

## A CASE STUDY OF TEACHING ADDITION AND SUBTRACTION TO A STUDENT WITH DYSCALCULIA

**Abstract:** In this study, it was aimed to teach the addition and subtraction to a student with dyscalculia who is in third grade at elementary school. Before preparing individualized program, the student was given a pretest to measure about his level of the subject. The instruction was carried out in a room in the school, with a time of 40 minutes per day in the form of individual instruction with the student. In addition, the study was supported by a researcher-developed scenario booklet, concrete materials, computer games, reinforcement award, and assignments. This study was conducted as a case study, one of the qualitative research methods. The data were analyzed by descriptive analysis technique. Results of the study indicate that the student achieved more than 90 % objectives on teaching basic addition and subtraction skills at the third grade. Gains have been actualized by the student with mathematic learning difficulties with over 90 % success in 63 individualized lessons. On the other hand, social validity data were collected through observation and interviews to identify strengths or weaknesses and changes occurring in the student work. As a result of the studies, it has been determined that the student gained self-confidence by enjoying his sense of accomplishment.

**Keywords:** Dyscalculia, mathematics learning disabilities, teaching addition and subtraction

### **Beyza Koç PhD**

Teacher  
Ministry of National Education,  
Konya  
Turkey  
Contact:  
E-mail: koc\_beyza@hotmail.com  
ORCID: 0000-0002-5674-7037

### **İsa Korkmaz PhD**

Full Professor  
Necmettin Erbakan University, Konya  
Turkey  
Contact:  
E-mail: ikorkmaz@erbakan.edu.tr  
ORCID: 0000-0002-6647-1812

## INTRODUCTION

It is impossible for all individuals to benefit from general education in the same way, time and efficiency. Different teaching methods and applications need to be employed for different individuals. Those are the individuals who require special education. Special education is the part of general education system that are provided to students with disabilities in cognitive, behavioral, social-emotional, physical and sensory areas and they are individually planned and aim to maximize the possibility of individual's living independently (Eripek, 1998). Individuals with special education needs are classified by Turkey's Ministry of National Education Special Education Services Regulation (MONE, 2006). Classifications are made according to the common characteristics and educational needs of individuals, although each individual's needs are unique. One of these classifications is specific learning disability for particular subject. Based on DSM-5; it is a disorder that is validated with valid personalized success measurement tests and comprehensive clinical evaluation and is diagnosed when individual's learning and school skills are significantly and measurably less than expected according to the age of the person (Köroğlu, 2013).

According to the Special Education Services Regulation; an individual with specific learning difficulties is defined as a person who is in need of special education and supportive education services due to difficulty in listening, speaking, reading, writing, spelling, paying attention and mathematical operations. In fact, this disorder arises in one or more of the informational processes which are necessary to understand and use the language in written or verbal language (MONE, 2006). DSM-5 criteria are used in the diagnosis of learning disability in Turkey. In DSM-5; Learning Difficulties in schools are defined in three subgroups as reading disorder (dyslexia), numerical (mathematical) disorder (dyscalculia) and disorder of written expression (dysgraphia) (Köroğlu, 2013).

Difficulties with counting, learning number facts, doing mathematical calculations, telling time, counting money, measurement, mental math and

problem solving strategies are called as mathematical difficulties (dyscalculia) (Cortiella & Horowitz, 2014). Students who have learning disabilities (dyscalculia) in mathematics have difficulty in daily life because they have difficulty in using quantities such as money, time and direction. They do not understand the prices and their efforts to calculate products' total prices in their daily shopping. Using hand and finger for calculation of prices may embarrass them publicly. The complexity of mathematical processes made it difficult to define what it means to have a mathematical learning disability (Geary, 2003).

Although there are many definitions about dyscalculia, dyscalculia in the most general sense is the defect and inability to recognize and use mathematical relationships, and to recognize, use and write numerical symbols (Butterworth, 2003). Researchers (Chinn, 2004; Dowker, 2004, 2005; Gifford, 2005; Hannell, 2005) emphasize that mathematical difficulties are often associated with problems in other areas, and that mathematical skills should be considered together with the difficulties associated with language, spatial orientation and memory (cited in Dowker, 2009). Geary (2004) explained that the difficulties experienced by students with dyscalculia include: dividing items into subgroups, estimating, remembering the concepts of numbers, counting down, understanding and applying the concept of time, money, sorting, finding the direction (left/right), recognizing number models and understanding and applying the language of mathematics. In addition, children with mathematics learning difficulties have difficulty in performing simple arithmetic operations (Shalev & Gross-Tsur, 2001) and using recall based procedures to solve verbal problems.

It is viewed that teaching mathematics is very tough subject for students in all level in every society. Besides that, some students really experience mathematics learning difficulty for some reason even though they do not have any mental problems. Although 40 % of students have difficulty in mathematics, dyscalculia is about 4 to 6 % of the population (Beachman, Trott, 2005).

Butterworth (1999) stated that approximately 10 % of the population is dyslexic.

In DSM-5, it is reported that learning disability in school-age children with different languages and cultures are between 5 and 15%, and the reading disorder is between 4 and 9% and mathematics disorder is between 3 and 7% (Köroğlu, 2013). It is stated that the students who have mathematics learning difficulties are about two years behind their peers and one year behind their peers in terms of working memory capacity during learning mathematic strategies used to solve simple (4+3) and complex (16+8) addition operations (Geary, Hoard, Byrd-Craven, & De Soto, 2004). Students with learning difficulties in mathematics generally use underdeveloped calculation strategies such as finger counting when performing calculations. One of the issues related to early mathematics skills is that children can perform addition and subtraction procedures quickly by the way of recalling without calculation. This is the ability of automaticity. In general, 50 % of children without learning disabilities who are in the 3rd grade gain automaticity rapidly. However, students with learning disabilities can improve automaticity later than other children (Bender, 2014).

