Southeast Asia Early Childhood Journal, Vol. 12 (2), 2023 (20-35)
eISSN 2821-3149
http://ejournal.upsi.edu.my/index.php/SAECJ

AN EFFECTIVE, ENTERTAINING AND INTERESTING TOOL TO IDENTIFY STUDENTS' MISCONCEPTIONS: THE CONCEPT CARTOONS

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Received: 29 April 2023; **Accepted:** 02 August 2023; **Published:** 08 August 2023

To cite this article (APA): Önal, H. An effective, entertaining and interesting tool to identify students' misconceptions: The concept cartoons. *Southeast Asia Early Childhood Journal, 12*(2), 20–35. https://doi.org/10.37134/saecj.vol12.2.2.2023

To link to this article: https://doi.org/10.37134/saecj.vol12.2.2.2023

ABSTRACT

The aim of this research is to determine the students' misconceptions of using concept cartoons and to evaluate the lessons taught with concept cartoons according to the students' opinions. The model of the research is the case study, which is one of the qualitative research methods. Participants are a total of 82 students, attending the 3rd grade (8 years old). Descriptive analysis method was used in the analysis of the data. Considering the results of the research, although most of the students chose the right character and stated the reasons for finding operational mistakes, it was determined the students who stated that they agreed with the characters in the wrong instruction and put forward reasons, most of which included misconceptions. For the lessons taught with concept cartoons, students; that they like concept cartoons very much, that they create curiosity and excitement in themselves, by using concept cartoons, they will not make mistakes, and even if they make mistakes, they will be able to realize and correct their mistakes by discussing with their friends and teachers, that the lessons cannot always be done with concept cartoons, that the teachers will make this decision stated as. As a result, it has been concluded that the use of concept cartoons is effective in identifying students' misconceptions and understanding their thinking processes, and that concept cartoons can be used easily in classrooms, increasing the interest and motivation of students, and enabling them to learn while having fun.

Keywords: concept cartoon, mathematics, misconception, mistakes, primary school

INTRODUCTION

The need to learn mathematics is enormous and continues throughout life. On the other hand, mathematics is a difficult field for many students to learn. Many of these students have difficulty obtaining technical degrees due to their difficulties in mathematics (Moore & Shulock, 2010). Mathematics is more than solving a lot of examples or imitating the methods described by the teacher. Doing mathematics means developing methods for solving problems, applying these methods, seeing whether they lead to a result and checking whether the answers given are meaningful (Van de Walle et al., 2014). We all use mathematics in our daily lives. Our ability to calculate, solve problems and apply mathematical concepts and skills affects many decisions in our lives. Success or failure in mathematics has little to do with the labels

attributed to it and is more linked to what is taught, how it is taught and the child's ability to be a learner. At the point of how it is taught, alternative methods and tools should be developed to meet the needs of students and to maximize their learning (Witsel & Little, 2018). At the primary and preschool levels, material and activity-based teaching methods for students have been the focus of teaching and learning mathematics (Ali & Mukhtar, 2017). It can be said that one of the methods and techniques that can be used to make mathematics lessons fun and interesting for students is concept cartoons (Dabell, 2008; Davidson & Askew, 2012; Samkova, 2017; Sexton, 2008; Sexton et al., 2009).

Concept cartoons include a pictorial representation of characters in settings familiar to students along with the use of written language or speech bubbles. Concept cartoons have some features in common with those used in comics, but rather than being designed to evoke joy, laughter, and fun, they aim to provide students with the opportunity to interpret and understand concepts (Keogh & Naylor, 1999; Naylor & Keogh, 1999). Concept cartoons primarily aim to serve as a teaching and learning tool (Naylor & Keogh, 1999). It is important to present alternative concepts, expressions, or questions about a main idea in a cartoon (Kabapınar, 2005; Naylor & Keogh, 1999). The fact that cartoons have a wide variety of views enables more diverse views and ideas to emerge in the classroom and creates a discussion environment in the classroom (Dabell 2008; Davidson & Askew, 2012; Kabapınar, 2009; Naylor & Keogh, 1999; Naylor et al., 2007). It helps students to question their thoughts, evaluate other points of view that might conflict with their own, and solve this problem (Dabell, 2004; Kabapınar, 2009; Naylor & Keogh, 1999). Generally, questions or views of three or more characters about a daily event are presented in the form of speech bubbles (Keogh & Naylor, 1999). While one of the ideas presented in the speech bubbles is necessarily scientific truth, the others consist of non-scientific truths, which are defined as misconceptions, on which students can think and express their personal thoughts (Kabapınar, 2005).

Misconceptions are defined as behaviours that emerge because of students' false beliefs and experiences (Cockburn & Littler, 2008; Ojose, 2015; Spooner, 2002). Students acquire new knowledge by using their previous knowledge. Therefore, it is very important to evaluate the prejudices of the students. Preliminary information is not always accurate; misconceptions may exist. Even when students correctly observe characteristics that examples have in common, they may connect a pattern with a misconception and thereby learn an erroneous procedure (Ashlock, 2006). It is important to identify the misconceptions and mistakes that students have in order to support them while they make sense of the concepts and skills learned in the mathematics subjects they are learning (Bamberger et al., 2010). Misconceptions should be used as a jumping off point or starting point in teaching. It is possible for teachers to turn the misconceptions that arise during teaching into an advantage. It is important to discuss the mistakes made by students in the classroom to be converted into an advantage (Borasi, 1994). Children learn mathematics through their experiences inside or outside the classroom. The role of teachers is very important for children to understand mathematical concepts correctly (Jamil, 2015). Effective teachers should have a variety of strategies in their course planning that do not undermine student confidence by predicting student mistakes, without allowing them to become widespread.

