paste activities and using materials such as paper and fruits.	5
		I learned easily when repeated in all courses.	2
		I learned better with team work.	1
Do you think that each subject should be taught in every class? What else can we do with this method?	Should it be proceeded?	Yes	10
	Which subject can we handle?	Geometrical shapes	6
		Addition	4
Do you think the fractions are learned the best in mathematics class? What is the reason?	Response	No	10
	Reason	I learned easily when was taught in all courses	10

First, the question of 'Do you want to do other courses in this way in the future? What is the reason?' was asked to the students. All students wanted this method to be used in the future. In this regard, St6 said:

"Yes, because I want to learn a subject in all courses. I learned better by this way."

St10 said:

"I would like to process other courses in this way in the future. Because we would have done other lessons and I would learn better."

It was thought that the students developed positive perceptions about the method. In addition to these statements, all the students had the opportunity to express themselves in an environment where they learned both fun and comfortable, and they achieved that they were able to perform better learning.

The second question asked was "How would you teach if you were a teacher?" to investigate the opinions of students about teaching courses based on interdisciplinary approach. The 60% of the students answered to the question as the activities such as cutting, pasting, painting and playing. Generally, children enjoyed while painting, cutting, pasting and playing games. The interdisciplinary approach is an approach that allows for the presentation of rich educational activities for each subject. The students also gave different examples of the activities to be done. For instance, St3 answered:

"I would teach with activities like you. In each class, I would use different activities."

'What kind of activities can be done?' was asked and he replied:

"I would make cut-and-paste activities, story writing, objects sticking on the board and playing games."

St10 said:

"If I were a teacher, I would make coloring activities with children. In Games and Physical Activities Class, I would play a game about addition. I would write questions on cardboards and want them to find the answers. I would make addition- subtraction problems with pencils in the class."

Accordingly, it is considered that the regulation of learning environments to allow for different activities is a positive reflection on learners.

The third question asked about the interdisciplinary approach was "How did this method affect your learning of fractions?" All the students stated that they easily learned with this method. The statement of St5 was,

"I was both more knowledgeable and learned easier because we were working on this topic in all courses."

It supports the fact that courses learned through an interdisciplinary approach are much more productive than courses we use without using this approach. St10 addressed similar opinion with St5 and said:

"Teaching the subject with this method made me learn easier. We did different activities in the courses and this facilitated my learning, too. We watched videos in the courses. We made cut-and-paste, coloring activities. We played games. It was easy to learn."

St7 mentioned that the subject of fractions was learned more easily through interdisciplinary approach by saying that:

"Teaching the subject with this method made me learn easier. For instance, we found the half, whole and quarters of fruits. We got a whole by combining halves. I learned easier in Games and Physical Activities Class, too. In addition, the activity of Math class was easy. Because these activities were more enjoyable than watching videos. We combined and colored. I learned fractions easier because of learning fractions in all courses."

Besides, St6 stated that he thought that he could succeed because he found the activities nice and easy by saying that:

"This method made learning easier to process fractions. For example, we showed half, whole, quarter's pizzas. We showed whole, half, and quarters from the paper and the fruit. It was easy for me. I learned more easily with this method. Because the activities were very nice and easy for me. That's why I thought I could do it."

In this sense, it is thought that the beliefs in learning are increased by the activities that the students actively participate in.

Question 4 "Do you think that each subject should be taught in every class? What else can we do with this method?" was asked to investigate the students' views on the interdisciplinary approach. All the students answered to this question positively. St1 said:

"We can handle the topic of Geometric Shapes. During games and physical activities, you could put geometric shapes. There were different shapes too. We tried to find geometric shapes. In Visual Arts, we could paint geometric shapes. As for addition problems, we could write whole, half, quarter objects side by side and we could make addition with them."

St1 established a relationship between two different subjects which were fractions and addition problem related to Mathematics. This statement indicates that students can relate not only between different disciplines, but also between different subjects in the same course. St5 said:

"Yes, for example, we can learn addition with this method. In Math class, we could write number one under the other and add. In Turkish class, we could write a text. It could be about addition process. We could ask riddle about addition. In Game and Physical Activities class, we could play a game. We could divide into groups. As the number of groups increased, we tried to find out how many groups there are by using addition."

It is thought that these students succeeded in transferring what they learned from the objectives of the interdisciplinary approach and developing different perspectives. The St2 responded to this question by mentioning the activities in the lessons:

"For example, we can study numbers. In Turkish course, we wrote the texts about the numbers. In the Game and Physical Activities course, you played the game about the numbers. For example, you divided us into groups. We played a number-gathering game. You wrote on the papers. We tried to collect them. The fastest collecting group won. We also worked on geometric shapes. You wrote text in Turkish course. In music class you showed circles, rectangles, square shapes. When you showed the circle, we would make applauses. When we showed the rectangle, we hit the iron rods to the hangers. When you showed the square, we played the bells."