Children with specific learning difficulties also face emotional problems as well as academic failures. Learning disabilities can lead to a decrease in children's self-confidence and an increase in anxiety and stress levels. As declared in DSM-5, specific learning disorder can have negative functional consequences through lifetime, including lower academic success, higher rates of high school dropout, lower rates of postsecondary education, high levels of psychological distress and poorer overall mental health, higher rates of unemployment and lower incomes (Köroğlu, 2013)

For all students with mathematics learning difficulties or normal development, it is necessary to determine the deficiencies in mathematical skills, to investigate the causes of these problems and to propose solutions for these reasons as mathematics is one of the prerequisite skills for all academic life. In fact, the main aim of this research is to examine how a student with mathematics

learning difficulties acquires the addition and subtraction skills and to demonstrate the knowledge and skills of the student before and after the study.

## METHOD

In this study, an intrinsic case study from qualitative research methods was used. In an intrinsic case study, the researcher is primarily interested in an understanding a specific individual or situation. The particulars of the case in order to shed some light on what is going on and study a particular student to find out why that student is having trouble learning to read and count (Fraenkel, Wallen & Hyun, 2012).

This research was carried out in an elementary school of the ministry of national education in one of the central districts of Konya Province in the second term of 2016-2017 academic year. The school where the research was conducted was chosen since the researcher was working as the deputy director of that school. This study is a single-case research consisted of a student with a dyscalculia report. While selecting the student, the researcher had previously interviewed the school counselor and decided that the participant would be a primary school student in the third grade to teach the addition and subtraction. The researcher first found the names of the students who had mathematics learning difficulties in the third grade. The reason why the student was selected from third grade is that in the first and second grade curriculum, addition and subtraction are composed of basic knowledge and skills which are not complicated. On the other hand, it was thought that it would be too late to teach addition and subtraction in the fourth grade.

It was also noticed that there were different students with mathematics learning disabilities in the same class. First, five third grade students with mathematics learning disabilities were interviewed. It was determined that two students knew the addition and subtraction procedures (addition without-regrouping and subtraction without- regrouping tens). It was decided that the study would not be able to work with these two students as they should have no knowledge of addition and subtraction for the study. Among the other three students, two students who were in the

same class and having a learning disability report were found to know single digit numbers and two digit numbers, but they weren't able to write and read three digit numbers and could not do addition or subtraction. It was decided that one of the students in the same class would be the student to be selected for the subject of this study.

The student's class teacher was interviewed and his approval was received. The teacher said that the parent of the student had only visited the school once or twice in three years. The teacher's communication with parent was only carry out by phone in case of need. The parent's permission for this study was obtained by phone firstly and then the permission form was signed by the student's father when he came to meet with the researcher before studying. The student's personal and academic status was determined by the way of individual interviews with students, classroom teachers, school counselors and parents by the researcher. Information about the student which was formed according to the interviews is given below: The real name of the student was not used and labeled as ALP.

ALP: He was a 10-year-old male student and was born in Konya. He studies in the third grade. He came to his present school and class at the beginning of the second grade. He changed two teachers before. He did not have any developmental problem such as speaking or walking. He attended the preschool and loved it. He also learned how to read and write on time. However, his writing was very complicated with incomplete sentences and included many mistakes. When he first came into the class, he was frequently hiding himself under the desk. Despite the persistence of the teacher, his family, and the efforts of the school counselor, he did not sit on his seat like his classmates during classes. However this problem disappeared by the third year. He liked watching cartoons, playing computer games, and playing soccer very much. His father was a truck driver, his mother was a housewife. The family's socio-economic level was mediocre. He had a brother who was in the second grade in elementary school and a two-year-old sister. Since he still had a big trouble in mathematics class in the second grade, the school counselor directed

him to a psychologist and thus he was diagnosed as a student with learning disability. His mother had never sent him to special education and rehabilitation centers since she did not want him to be labeled as a mentally disabled person by the community. She took care of all his school relations.

#### DATA COLLECTION PROCESS AND STEPS OF CASE STUDY

Data triangulation was employed to ensure the reliability of the research, and interview, observation and document review techniques were used at the data collection stage. Observation notes were kept while the studies were carried out with the student. In addition, the status of the student in physical education and mathematics classes was observed and recorded. The student was asked to draw a picture of his family and himself in order to have information about the value given to the concepts of parents and siblings by him and their psychological status in family relations. His drawing was interpreted by a teacher who had a certificate of Analysis of Children's Picture. In addition, semi structure interviews were made with the student's parents, teacher and classmates. Those interviews were recorded, transcribed and analyzed. After every day studying with the student, notes were reported about the developments into the research journals.

The course hours, goals and activities to be performed during the study had been determined beforehand and the study was performed within the scope of that pre-prepared program. The application part of the study was carried out completely by the researcher. Individual studies were conducted with the student. In the last three courses, the student was tested with mixed exercises. Firstly, the student was subjected to a preliminary examination and his knowledge of mathematics was tested. In this preliminary examination, firstly, the student was asked the basic information about the addition and subtraction which were expected to be known already. In this level, it is necessary for the student to know the values of numbers, the concept of size of numbers, the writing and reading of numbers (up to three digits), which are the basic skills for addition and subtraction. With the help of the

questions asked to the student, it was realized that the student had no knowledge about the value of the digits.