The use of concept cartoons aims to reveal students' pre-mathematics knowledge. It is expected that the use of concept cartoons in the mathematics lesson will encourage students to discuss their previous knowledge and question their current beliefs, thus enabling misconceptions to be revealed and addressed (Davidson & Askew, 2012). Concept cartoon is a learning and teaching tool used primarily in science education to explore scientific concepts

(Dabell et al., 2008; Kabapınar, 2009; Naylor & Keogh, 2013). While creating concept cartoons for mathematics teaching, creating cartoons on mathematical concepts instead of just examples related to daily life, and basing the discussions and research on mathematical situations or facts, unlike the way it is in science teaching, can expand the usage areas of cartoons and increase their effectiveness (Uğurel & Moralı, 2006). The studies show that its use in mathematics education is also effective (Dabell, 2008; Dabell et al., 2008; Davidson & Askew, 2012; Önal & Çilingir-Altıner, 2022; Samkova, 2017; Sexton, 2008; Sexton et al., 2009). Mathematical concept development begins with early childhood (Fuson et al., 2015; Pound, 2008; Sophian, 2017). Mathematics learning in early childhood lays the foundation for more complex mathematics learning in the future. This is very important for a child's academic success. Without a solid foundation and a correct teaching strategy, the future of children's academic success will be negatively affected (Sia & Abu Bakar, 2022). The learning area of numbers and operations and the arithmetic operations in this area occupy a large place in the primary school mathematics curriculum and form the basis of the mathematical subjects to be learned later. In this period; Incorrectly learned information, mistakes made, and misconceptions affect students' mathematics achievement and attitudes towards mathematics in later education situations. In the primary school process, how these processes are learned depends on pre-school pre-learning. Identifying mistakes and misconceptions is important in terms of correcting and preventing mistakes made and possible misconceptions in the early period. At the same time, it is thought that this study is important in terms of determining whether it is necessary to give more space to the use of concept cartoons in primary school mathematics lessons. The aim of the research is to determine the students' misconceptions of using concept cartoons and to evaluate the lessons taught with concept cartoons according to the students' opinions.

METHODOLOGY

Research Model

Qualitative research is a method of research that describes how people interpret their experiences (Merriam & Tisdell, 2015). Case studies are one of the qualitative research designs that are a way of looking at what is happening in the environment, systematically collecting data, analysing it, and presenting the results. The resulting product is a keen understanding of why this is so and what needs to be focused on more detail for future research (Davey, 1990). In this direction, these method and design was used in the research as it was aimed to determine the students' misconceptions of using concept cartoons and to evaluate the lessons taught with concept cartoons according to student opinions.

Participants

The participants of the research were determined by using criterion sampling, one of the purposive sampling methods. A total of 82 students, 48 girls and 34 boys, attending the third grade (8 years old) at the same public primary school in Ankara, Turkey, participated in the research conducted in March of the 2020-2021 academic year. Criterion sampling: It is the study of all situations that meet a predetermined set of criteria. The criterion is created by the researcher, or a pre-prepared list of criteria can be used (Marshall & Rossman, 2014). In the selection of the research sample; as a criterion, participants had not encountered concept

cartoons before, and that there were classes with mixed-ability students in terms of the effectiveness of in-class discussion, and the school to be applied was determined accordingly.

Data Collection Tool

The "concept cartoon worksheet" developed by the researcher was used as a data collection tool in the research. In the first four questions in the worksheet, to determine student misconceptions, concepts containing incorrect operation questions thought to be misconceptions of students were included. In this direction, firstly, mathematical questions thought to have misconceptions of students were prepared, and at this point, the questions were formed by examining the relevant literature and interviewing mathematics education experts. The answers of the characters presented in the speech bubbles were created in the form of dialogues that would provide an in-class discussion environment, in which a character's answer includes scientific truth and other alternative ideas (cases where possible student misconceptions may occur). Considering that the scenario takes place in familiar environments known to the students, the classroom environment, teacher and student characters were included.

The last three questions in the worksheet to determine the students' opinions on the use of concept cartoons were formed as questions in which students can easily express their opinions by interviewing the experts in the relevant literature and their fields. At this stage, the opinions of experts in this field and classroom teachers were used. Davis technique was performed by taking expert opinion from 3 mathematics education experts and 2 classroom teachers. The suggestions given by the experts were examined and the items in the worksheet were reviewed and necessary corrections were made. Content validity indexes (CVI) were determined in line with the data obtained from the experts. Davis (1992) grades expert opinions on the technique as (1) “The item is appropriate”, (2) “The item needs some correction”, (3) “The item should be seriously reviewed” and (4) “The item is not suitable”. In this technique, the content validity index (CGI) of 0.89 was obtained by dividing the number of experts who ticked options (1) and (2) by the total number of experts. If the CGI is above 0.80, it is accepted that the content validity result of the questions in the scale is appropriate (Davis, 1992).