In all mentioned views, the students explained how they would relate a different topic in a mathematics course and another courses. This is thought to be important in that it shows that the learners can be transferred to different situations. For the students, the fifth question asked about the interdisciplinary approach is to learn the question "Do you think fractions are best learned in math? Why?" All the students answered that the subject of fractions was not be learned the best in the mathematics. Besides, they said that teaching of a subject in all courses facilitated their learning. All students, after the course taught with an interdisciplinary approach, realized that a subject could be learned in different courses and expressed that they could learn subjects more easily. St9 found the lesson easier because he found the Game and Physical Activity lesson fun. He stated that:

"We can learn about fractions in other lessons. Studying the subject in all the courses made my learning easier. I learned it easier because the game and the physical activities lesson are very fun."

St1 student stated that:

"This activity can also be learned with the activity performed in the introduction to life. We can learn in other courses. For example, in Introduction to life course, we pasted whole, half, quarter foods in suitable places. We can learn from there. I learned more easily when we studied the subject in all the courses."

St3 student also said,

"No, this can be learned in all courses. We wrote the text in Turkish. We can learn there too. Studying the subject in the other courses made it easier for me to".

It is believed that these statements are important in terms of demonstrating the benefits of learning in the use of activities that will appeal to different interests.

Conclusion

According to the results obtained from the observations in the study, all the students showed a very active participation in the activities carried out in the courses. When the research results are investigated, the interdisciplinary teaching approach is adopted by the students, and the results show that their interest and motivation levels are kept at a very high level. As a matter of fact, Guthrie, Wigfield & VonSecker (2000) and Doğan & Şahin-Taşkın (2018) also stated that the motivation of students studying in an interdisciplinary approach is higher than those who study in a traditional environment. In his study, Guercio (2003) stated that motivation of students increased by 50% compared to the old one when interdisciplinary approach was applied. The results of these two studies are supportive of the results obtained in this study. According to the findings, the most prominent benefits of interdisciplinary approach is that it makes learning easier, makes learning more permanent and is transferable to everyday life, and increases academic success. Through the activities carried out in the implementing process, the students were given the opportunity to look at the events from different perspectives of the disciplines. It was aimed at making the learning easier and more permanent and transfer to other daily life situations by this way. In addition, students worked as teamwork by fulfilling their responsibilities in group work and produced a product together. They participated in the activities of the interdisciplinary teaching approach which were realized by presenting the information in terms of different disciplines. It is known that different researchers reached positive results in the researches they made related to the interdisciplinary approach at different times. For example, in the study conducted by Dogan (2014), it was observed that students succeeded in learning the information by taking advantage of different disciplines, developing various viewpoints at the source of the problem, being very active in the

course. In addition, in the applications carried out, the students were successful in transferring the information they learned to daily life, as well as an important conclusion was reached.

One of the negative situations encountered during the research activities was the disciplinary problems that occasionally appeared in the crowded classrooms. In this case, it became difficult to provide active participation of all the students in some of the courses. In addition, crowded classes also prevent the provision of a student-centered learning environment. During the research, it was observed that some problems occurred during the application of the interdisciplinary approach in the crowded classrooms. Therefore, the governors must take the necessary precautions, and the crowded classes in some regions should make the necessary efforts to reach their ideal number.

The planning of activities related to interdisciplinary approach in this study was done by the course teacher previously. It was observed that the Ministry of National Education curriculum is inadequate in terms of activities that can be carried out in the process. Since the content in the available textbooks is not conducive enough to plan interdisciplinary activities and to associate them with different disciplines, textbooks is used very little in the process. It is thought that the content of the materials and textbooks prepared for education should be supportive of the interdisciplinary approach in terms of functioning of the program properly. This approach needs to be supported with the textbooks and the instruction materials to achieve its goal more appropriately. The Ministry of national education should work on both the curricula and the supply of materials and ensure that the content is better suited to the approach. Another factor that is required to successfully carry out the interdisciplinary approach in general is the educational environment. Different physical environments are needed to carry out activities of different disciplines. The use of different tools and materials of discipline contributes to the efficient learning of the relevant topic or theme. As a matter of fact, Coşkun (2009) stated that teaching materials should be used to make the interdisciplinary teaching approach effective.

In this study, the teacher made and implemented the planning himself without exchanging any opinions with his colleagues. However, teachers who are practitioners of the system should exchange ideas with each other during the planned activities. They should also have enough knowledge and skills about interdisciplinary approach and have mastery of the subject. Teachers can be given in-service trainings on the subject.

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