The student ranked the single-digit numbers in terms of their value. However, he did not succeed in the ranking of the double digit numbers. In addition to not being able to read and write three digit numbers, he also made mistakes in reading and writing two digit numbers. He was unable to add up the numbers when his fingers were not enough to count (the numbers whose results were higher than 10 in total) and he was unsuccessful in subtraction when his fingers were not enough.

According to the results of this preliminary test, it was determined that the basic skills required for the student to carry out the addition and subtraction calculations from first to third grade level such as values of numbers including three-digit numbers (hundreds, tens, and units digits), how to read and write numbers including three-digit numbers and how to order numbers including three-digit numbers from smaller ones to the bigger ones or vice versa.

Therefore, these basic skills were primarily included in the study program, which were necessary for addition and subtraction. Then, addition without-regrouping, addition with regrouping, subtraction without-regrouping and subtraction with regrouping tens and hundreds operations were taught respectively. Studies were also supported with concrete materials, computer games, reinforcement awards and assignments. The mistakes made by the student were determined after each lesson and those mistakes were taken into consideration while planning the next lesson. After the learning level of each skill had reached to at least 90 % success, the next skill was started to be taught.

At first, the study started with natural numbers. The student who learned the concept of digit values easily read two-digit and three-digit numbers and managed to establish relationship between numbers in terms of their values. Since it complied with the Ministry of National Education's 3rd grade mathematics curriculum of the elementary school, operations with numbers up to 3-digit were included in the program. While the

students who had normal development were expected to learn these goals at 93 % in lessons, the students with mathematics learning difficulties learned them with success by over 90% in 63 lessons at individualized curriculum.

The student with mathematics learning difficulties who learned numbers up to 3-digit was then introduced to addition without-regrouping operations. In order to better understand the concept of addition, the teaching process was supported with abacus and concrete materials. Carpenter and Moser (1984), examined the different strategies used by children with normal development to solve mathematical problems about addition and they mentioned about 3 strategies which were counting all, counting-on from larger and recall (retrieving the added numbers from long-term memory by regrouping). While using the counting-all strategy, the union of the two sets is counted by using physical objects or fingers until counting up to total result. Although it is the most commonly used strategy, it does not work for additions with numbers larger than 10 because that strategy requires using the fingers of a hand. At this point the counting-on from larger strategy is more favorable than the previous one; it requires saying the larger number in the problem first and counting the smaller one on it. With this strategy, students learn to start counting with the largest number, so they gain time. The last strategy in the addition requires the use of long-term memory and allows the results to be achieved by keeping the numbers in mind. In this strategy, with repeated practice and empowerment, the student memorizes the basic facts and uses them when necessary. For example, the student memorizes the  $4+5=9$  problem over time.

The researcher thought that teaching ‘‘counting-on from larger strategy’’ to the student who was incompetent with addition would be the most useful thing and he created a scenario including that strategy. The student would gain the ability of carrying out operations more easily by this way and with the help of the scenario developed by the researcher. In fact, using this strategy help the student be able to do addition operations without using any concrete material. The researcher

created a small scenario book by drawing and painting pictures. With the strategy of "counting-on from larger" addition without-regrouping, addition with regrouping, subtraction without-regrouping and subtraction with regrouping tens and hundreds skills were easily acquired by the participant student. The scenario book consisted of 5 pages. During the adaptation period, the scenario firstly encouraged the student to use his fingers while performing a mathematical operation. In this scenario, the steps of the required addition operation were:

For Example;

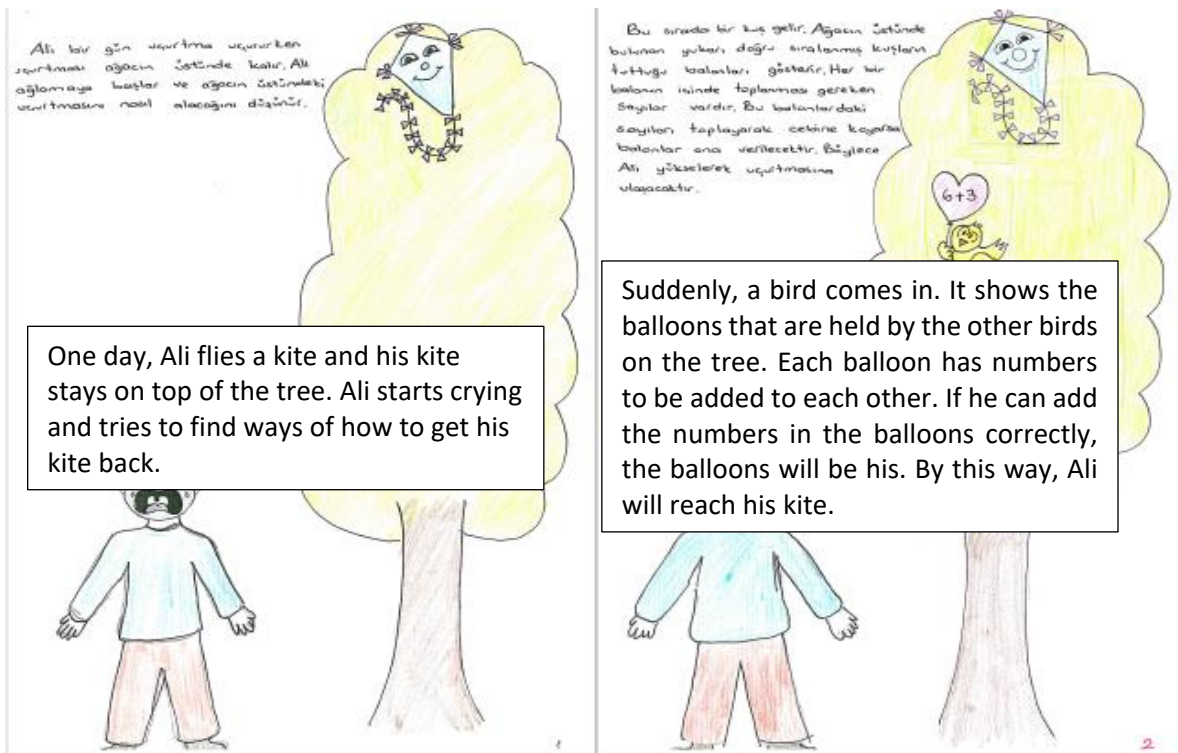
$$\begin{array}{r} 6 \text{ (larger number is in our pocket)} \\ + 3 \text{ (smaller number is on our hand)} \\ \hline 9 \end{array}$$

