MIDDLE SCHOOL MATHEMATICS TEACHERS' PERCEPTIONS OF INCLUSION AND THEIR USE OF TEACHING STRATEGIES IN BASIC ARITHMETICAL OPERATIONS AND PROBLEMS

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ABSTRACT

MIDDLE SCHOOL MATHEMATICS TEACHERS' PERCEPTIONS OF INCLUSION AND THEIR USE OF TEACHING STRATEGIES IN BASIC ARITHMETICAL OPERATIONS AND PROBLEMS

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The aim of this study is to examine the perceptions of middle school mathematics teachers about inclusion and their teaching strategies in basic arithmetical operations and problems. In addition, the other purpose is to investigate opinions of middle school mathematics teachers about touch point, concrete-representational-abstract (CRA) and virtual-representational-abstract (VRA) strategies. The study was carried out in the 2018-2019 academic year in a middle school in Küçükçekmece, Istanbul with six mathematics teachers. The study is a qualitative study, which was conducted in the form of interviews. As a data collection tool, "Semi-Structured Interview Form" developed by the researcher was applied. Three different interviews were conducted with each participant. It was revealed that factors that affect perception of teachers were experience, training and school conditions. Moreover, It was found out that supportive education service was helpful for teachers to support students with disabilities in terms of implementing different curricula. Furthermore, it was noticed that the participants used direct teaching method and question-answer technique in instructing four basic arithmetical operations and problems, but there were changes in the preferred strategies and use of concrete manipulative. It was found that a few participants

used concrete materials while teaching four arithmetical operations and problems. In addition, it was observed that all participants used worksheets as a material, and they led students with MLD to solve lots of problems. Therefore, it was inferred that although some participants put emphasis on conceptual understanding to a certain extent, they usually emphasized procedural understanding.

Keywords: Inclusion, Middle School Mathematics Teachers, Teacher Perception, Basic Arithmetical Operations and Problems

ÖZ

ORTAOKUL MATEMATİK ÖĞRETMENLERİNİN KAYNAŞTIRMAYA YÖNELİK ALGILARI VE TEMEL ARİTMETİK İŞLEMLER VE PROBLEMLERİNİN ÖĞRETİMİNDE KULLANDIKLARI STRATEJİLER

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Bu çalışmanın amacı ortaokul matematik öğretmenlerinin kaynaştırma uygulamaları hakkındaki algılarını ve özel gereksinimli öğrencilerine temel aritmetiksel işlemleri ve problemleri hangi stratejilerle kazandırdıklarını incelemektir. Buna ek olarak, çalışma ortaokul matematik öğretmenlerinin nokta belirleme, somut-yarı somut-soyut ve sanal-yarı somut-soyut stratejileri hakkındaki görüşlerini edinmeyi de hedeflemektedir. Çalışma 2018-2019 eğitim öğretim yılında İstanbul ilinin Küçükçekmece ilçesinde bulunan bir devlet ortaokulunda 6 matematik öğretmeni ile gerçekleştirilmiştir. Nitel olan bu çalışmanın verileri görüşme yoluyla elde edilmiştir. Veri toplama aracı olarak araştırmacı tarafından hazırlanan "Yarı Yapılandırılmış Görüşme Formu" kullanılmıştır. Her bir katılımcıyla üç ayrı görüşme yapılmıştır. Araştırmanın sonucunda öğretmenlerin kaynaştırma uygulamasına yönelik algılarını etkileyen unsurların başında öğretmenlerin kaynaştırma eğitimi ile ilgili tecrübesi, bilgisi, kaynaştırmaya dönük aldığı eğitimler ve bulunduğu okul koşullarının geldiği ortaya çıkmıştır. Ayrıca destek eğitim hizmetinin öğretmenlere özel gereksinimli öğrenciler için farklı müfredat uygulanması konusunda yardımcı olduğu bulunmuştur. Ayrıca katılımcıların dört işlem ve problem çözme öğretimde doğrudan öğretim yöntemi

ve soru cevap tekniğini ağırlıklı olarak kullandıkları ancak her bir işlem için bu yöntemle beraber kullandıkları stratejilerde ve somut materyal kullanımlarında değişiklikler olduğu fark edilmiştir. Çok az sayıdaki katılımcının dört işlem ve problem çözme öğretimi sırasında somut materyallerden yararlandıkları saptanmıştır. Ayrıca bütün katılımcıların materyal olarak alıştırma kâğıdı kullandıkları ve özel gereksinimli öğrencilerine çok soru çözdürerek dört işlem ve problem çözme becerilerini kazandırmaya çalıştıkları gözlemlenmiştir. Bu nedenlerle bazı katılımcıların dört işlem öğretiminde kısmen kavramsal anlamaya önem verseler de genellikle kurala dayalı işlemsel anlamaya yönelik öğretim vermeyi tercih ettikleri saptanmıştır.