The draft version of the concept cartoons before being illustrated was piloted on 13 students in a different school than the study group and in the operational mistakes in the concept cartoon, the students were asked to state which character they agree with, the reasons for choosing this character, and their opinions on the use of concept cartoons. Upon the incoming feedbacks, the concept cartoon of seven questions was finalized by making the necessary arrangements. There are concept cartoons of 4 scenarios in the worksheet. To identify students' misconceptions under each of these scenarios, “Which character said the correct answer? Why?" question is included. To evaluate the lessons taught with concept cartoons according to students' opinions; “Did you like concept cartoons, what did you think about them? "Did you also make the operational mistakes shown in the pictures in the first and second grades? If your lessons were done with pictures like this, would you still make mistakes?", "Would you like your mathematics lessons to be taught using concept cartoons in this way?" questions are included. The visuals in the concept cartoon worksheet are in Figure 1.

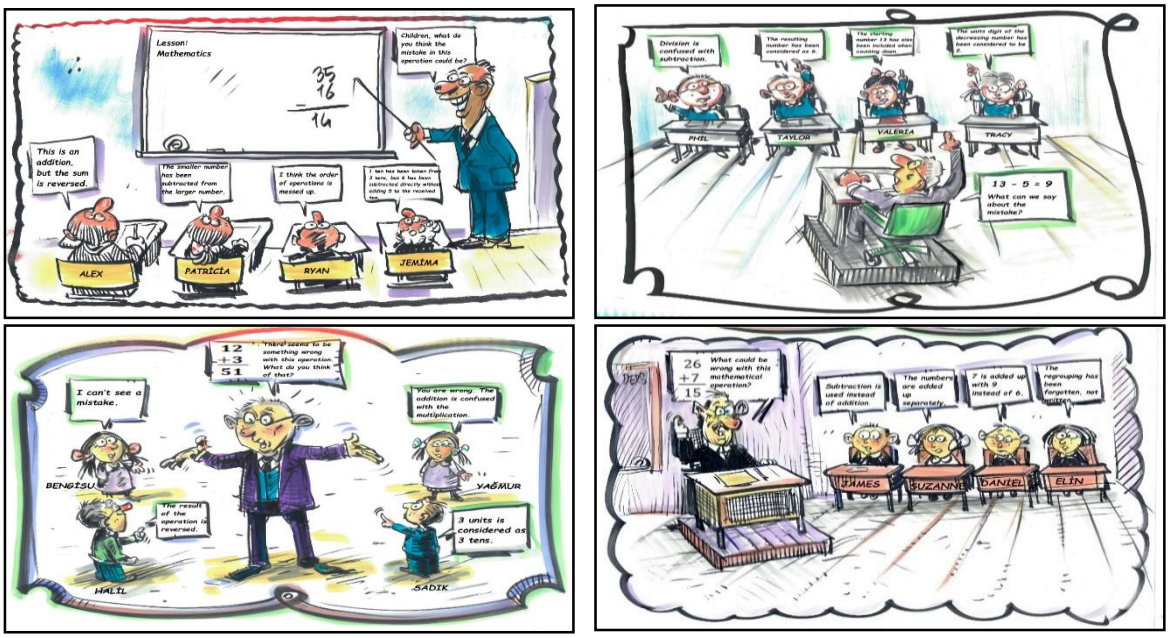

Figure 1. The images in the concept cartoon worksheet.

Data Collection Process

The data were collected during the implementation of formal education 2 days a week in schools in March, when the effects of the Covid-19 epidemic diminished. The researcher gave information about the study and the process to the school administrators and teachers in the schools where the application would be made. Necessary consents were obtained from the participants and their families to participate in the study. The researcher informed the classroom teachers of 4 different classes (A-B-C-D) at the third-grade level (8 years) in a public school about how to implement the research. The research was carried out during 2 course hours. In line with the information provided, in the first hour of the mathematics course, the teacher was asked to distribute concept cartoon worksheets to the students and give a brief information about the use of concept cartoons. Then, the teacher asked the students to read the speech bubbles, individually answer which character they agreed with regarding the concept and why. After the first four questions were completed, groups of 3-4 people were formed in the class and the group discussion was requested, and the students selected from different groups in the class were given the right to speak and as a whole class discussion, they were asked to explain which character they chose and why. In the second lesson hour, the students were asked to answer the other questions (5th, 6th, 7th) in the worksheet to determine their views on concept cartoons. The classroom teachers were asked not to be directive in the answers of the students during this period. The classroom teachers delivered the worksheets containing the students' answers to the researcher, and the data were collected. During the data collection process, the researcher in the classroom; It has not been found to avoid the conditions and distraction caused by the pandemic conditions.

Data Analysis

In the research, the data collected using the "concept cartoon worksheet" were analysed with the descriptive analysis technique. In descriptive analysis, it is essential to present the interview transcripts, document texts and observation notes to the reader in a descriptive manner with direct quotations from the collected data (Creswell, 2016; Marshall & Rossman, 2014; Miles & Huberman, 1994). The researcher is obliged to present events and facts without distorting the truth; events and facts are not detached from their own reality and context, they are tried to be preserved as they occur (Miles & Huberman, 1994). The answers given by the students to the worksheets formed the data of the research. The data obtained from the students participating in the research were organized by labelling as Student1, Student2, … Student82. The answers given by the students to the worksheet were examined, and which student participated in which concept cartoon character was tabulated according to the number of students. The reasons for choosing the characters and the thoughts of the students about the concept cartoons were presented by the researcher as they were, without adding any comments.