While carrying out the addition, we say that we should put the larger number into our pocket since it is heavy and we cannot hold it anymore. We hold

the smaller number, i.e. show the other number (smaller one) with our fingers. We add the number on our hand to the number that we have in our pocket. We start counting on from the larger added in the problem. For example, we hit our pocket and say "6". We count on by showing our fingers "7,8,9". The answer is 9. If the numbers are equal, we hold one of the numbers by hand and put the other one into our pocket. While we count-on from the number in our pocket in an addition operation, we count down the number in our pocket in a subtraction operation. This method made it more enjoyable to acquire mathematics operation skills and it provided convenience to the researcher and the participant student as it might be used for the further applications.

The scenario booklet created by the researcher is as follows:

Figure 1. The scenario booklet created by the researcher



Ali sayıları toplamaya karar verir. Önce en aşağıda bulunan balondaki sayıları eline alır. Ama büyük olan sayı ağırdır. Bu nedenle önce onu cebine koyar. Küçük sayıyı da parmaklarına alır. Yani parmaklarında gösterir.



Ali decides to add the numbers to each other. First, he gets the numbers in the balloon below. But the larger number is too heavy. That's why he puts it in his pocket first. He holds the smaller number on his hand. That means he shows it with his



3

Büyük sayının yani 5 sayısının cebinde olduğundan emin olmak için büyük sayıyı sırtlayarak cebine vurur. Sana parmaklarıyla gösterdiği küçük sayıyı yani 3 sayısını cebindeki sayının üstüne koyarak sayıları cebinde toplama olur. "6, 7, 8" Tanıt 8. Hadi diğer balondaki sayıları da aynı yolla biriktirelim. Ali'yi uyardırmama çalışalım.



He tells the larger number (5) and hits his pocket in order to make sure that the larger number is in his pocket. Then, he counts on from the larger number in his pocket by using the numbers on his hand. He counts "6,7,8". The answer is 8. Let's add the numbers in the other balloons with the help of the same method. Let's help Ali reach his kite.



4



Ali reaches his kite with the help of the balloons.

Ve Ali balonlarla göstererek uyardırmama ulaşır.

5

FINDINGS

FINDINGS RELATED TO COUNTING SKILLS

The operations and skills in mathematics are consecutive. That means learning an operation or skill requires learning the concepts or skills that precede it. In the process of editing the content of

mathematics, it should be taken into consideration that concepts, skills or processes are prerequisites of each other (Yıkılmış, 1999). In this study, the student's knowledge of numbers was measured first in order to have the student with learning difficulties gain the desired math skills.

Figure 2. The student's preliminary knowledge of numbers

**ÖN TEST**

Aşağıdaki sayıların basamaklarının altına basamak adlarını yazın. (Birler - onlar - yüzler)

$6$                        $17$                        $326$   
 $\downarrow$                        $\downarrow$                        $\downarrow$   
 $\downarrow$                        $\downarrow$                        $\downarrow$

14, 35, 27, 83 sayılarını boyutları küçükten büyükten sıralayın.  
 $14$   $35$   $27$   $83$

2, 5, 7, 9 sayılarını büyükten küçükten sıralayın.  
 $9$   $7$   $5$   $2$

326, 375, 162 sayılarını büyükten küçükten sıralayın.  
 $326$   $375$   $162$

Aşağıdaki toplama işlemlerini yapınız.

$\begin{array}{r} 3 \\ + 2 \\ \hline 5 \end{array}$        $\begin{array}{r} 5 \\ + 9 \\ \hline 14 \end{array}$        $\begin{array}{r} 12 \\ + 13 \\ \hline 25 \end{array}$        $\begin{array}{r} 25 \\ + 13 \\ \hline 38 \end{array}$        $\begin{array}{r} 126 \\ + 103 \\ \hline 229 \end{array}$

Aşağıdaki çıkarma işlemlerini yapın.

$\begin{array}{r} 5 \\ - 2 \\ \hline 3 \end{array}$        $\begin{array}{r} 12 \\ - 2 \\ \hline 10 \end{array}$        $\begin{array}{r} 13 \\ - 5 \\ \hline 8 \end{array}$        $\begin{array}{r} 25 \\ - 12 \\ \hline 13 \end{array}$        $\begin{array}{r} 132 \\ - 12 \\ \hline 120 \end{array}$

Figure 3. The student's knowledge of numbers after the practice

**SAYILARDA KARŞILAŞTIRMA, SIRALAMA**

1) Yanda boy uzunlukları verilen öğrencilerin boylarını uzundan kısaya doğru sıralayalım

$143$  cm       $152$  cm       $137$  cm       $149$  cm  
  
 $152$   $149$   $143$   $137$

2) Aşağıda gösterilen sayıların büyükten küçükten doğru sıralayalım.

$537$        $503$        $540$        $409$   
  
 en büyük      en küçük

3) Aşağıda verilen sayılardan 540'ın büyük olanlara "x" işareti koyunuz.