To ensure reliability, randomly selected samples from student handouts were analysed at different times and the results were compared. Member control is the most useful method to increase reliability in qualitative research (Glesne, 2012; Miles & Huberman, 1994). In this study, while descriptive analysis was carried out, another researcher, who is an expert in mathematics education, was provided to analyse the data and reach the results to ensure reliability. Miles and Huberman (1994) reliability formula (Reliability = Consensus / (Agreement + Disagreement) x 100) was used to calculate the consistency between the two analyses, and the consistency value was determined as 94.62%. This shows that the research results are reliable. According to Miles and Huberman (1994), if the reliability calculations are over 70%, they are considered reliable for research.

RESULTS

In this part of the study, examples of concept cartoons used in the data collection process, findings that emerged in line with the data obtained, tables of each concept cartoon and student opinions are included. The first example of the concept cartoon created to identify students' misconceptions in the process 35 - 16=14 is given in Figure 2.

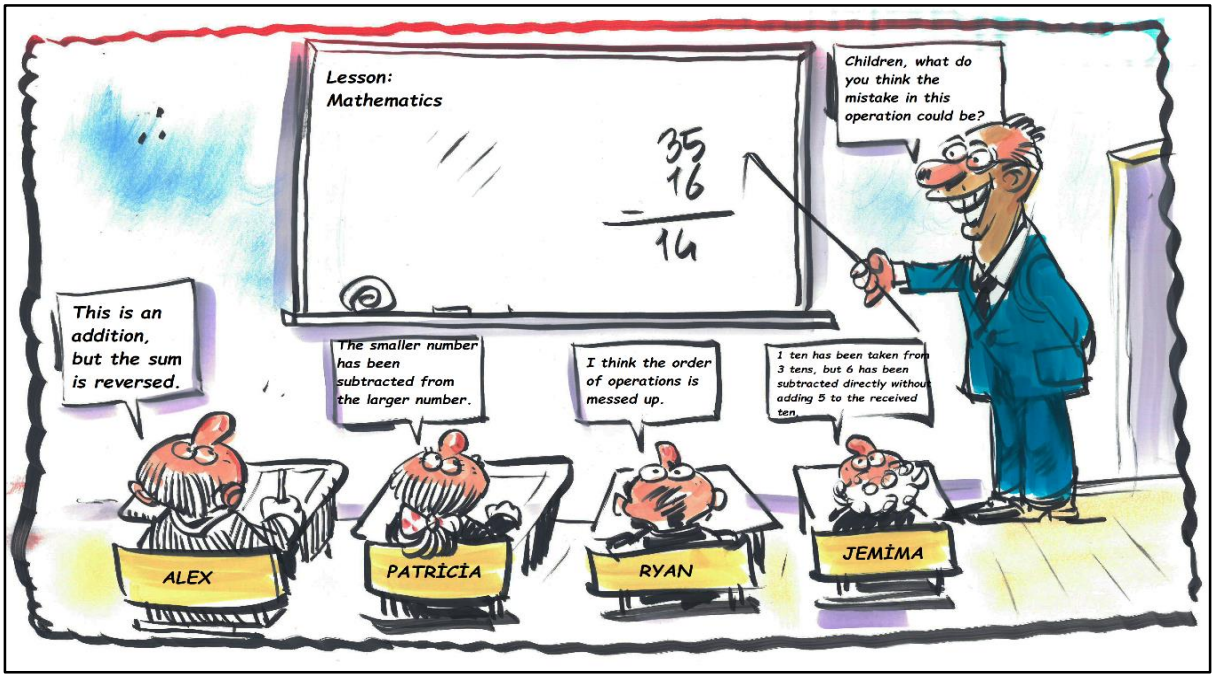

Figure 2. The example of concept cartoon for finding the mistake in the operation of 35 – 16 = 14.

After the concept cartoon was shown, the students were asked to determine the name of the most appropriate character to their thoughts and calculations regarding the mistake made in the operation and indicate the reason for choosing this character. The determination of the possible misconceptions of the students in the operation of 35 – 16 = 14 is given in Table 1.

Table 1
The determination of the mistakes in the operation of 35 – 16 = 14.

Class	Alex	Patricia	Ryan	Jemima	Patricia & Jemima	Alex & Ryan	Patricia & Ryan	Unanswered	Total
A	6	3	4	7	1				21
B	8	4	6	7		1			26
C	5	4	2	5	1			1	18
D	6	2	3	5			1		17
Total	25	13	15	24	2	1	1	1	82

When Table 1 is examined, for the mistake made in the 35 – 16 = 14 operation, a total of 25 third-year students' Alex (this is an addition, but the sum is reversed) character, Jemima of 24 students (1 ten has been taken from 3 tens, but 6 has been subtracted directly without adding 5 to the received ten) character, 15 students chose the character Ryan (I think the order of operations is messed up), and 13 students chose the character Patricia (The smaller number has been subtracted from the larger number). The student43 who chose the character of Alex was the reason for choosing "He has processed from left to right, that's how I do it." gave the answer. This kind of misconception; this is because many students do not internalize the sequence of operations sufficiently or do not understand the concept of sequence and sequence sufficiently in the multistage process (Hansen et al., 2014). Choosing the character Patricia,

student25 “because always subtracts the smaller number from the larger number.” He stated the reason for his choice. When the student answer is examined, it is seen that the student has misconception. Such misconceptions can be seen by making changes in the questions that students commonly encounter in subtraction, in the direction of subtraction, where the student feels less difficulty (Ashlock, 2006; Ojose, 2015; Önal & Aydın, 2022; Ryan & Williams, 2007; Sadi, 2007).