$234$        $924$        $564$        $664$        $742$        $419$   
 $71$        $839$        $256$        $23$        $894$        $539$

4) Her bölümden üzerinde küçük sayı yazılı olan lambayı işaretleyelim.

5) Her bölümden üzerinde büyük sayı yazılı olan lambayı işaretleyelim.

6) 750, 924, 513, 124 ve 346 sayılarının büyükten küçükten doğru sıralanışı aşağıdakilerden hangisidir?

A) 750, 924, 513, 346, 124  
 B) 924, 513, 750, 346, 124  
 C) 924, 750, 513, 346, 124

$924, 750, 513, 346, 124$  ✓

7) 272, 316, 716, 811, 309 sayılarını büyükten küçükten doğru sıraladığında baştan ikinci sayı hangisi olur?

A) 811      B) 416      C) 309

$811 = 416 = 309$  ✓

8) Sayıları sıralayalım.

$20, 270, 700, 200 : 7, 2, 0, \dots$   
 $350, 305, 39, 395 : 5, 2, 3, \dots$   
 $84, 804, 48, 870 : 8, 4, 0, \dots$



FINDINGS RELATED TO ADDITION

After the student with mathematics learning difficulty had acquired the necessary skills to carry out addition without-regrouping and addition with regrouping operations appropriate to the level of 3rd grade, addition operation skills began to be taught. Firstly, it was aimed to have the student understand the meaning of addition exactly. For this purpose, it was aimed that the student understood that addition is an incrementation operations and the student carried out addition calculations by using an abacus. After the student had understood the logic of addition, a method for addition operations (put the larger number into your pocket and hold the smaller number on your hand) was taught to the student with the help of a scenario developed by the researcher. As a result of this process, it was determined that the student achieved a success of 90 % in addition without-regrouping and addition with regrouping operations.

After the student with mathematics learning difficulty had acquired the necessary skills to carry out addition operations appropriate to the level of 3rd grade, problems related to addition process were studied. Although the student had sufficient automaticity on addition operations, he was insufficient for understanding the problems and determining the order of the operations, so some of the problems were explained to the student by the researcher by drawing the visuals. After understanding the problems, the student solved them himself by using his skills. As the main purpose of the study was to teach the skills of addition and subtraction to the participant student, the researcher did not carry out any additional activity to have the student with learning disabilities understand the problems. Figure 3 shows the student's ability of addition before the practices, and Figure 4 shows the student's ability of addition after what had been worked on.

Figure 4. The student's addition performance after the practices

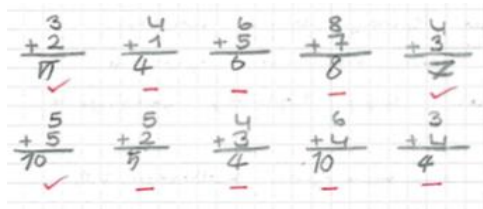


Figure 5. The student's level of addition skill after the activities

**ELDELI TOPLAMA İŞLEMİ**

\*\*Aşağıdaki toplama işlemlerini yaparken önce birlikleri, sonra onlukları, sonra da yüzükleri toplayınız.

Yüzlük	Onluk	Birlik	Yüzlük	Onluk	Birlik	Yüzlük	Onluk	Birlik
+ 2	3	5	+ 3	8	4	+ 4	8	6
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
.8	.5	.2	.8	.4	.4	.8	.6	.4

$\begin{array}{r} 264 \\ + 255 \\ \hline 519 \end{array}$	$\begin{array}{r} 358 \\ + 415 \\ \hline 773 \end{array}$	$\begin{array}{r} 509 \\ + 153 \\ \hline 662 \end{array}$	$\begin{array}{r} 679 \\ + 205 \\ \hline 884 \end{array}$	$\begin{array}{r} 400 \\ + 108 \\ \hline 508 \end{array}$	$\begin{array}{r} 297 \\ + 255 \\ \hline 552 \end{array}$	$\begin{array}{r} 898 \\ + 57 \\ \hline 955 \end{array}$
$\begin{array}{r} 384 \\ + 251 \\ \hline 635 \end{array}$	$\begin{array}{r} 695 \\ + 75 \\ \hline 770 \end{array}$	$\begin{array}{r} 407 \\ + 323 \\ \hline 730 \end{array}$	$\begin{array}{r} 860 \\ + 153 \\ \hline 1013 \end{array}$	$\begin{array}{r} 676 \\ + 76 \\ \hline 752 \end{array}$	$\begin{array}{r} 394 \\ + 252 \\ \hline 646 \end{array}$	$\begin{array}{r} 589 \\ + 83 \\ \hline 672 \end{array}$
$\begin{array}{r} 247 \\ - 303 \\ \hline 824 \end{array}$	$\begin{array}{r} 558 \\ - 37 \\ \hline 521 \end{array}$	$\begin{array}{r} 382 \\ - 233 \\ \hline 149 \end{array}$	$\begin{array}{r} 585 \\ - 63 \\ \hline 522 \end{array}$	$\begin{array}{r} 458 \\ - 3 \\ \hline 455 \end{array}$	$\begin{array}{r} 189 \\ - 293 \\ \hline 104 \end{array}$	$\begin{array}{r} 227 \\ - 37 \\ \hline 190 \end{array}$
$\begin{array}{r} 284 \\ + 26 \\ \hline 310 \end{array}$	$\begin{array}{r} 201 \\ + 40 \\ \hline 241 \end{array}$	$\begin{array}{r} 152 \\ + 152 \\ \hline 304 \end{array}$	$\begin{array}{r} 380 \\ + 297 \\ \hline 677 \end{array}$	$\begin{array}{r} 297 \\ + 297 \\ \hline 594 \end{array}$	$\begin{array}{r} 297 \\ + 297 \\ \hline 594 \end{array}$	$\begin{array}{r} 297 \\ + 297 \\ \hline 594 \end{array}$

\*\*Aşağıdaki toplama işlemlerini yaparken önce birlikleri, sonra onlukları, sonra da yüzükleri toplayınız.