The second example of a concept cartoon to identify students' misconceptions in the operation of 13 - 5 = 9 is given in Figure 3.

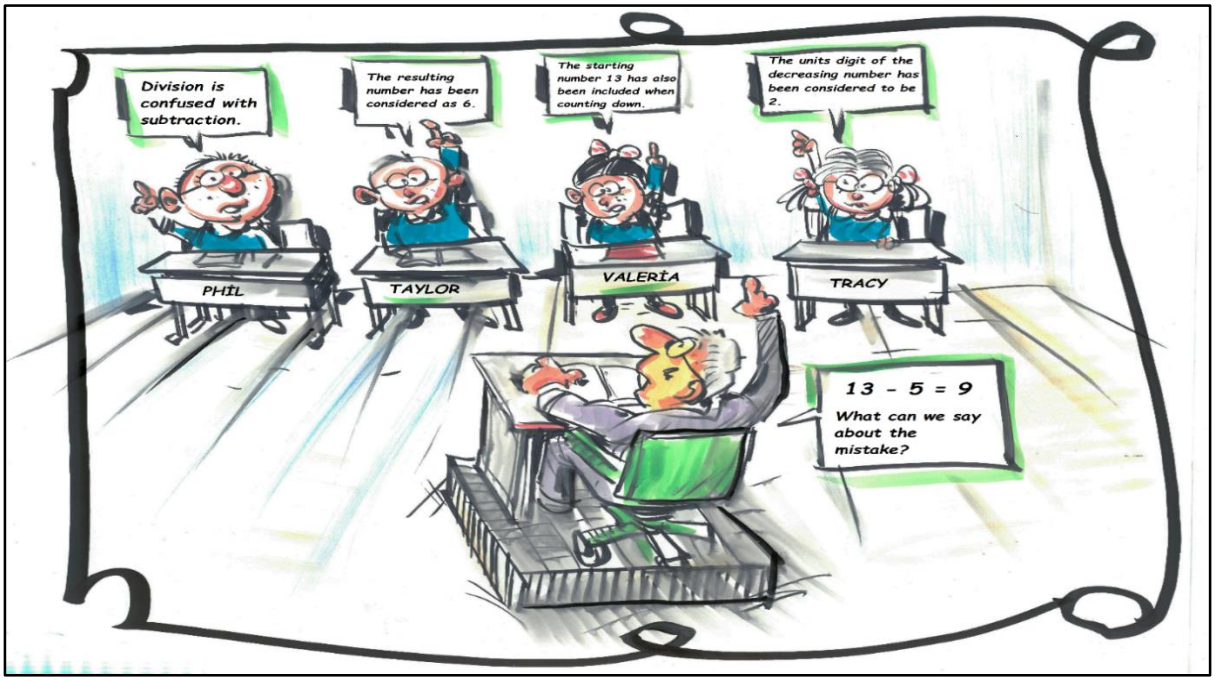

Figure 3. The example of a concept cartoon for finding the mistake in the operation of 13 – 5 = 9.

After the concept cartoon was shown, the students were asked to determine the name of the most appropriate character to their thoughts and calculations regarding the mistake made in the operation and indicate the reason for choosing this character. The determination of the possible misconceptions of the students in the operation of 13 - 5 = 9 is given in Table 2.

Table 2
The determination of the mistakes in the operation of 13 - 5 = 9.

Class	Phil	Taylor	Valeria	Tracy	Taylor & Valeria	Phil & Tracy	Unanswered	Total
A	3	5	6	5		1	1	21
B	4	7	8	7				26
C	3	3	7	4	1			18
D	2	4	6	4			1	17
Total	12	19	27	20	1	1	2	82

When Table 2 is examined, 12 students chose the character Phil (division is confused with subtraction), 19 students chose the Taylor (the resulting number has been considered as 6) character, 27 students chose the Valeria character (the starting number 13 has also been included when counting down), and 20 students chose Tracy (the units digit of the decreasing number has been considered to be 2) character. It was determined that 1 student each agreed with the views of the characters Taylor & Valeria and Phil & Tracy. When the characters that the students agree with are examined, it is seen that they chose the other characters with the same frequency, except for the character Phil. Student75 who chose the character Phil stated the reason for choosing the character as "because the symbol represents the division operation". It has been determined that the student has a misconception with this answer. According to Hansen et al. (2014), It can be difficult for children to distinguish each pair of symbols and, as the child may have a poor conceptual understanding of multiplication and division, he or she is more likely to gravitate towards the concepts of addition and subtraction. In addition to introducing symbols to children, they also need to have a solid understanding of the underlying concepts.

An example of a concept cartoon to identify students' misconceptions in the operation of 12 + 3 = 51 is given in Figure 4.

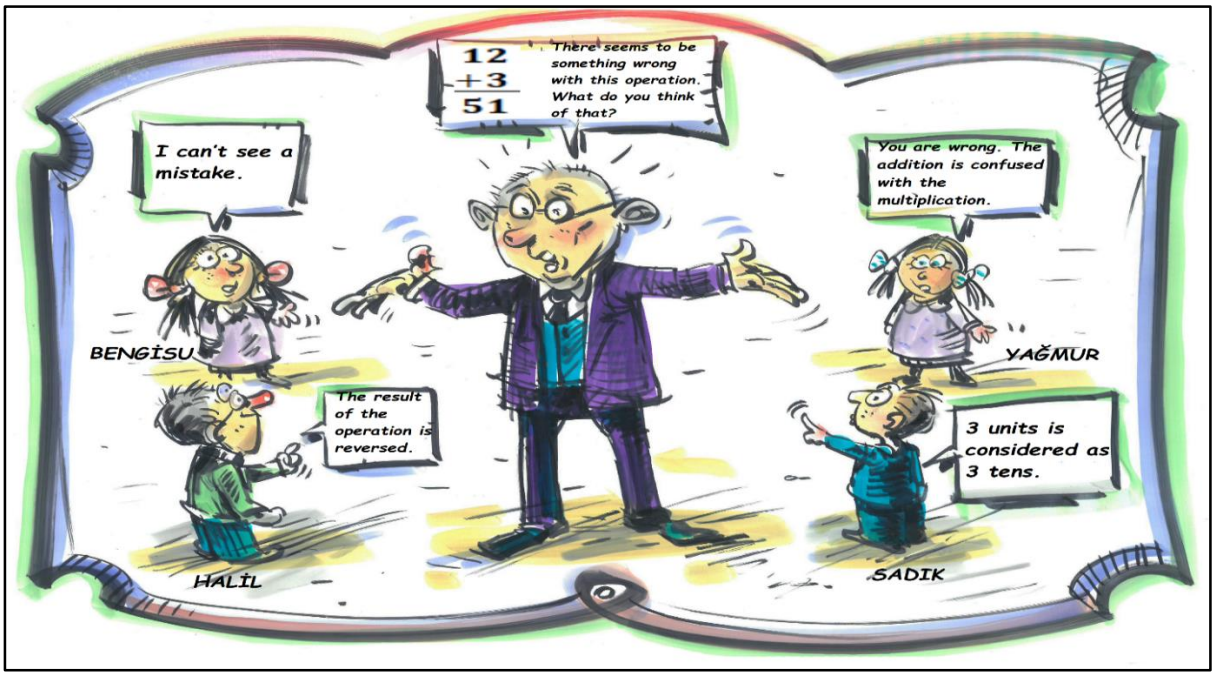

Figure 4. The example of a concept cartoon for finding the mistake in the operation 12 + 3 = 51.

After the concept cartoon was shown, the students were asked to determine the name of the most appropriate character to their thoughts and calculations regarding the mistake made in the operation and indicate the reason for choosing this character. The determination of the possible misconceptions of the students in the operation of 12 + 3 = 51 is given in Table 3.

Table 3
The determination of the mistakes in the operation of 12 + 3 = 51.

Class	Bengisu	Halil	Sadık	Yağmur	Halil & Yağmur	Halil & Sadık	Sadık & Yağmur	Unanswered	Total
A	3	6	7	4				1	21
B	4	8	8	4		1	1		26
C	3	7	5	2	1				18
D	1	8	3	3	1			1	17
Total	11	29	23	13	2	1	1	2	82

When Table 3 is examined, it has been determined that 11 students chose the character Bengisu (I can't see a mistake), 29 students chose the character Halil (The result of the operation is reversed), 23 students chose the character Sadık (3 units is considered as 3 tens), and 13 students chose the character Yağmur (You are wrong. The addition is confused with the multiplication). Student18 gave the answer, "Multiplication was performed when addition should have been done, multiplying increases the numbers" as the reason for choosing the Yağmur character. At this point, the student's thought that multiplication always enlarges the number appears as a misconception. A student who has such a misconception over-generalizes the rule that multiplication in natural numbers always enlarges the result, and acts with this generalization in multiplication in decimal numbers and fractions. As a result, they have difficulties in solving such calculations. Students may think that "multiplication increases, division decreases" in all operations (Baki & Aydın Güç, 2014).

An example of a concept cartoon to identify students' misconceptions in the operation of 26 + 7 = 15 is given in Figure 5.