$\begin{array}{r} 238 \\ + 454 \\ \hline 692 \end{array}$	$\begin{array}{r} 362 \\ + 285 \\ \hline 647 \end{array}$	$\begin{array}{r} 364 \\ + 358 \\ \hline 722 \end{array}$	$\begin{array}{r} 385 \\ + 256 \\ + 149 \\ \hline 790 \end{array}$	$\begin{array}{r} 308 \\ + 452 \\ + 234 \\ \hline 1094 \end{array}$	$\begin{array}{r} 468 \\ + 257 \\ \hline 725 \end{array}$	$\begin{array}{r} 294 \\ + 481 \\ + 236 \\ \hline 1011 \end{array}$	$\begin{array}{r} 384 \\ + 179 \\ \hline 563 \end{array}$
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FINDINGS RELATED TO SUBTRACTION

After the student with mathematics learning difficulty had acquired the necessary skills required for the addition operations sufficiently, concrete materials (abacus, floor blocks, etc.) and visual images were used in order for the student to comprehend the logic of the subtraction operations. The visual picture drawn by the researcher was used to explain the difference between addition and subtraction. According to this picture, the addition is represented by a girl who collects flowers into her basket and increases the number of her flowers; the subtraction is represented by the girl who puts her flowers from the basket back to their place and decreases the number of her flowers. In order to perform a subtraction operation, the minuend must be bigger than the subtrahend. The researcher explained this situation with the help of a picture showing that as a big man can't get out of a small size door, a larger number cannot be subtracted from a smaller number. This picture was also drawn by the researcher. It was determined that the student with learning difficulties understood the subject more easily thanks to these pictures.

In order for the student with a learning difficulty to understand that subtraction is a decreasing operations, the student performed subtraction operations with an abacus. Afterwards, it was tried to be taught the student subtraction by counting backwards and using the regrouping techniques which had been learned by the student for addition. During this lesson, it was seen that the student was

insufficient in counting backward, and so counting backwards exercises were performed.

After the student had acquired the ability to count backwards, it was seen that the student achieved over 90 % of the objectives in the subtraction without-regrouping and subtraction with regrouping operations which were appropriate for the levels up to 3rd grade by using the "in my pocket-on my hand" technique. Mixed exercises were carried out in order for the student to differentiate between subtraction with regrouping and subtraction without-regrouping operations.

The problems including both addition and subtraction operations were studied with the student after he had learned how to carry out addition and subtraction operations. The student had difficulty in understanding some problems and determining the order of the operations and those problems were explained by the researcher to the student. After understanding the problems, the student solved them himself. As the main purpose of the study was not to improve the student's comprehension of the problems, the researcher did not carry out any additional activity to have the student understand them.

During the last three study hours, the student was tested with mixed (addition-subtraction) operations and it was found that the student achieved over 90 % of subject. Figure 6 shows that the student had no knowledge of the subtraction operation while Figure 7 shows the student's ability of subtraction after the practices.

Figure 6. Preliminary knowledge of the student about his subtraction skill



Figure 7. The student's level of subtraction skill after the practice

**ONLUK VE YÜZLÜK BOZARAK ÇIKARMA İŞLEMİ**  
Aşağıda verilen çıkarma işlemlerini örnekteki gibi yapınız.

Y	O	B
6	4	2
-3	2	8
3	2	4

Y	O	B
6	7	1
-4	7	5
2	5	6

Y	O	B
4	5	0
-2	6	5
2	4	0

Y	O	B
6	7	2
-3	4	5
3	8	2

Y	O	B
5	4	0
-3	8	2
2	6	8

**PRATİK BİLGİ**

Y	O	B
6	10	13
7	4	3
-3	5	7
3	8	6

Yukarıdaki çıkarma işleminin yapıldığını inceleyin.

- 3 birlikten 7 birlik çıkarılmaz. Onlar basamağından 1 onluk alırız. 13'ten 7 çıkar, 6 kalır.
- Onlar basamağında 3 onluk kalmıştı. 3 onluktan 5 onluk çıkarılmaz. Yüzlük basamağından 1 yüzlük alırız. 1 yüzlük 10 onluk eder. 3 onluğa eklediğimizde 13 eder. 13'ten 5 çıkar, 8 kalır.
- 7 yüzlükten birini almıştık. 6 yüzlük kaldı. 6'dan 3 çıkar, 3 kalır.