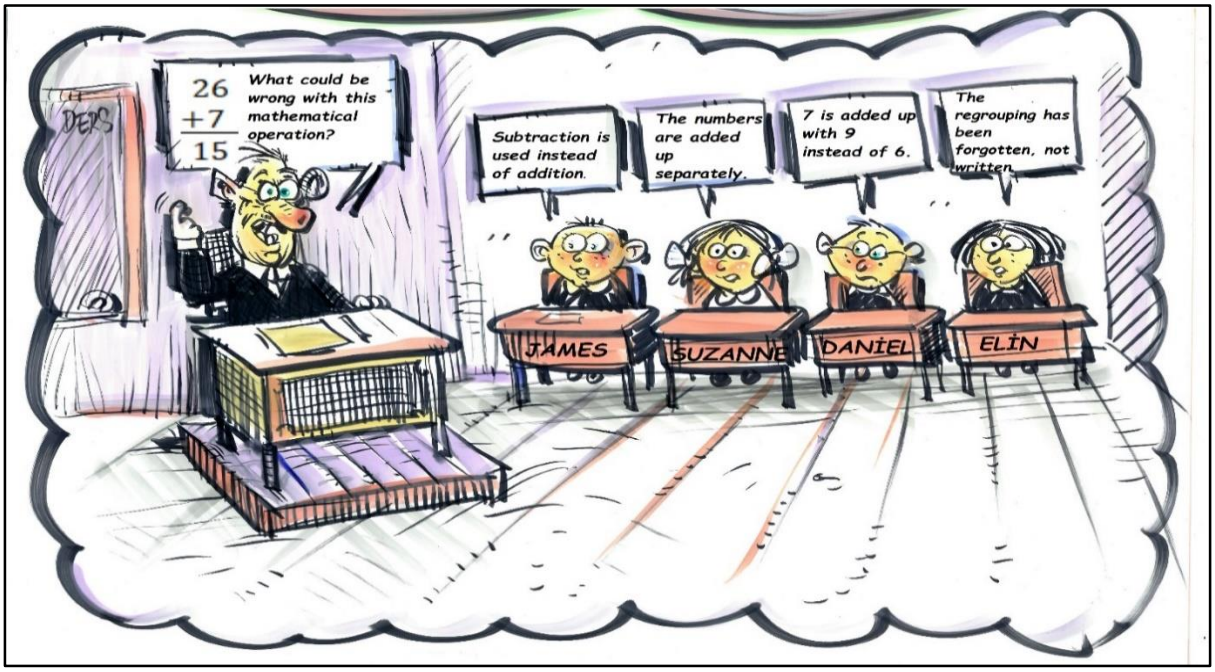

Figure 5. The example of a concept cartoon for finding the mistake in the operation 26 + 7 = 15.

After the concept cartoon was shown, the students were asked to determine the name of the most appropriate character to their thoughts and calculations regarding the mistake made in the operation and indicate the reason for choosing this character. The determination of the possible misconceptions of the students in the operation of 26 + 7 = 15 is given in Table 4.

Table 4
The determination of the mistakes in the operation of 26 + 7 = 15.

Class	James	Suzanne	Daniel	Elin	James & Suzanne	Suzanne & Elin	Daniel & Elin	Unanswered	Total
A	5	7	5	2			1	1	21
B	7	8	6	4		1			26
C	5	6	4	2				1	18
D	4	5	4	1	1		1	1	17
Total	21	26	19	9	1	1	2	3	82

When Table 4 is examined, to find the mistakes made in the operation 26 + 7 =15, 21 students chose the character James (subtraction is used instead of addition), 26 students chose the character Suzanne (the numbers are added up separately), 19 students chose Daniel (7 is added up 9 instead of 6), and 9 students chose the character Elin (the regrouping has been forgotten, not written). Student62 stated that he agreed with the character of Elin. As the reason for joining, he gave the answer "he had to subtract to find the result but forgot to carry over one to tens digit." It can be said that the student has a misconception. It is clear from this answer that the number we receive tens from the other digit is decreased however, the student uses the concept of regrouping, which increases the number. When the characters they agree with the students are examined, it is seen that they chose the other characters with the same frequency, except for the character Elin. When students can't solve operations, they change the rules to fit the operations instead of quitting. Faulty solutions may be permanent. As a result, misconceptions occur. Misconceptions begin as a void formed by a lack of knowledge. This gap is randomly filled by the unqualified teaching given by the teacher, the existing knowledge of the students, and the experiences encountered. The information obtained by the student with random fill-in-the-blanks is undoubtedly successful to some extent, but after a point, this event appears as systematic mistakes.

For the evaluation of the lessons taught with concept cartoons according to the students' opinions; "Did you like concept cartoons, what did you think about them?" to the question;

Student48: *"I liked it very much, we had a lot of fun in our lesson."*
Student14: *"I wish our math classes were always like this."*
Student32: *"When our teacher handed out our worksheets and saw the cartoons, I said 'hooray' in my mind.*"
Student61: *"We discussed the results with my friend even during the break time."*
Student39: *"Yes, I liked it very much, it was very enjoyable to learn with pictures."*
Student75: *"I chose the wrong character; I understood it when I talked to my friends."*
Student4: *"I liked it because it was more understandable with concept cartoons.".*

When student answers are examined, it is seen from the answers that their thoughts on the question "Did you like the concept cartoons, what did you think about them?" are quite positive. Most of the students stated that they loved, liked and were interested in concept cartoons. At the same time, they stated that they corrected their mistakes by discussing them with their friends.

When the answers given by the students to the question of "Did you also make the operational mistakes shown in the pictures in the first and second grades? If your lessons were done with pictures like this, would you still make mistakes?":

Student43: *"When I counted with my fingers, I would either find one less or one more, I counted the first number twice, but I did not make any mistakes in this operation. If I had learned this way first, I would have realized my mistake and I would not have made any mistake."*
Student25: *"I also used to find the result of the operation, but write it inversely, I was confusing the places of tens and units. The decimal is written to the right because it is larger. My teacher noticed it and then I didn't make any more mistakes.".*
Student80: *"I wish our lessons were like this from the first grade, because it's so enjoyable, I wouldn't make any mistakes."*
Student57: *"I used to add the numbers one by one starting from the top as in the operation 26 + 7 = 15, then when I learned the tens digit, I realized my mistake. With these pictures, I wouldn't make mistakes, I would always do it right."*
Student79: *"I remember that I wasn't doing it, I wouldn't do it if it was like this.".*

To the question of "Did you also make the operational mistakes shown in the pictures in the first and second grades? If your lessons were done with pictures like this, would you still make mistakes?", some students said that they used to make mistakes and then corrected these mistakes, and the majority of them said that they would not have made any mistakes if the lessons were taught using concept cartoons.

The answers given by the students to the question of "Would you like your mathematics lessons to be taught using concept cartoons in this way?":

Student11: "*Yes, I would even like all our lessons to be like this."*
Student50: *"Our teacher promised, we will have the lessons like this again, but it doesn't always happen."*
Student2: *"İt would be great, I would have liked the math class more."*
Student34: *"Sometimes it can be nice."*
Student41: *"I would love to, it is very entertaining, we discuss with our friends."*
Student53*: "Depending on the request of our teacher, it may be.".*

When the answers were examined, it was seen that the students mostly expressed their opinions that the lessons should be taught by using concept cartoons and stated that their teachers could make this decision and that the lessons could not always be held in this way.

DISCUSSION AND IMPLICATIONS

When the answers given by the students are examined, it is seen that many students chose the correct character for finding the operational mistakes and stated their reasons, but in the instruction, the students who stated that they agreed with the wrong characters and put forward reasons containing misconceptions are also identified. At this point, it can be said that the use of concept cartoons is effective in identifying the misconceptions of the students and understanding their thinking processes. The studies (Balım et al., 2008; Keogh & Naylor, 1999; Dabell, 2008; Davidson & Askew, 2012; Ekici et al., 2007; Kabapınar, 2009; Samkova, 2017; Sexton, 2008; Sexton et al., 2009) support this result. Misconceptions are very common in mathematics. They accumulate throughout the educational life of a child. Some are specific to the subject, others are the results of teaching methods that encourage the emergence of these misconceptions (Sadi, 2007). Misconceptions can be detected by increasing the use of concept cartoons in mathematics lessons, which are thought to be students' misconceptions. Ryan and Williams (2007) stated that, it is impossible to teach mathematics in a way that prevents students' mistakes and misconceptions, and it should be the responsibility of the teacher to reveal and address the mistakes of learners in the classroom.

According to the other results of the research, when the students' opinions are examined, it is seen that the students gave very positive answers to the concept cartoons, stated that they liked them very much, they were interested in them, and the concept cartoons aroused curiosity and excitement in them. They said that they made operational mistakes in the first and second grades and that they would mostly not make mistakes if the lessons were taught using concept cartoons. They stated that even if they made mistakes, they could realize and correct their mistakes by discussing with their friends and teachers. At the same time, they also stated that they mostly expressed their opinion that mathematics lessons should be taught using concept cartoons, and that their teachers could make this decision, and that the lessons could not always be taught in this way. In their study, Naylor and Keogh (2013) concluded that the reactions of teachers and students to concept cartoons were generally quite positive. They stated that even the naughtiest child in the class did not want the lesson to end to continue the discussion. Balım et al. (2008) stated that concept cartoons containing visual elements related to the subject to be taught increase the interest and motivation of the students, thus enabling them to learn while having fun. Birisci et al. (2010) in their study with prospective classroom teachers showed that the use of concept cartoons in teaching frees students from boring traditional lectures, makes the lesson more interesting and fun, and enables students to participate more actively in the lesson. lesson. They also stated that concept cartoons create a discussion environment where students can develop their critical thinking skills, positively affect students' attitudes towards the course and the school in general and have an important role in increasing students' academic success.

Concept cartoons can be used easily in the classroom. It encourages student participation and creates a motivating atmosphere (Keogh & Naylor, 1999; Naylor & Keogh, 2013). At the same time, researchers stated that teaching through concept cartoons minimizes classroom management problems and provides a manageable way to base teaching directly on the ideas of individual students (Keogh & Naylor, 1999; Kabapınar, 2009). Concept cartoons are one of the activities that can be used to reduce students' negative thoughts about mathematics, and they are tools that are frequently used in mathematics teaching (Dabell, 2008; Uğurel & Moralı, 2006). Concept cartoons can be used as lesson starters, turned into whole-class lessons, and used as general activities or summative assessments (Dabell, 2008). Research on concept cartoons has shown that the discussion created through concept cartoons is focused

and self-sustaining, resulting in high student engagement (Kabapınar, 2009; Keogh et al., 2003; Naylor et al., 2001).

CONCLUSION

In this study, students' misconceptions about four operations were tried to be determined. Such studies can also be done in the field of geometry, measurement, and data processing, which are other learning areas of primary school mathematics. The different concepts can be used. In this study, worksheets were distributed to the students individually. The worksheets can be distributed to groups or projected to the whole class with the help of projection. Concept cartoons, in which students present a generally positive opinion, can be used to obtain information about how they make sense of the learned mathematical concepts and to draw attention at the beginning of the lesson. To increase motivation, keep the interest alive during the course and to gain the ability to look at different perspectives critically, they can be used as an evaluation tool to evaluate students' learning at the end of the course and in the subjects where students make mistakes, have difficulty in understanding, and think they may have a misconception.

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