Figure 8. Mixed problems from the latest session of the practice

- KARMA ALIŞTIRMALAR -

$\begin{array}{r} 136 \\ + 12 \\ \hline 148 \end{array}$	$\begin{array}{r} 162 \\ + 143 \\ \hline 305 \end{array}$	$\begin{array}{r} 826 \\ - 132 \\ \hline 694 \end{array}$	$\begin{array}{r} 450 \\ - 149 \\ \hline 301 \end{array}$
$\begin{array}{r} 27 \\ + 85 \\ \hline 112 \end{array}$	$\begin{array}{r} 34 \\ + 79 \\ \hline 113 \end{array}$	$\begin{array}{r} 812 \\ - 74 \\ \hline 738 \end{array}$	$\begin{array}{r} 84 \\ - 16 \\ \hline 68 \end{array}$
$\begin{array}{r} 62 \\ - 18 \\ \hline 44 \end{array}$	$\begin{array}{r} 85 \\ - 49 \\ \hline 36 \end{array}$	$\begin{array}{r} 836 \\ - 172 \\ \hline 664 \end{array}$	$\begin{array}{r} 85 \\ - 38 \\ \hline 47 \end{array}$
$\begin{array}{r} 10 \\ + 58 \\ \hline 68 \end{array}$	$\begin{array}{r} 16 \\ + 52 \\ \hline 68 \end{array}$	$\begin{array}{r} 346 \\ + 273 \\ \hline 619 \end{array}$	$\begin{array}{r} 326 \\ + 135 \\ \hline 461 \end{array}$
$\begin{array}{r} 12 \\ + 26 \\ \hline 38 \end{array}$	$\begin{array}{r} 19 \\ + 49 \\ \hline 68 \end{array}$	$\begin{array}{r} 1 \\ + 143 \\ \hline 144 \end{array}$	$\begin{array}{r} 11 \\ + 175 \\ \hline 186 \end{array}$
$\begin{array}{r} 43 \\ - 13 \\ \hline 30 \end{array}$	$\begin{array}{r} 36 \\ - 18 \\ \hline 18 \end{array}$	$\begin{array}{r} 88 \\ - 17 \\ \hline 71 \end{array}$	$\begin{array}{r} 63 \\ - 14 \\ \hline 49 \end{array}$

2 yanlış

Social validity data were collected by having interviews with the student's parents, classmates and class teacher about strengths and weaknesses of the research and the changes that occurred in the student and by observing the student's math and physical education lessons.

After the interviews with the student, his parents and the teacher, it was found that the student had difficulty in learning or weren't able to learn at all due to his learning difficulties. This situation caused the student to be excluded by his friends and labeled as a lazy boy. At the first meeting with the student's parents, it was stated that ALP wasn't able to understand the subjects since he had mental problems and his performance related to subjects was very bad. At the end of the study, the student's parents expressed that their son learned how to do addition and subtraction operations although they hadn't expected it to happen.

At the first meeting with the student's teacher, the teacher thought that ALP was not able to learn since he had some mental problems. Then, the mathematics operations and work sheets done by ALP were shown to the teacher and ask about them. He was amazed at the level of ALP, and said that ALP was no longer passive in the mathematics class. Moreover, the teacher stated that ALP was more engaged in mathematics lessons and he could perform addition and subtraction at the level of his friends.

At the first meeting with the student's friends, one of his friends R.A. described him as socially incompatible and a lazy boy. He said that ALP, who had learning difficulties, could not succeed in lessons because of not studying. In the meeting after the practices, the samples of the activities which ALP could do were shown to student R.A. and he was asked about ALP's performance in mathematic skills. At first, R.A. was surprised and said that ALP could learn, and sometimes he saw him doing his assignments during breaks.

In order to understand the mental state in his home environment, ALP was asked to draw a picture about his family and home environment. Children's drawings are an effective tool for reflecting children's observations, experiences, problems or ideas (Chang, 2005). The child's drawings are not only a criteria for identifying

children psycho-pedagogically, but also reflecting the mental capacity, personalities and inner world of children (Doğru and et al., 2006). In 1970, Burns and Kaufman developed the Kinetic Family Drawing Technique. In this technique, children are asked to draw a picture of their family including themselves. This picture aims to reveal the child's attitudes towards family and general family dynamics. Having children draw pictures of their family members can help experts who work with children understand children's social values and world views (Malchiodi,1998). For example, the father figure is often drawn as reading newspapers or doing some gardening, and the mother is always placed in the kitchen as preparing food for the family (Lee, Lim & Chia, 2017).

In his family-themed picture, the student ALP drew himself while he was reading a book in his room. His father and two siblings play games in the children's room, while his mother works in the kitchen. According to him, his father is generally busy with a mobile phone and takes care of his siblings. The figure of ALP is in the lower part of the paper and is quite small.

#### DISCUSSION, CONCLUSION AND SUGGESTIONS

It is possible to find lots of studies in which various methods were used to teach counting skills to the students with learning difficulties in mathematics. For example, Zerafa (2015) states that with appropriate interventions, students with mathematics learning difficulties can make progress in understanding the basic numbers. In Kaufman, Handl and Thony's (2003) research with six students with low mathematics performance, the students learned counting skills, symbols, addition, subtraction and digit values by means of the explicit teaching method in which manipulative tools (bead, counting bar, base ten blocks, etc.) were used. Browder, Jimenez, Spooner, Saunders, Hudson, and Bethune, (2012) developed a conceptual model in order to provide mathematical skills to the students with moderate and severe developmental disabilities. The student's performance in mathematical skills (counting groups of 5 objects, counting up to 10 by heart etc.) increased with the help of systematic clues and feedback-based instruction. Mononen, Aunio, Koponen and Aro (2014) investigated the studies on teaching early numeracy to the children

between 4 and 7 years with low mathematics performance. They emphasized that studies on early numeracy teaching focused more on explicit teaching, computer aided education, game-based instruction and teaching with concrete visual representations and these applications were effective. According to our research findings and other related research on this subject, it can be said that the student with learning difficulties in mathematics can acquire numeracy skills through appropriate interventions and appropriate teaching methods. For this student, firstly the appropriate plan and program should be prepared, physical conditions should be arranged and the teaching process should be planned by using feedback. It can be said that students who have learning difficulties should be given more attention and time in the teaching of numeracy.

In this study through a scenario developed by the researcher, addition skill was taught to the student with mathematics learning difficulty with the method of putting the larger number into a pocket and adding the smaller number on it by using fingers. The *counting up from given strategy* has also shown consistency with other studies: Barody (1995) conducted a study on teaching addition to mentally handicapped and normal children. The teaching was designed as six separate steps. In the sixth step; the larger number was kept in mind, as many fingers as the smaller number were opened, and then the answer was found by counting on from the larger number. It was found that the application conducted in the last step was more effective for all the children to learn addition operations. Tournaki (2003) examined the effectiveness of test-based (memorization) and strategy-based (counting on from given) methods in teaching addition of single digit numbers to the normal students and the students with learning difficulty. While the normal student accelerated in addition with both of the methods, the children with learning disabilities gained faster results with the strategy-based method.

Although the student was able to perform the addition operations, he was insufficient to understand the problems and determine the order of operations. According to Olkun (2015), it was stated that students with learning disabilities

needed more concrete examples since they could not have the necessary cognitive and memory skills to solve multi-stage problems. Students with mathematics learning difficulties have difficulty in learning, understanding and remembering arithmetic operations (Shalev et al., 2001) and using recall procedures to solve verbal problems (Geary, 2004). Vassaf (2011) stated that these operations could be done correctly by the students with learning difficulties when the numbers that should be added or subtracted are told by someone else. However, those students cannot decide which operations (multiplication, addition etc.) to do when they hear or read the problems on their own.

As a result, it can be said that the addition consists of three stages. In the first stage of the addition, with the help of the 3D objects, visuals, figures and concrete materials, it must be taught to the students conceptually that addition is an increasing and adding operation. After the student understands the essence of addition, the addition can be taught with the strategy of counting smaller numbers on from the larger numbers by using fingers. For the student with learning difficulties, these first two stages are important and need to be focused on. At the third stage, the student can now perform addition operations by using mental abilities. It might take a long time for the students with dyscalculia to reach the third stage. The student who is capable of addition is now ready to deal with mathematics problems. Students who have learning difficulties may have a trouble in organizing maths problems in their memory since they have cognitive problems. In this case, problem solving skills of the students with dyscalculia can be improved with the help of the strategies such as narration, storytelling, giving examples from daily life and drawing by using number bars, visuals, 3D objects etc.

In the teaching of subtraction operations, as in the operation of addition, with the help of the 3D objects, visuals, figures and concrete materials, it must be taught to the students conceptually that subtraction is decreasing operation. After the student understands the essence of subtraction, in order to subtract a number from another one, the strategy of counting backwards from the larger number to the smaller one by using fingers is

taught. After that, the students can now perform subtraction operations by using mental abilities on their own. It is possible to say that the students who have learning difficulties stay longer in this stage. As stated for the addition problems, students with dyscalculia have difficulty in understanding the problems, so it can be said that various strategies can be used to perceptually improve their problem solving abilities.

As a result of the interviews conducted with the student himself, his family and the teacher, it was seen that the student could not learn or had hardly learned because of his learning difficulties. This situation caused the student to be excluded by his friends and seen as a lazy boy. Many studies have shown consistency with these findings. Similar findings had been stated in some studies (Kabasakal, Girli, Okun, Çelik & Vardarlı, 2008), it was determined that students with special needs were not preferred to carry out a joint study by their friends and they were perceived as persons with compliance and communication problems. The studies examining the relationship between emotional situation and cognitive success indicate that there is a positive relationship between depression and anxiety levels of children with learning disabilities. Children and adolescents with mathematics disorder have symptoms such as not going to school, skipping the school, and depression (Karabekiroğlu, 2012). Therefore, the development of positive problem solving skills in social areas also helps to cope with the lack of mathematical ability.

As a result of this study, it was found that the students with dyscalculia had difficulties in their social environment and daily life, those students acquired the gains of the middle school mathematics curriculum at a very low level and the teachers had insufficient knowledge about "Dyscalculia" (Hacısalıhoğlu Karadeniz, 2013). The lack of guidance from parents at home and their exclusion from the society at school because of their low academic achievement may have led those students to experience depression. It can be said that if a student feels unhappy and alone in the family, this situation affects his social skills, academic achievement and communication with peers negatively.

During the research, ALP was asked to draw a picture about his family and home environment in order to understand his mental state in the home environment. When ALP described the picture he had drawn, he expressed that he loved his father very much, but his father didn't love him and he cared about only his siblings. The researchers state that the students show their mental state in their paintings when their family-themed pictures are taken into consideration. It can be said that the student is unhappy and alone in the family and this situation affects his social skills, academic achievement and communication with peers negatively.

To summarize the result of this study reveals that although there is a negative bias about mathematics by the students with mathematics learning difficulties, mathematics must be made attractive for those students by using games, rewards, concrete materials and fun activities. Besides, computer games specific to a subject can be used. Different types of activities that appeal to five senses can be carried out. If the lessons are based on the common grounds of students with learning disabilities and associated with everyday life, they can help them develop positive attitudes about mathematics. Teachers should not have negative thoughts for those students.

Individualized Learning Plans should be prepared for the students with mathematics learning difficulties before teaching the aims of the curriculum and the teaching process should be carried out in line with those plans. When teaching counting skills, the next goal should not be taught before achieving the objectives that must be learned first. The basic mathematical skills, which must be gained in order to carry out addition operations, should be taught as a priority. The basic mathematical skills, which must be gained in order to carry out subtraction operations, should be taught as a priority, too. The families of students with mathematics learning difficulties should take this situation seriously and cooperate with the student and the teacher in order to ensure an effective education for their children. Guidance should be provided to support those families. Since the participation of the students with

learning difficulties in an active social-cultural activity influences their self-concept positively, it will be beneficial to provide guidance services that direct these students to social-cultural activities appropriate for their interests and abilities.

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