Anahtar Kelimeler: Kaynaştırma, Ortaokul Matematik Öğretmenleri, Öğretmen Algısı, Temel Aritmetik İşlemler ve Problemleri

To My Parents

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LIST OF ABBREVIATIONS

CCSS-M	Common Core State Standards of Mathematics
CRA	Concrete-Representational-Abstract
IDEA	Individuals with Disabilities Education Act
IEP	Individualized Education Plan
LD	Learning Disability
MLD	Mathematical Learning Disability
MoNE	Ministry of National Education
NCTM	National Council of Teachers of Mathematics
VRA	Virtual-Representational-Abstract

CHAPTER 1

INTRODUCTION

Ministry of National Education (2018) defined special education as teaching programs which are carried out in convenient environments with specially educated staff to fulfill both social and educational needs of the students. Students who are in need of special education have some significant differences from their peers with respect to individual and developmental properties and educational adequacy (Special Education Services Regulation, 2018). Turkish Statistical Institute (2009) asserted that 12.29% of the total population in Turkey is accounted individuals with special needs. The children who have special needs are classified into four groups in terms of characteristics of physical, intellectual, adaptation and learning difficulties (National Prime Ministry Administration of Disability, 1999). Learning and intellectual disabilities are different from each other since students with learning disabilities has intelligence level of average or above average despite the fact that they make an effort to obtain necessary skills both in academic and social environment. Learning difficulties are categorized into four classes with respect to type of difficulty. These are dyslexia, dysgraphia, dyspraxia and dyscalculia, which are related to difficulties in language, writing, fine motor skills and learning math, respectively (NCLD, 2014). Mathematics disability which is known as learning disability in mathematics depicts the students whose achievement level is low in mathematics owing to general or particular cognitive deficiency (Graham, Bellert & Pegg, 2007). In other words, the main cause of mathematical disabilities is based on neurologic disorders, and the students with MLD have difficulty in learning mathematics (Mazzocco, Feigenson & Halberda, 2011). Many studies reveal that in addition to students with MLD, children diagnosed with intellectual disability suffer from extreme difficulty in mathematics instruction (Bouck, Park, Shurr, Bassette & Whorley, 2018; Kot, Sönmez, & Yıkmış, 2017). However, it is essential to succeed in mathematics, and this has been emphasized for more than two

decades by various reform attempts (Flores, Hinton & Schweck, 2014). Moreover, NCTM (2000) asserts every student has the right of receiving enhanced quality mathematics education in the general education classrooms. This idea brought the concept of inclusion which refers to the fact that students with special needs and their peers who have normal development are trained within the same pre-schools, elementary and secondary schools and non-formal educational institutions to make sure that the necessary support is provided to the students with disability (Special Education Regulations of Ministry of National Education, 2000). Frederickson and Cline (2002) explain the essential support in having equal opportunity in education for students with disability can be provided through reforms in curriculum and materials. In Turkey, students with special needs may continue their education full-time in the same class with their peers or part-time in special education classes through inclusion. In full-time inclusive education, students follow the training program implemented at the school in which they are enrolled. In addition, individualized education plan (IEP) is prepared considering the programs that students follow. Moreover, necessary arrangements for educational environments are done and also resource rooms are used for students with special needs (Special Education Services Regulation, 2018). Frederickson and Cline (2002) explains the essential support to have equal opportunity of students with disability as reforming the curriculum and materials. Pasha (2012) states that providing students with disabilities with equivalent schooling conditions is quite difficult since a great number of educators are not ready academically for inclusive education. Kırcaali-İftar (1992) pointed out that one of the most important elements in the success of inclusion is that the general education teachers are determined to succeed in inclusive education, and they are willing to accept the students with disabilities to classroom. Thus, it is crucial to understand mathematics teachers' perceptions of inclusion in order to provide the students with disabilities with effectual inclusive mathematics education (DeSimone& Parmar, 2006).

Teacher perception is critical because negative perception causes them not to be open to change their instruction strategies, and it also impedes the development of inclusive education (Hill, 2009; Contreras, 2011). Among various factors which

have impact on teachers' perception are teachers' experience regarding inclusive education, duration of time spent communicating with students with disabilities, teachers' training, administrative support, work load, limited time, etc. (Albritten, Mainzer, & Ziegler, 2004; Leatherman, 2007). On the other hand, teachers' perceptions regarding inclusion affect their teaching methods and strategies (Shin, Ok, Kang & Bryant, 2018). Efficient teaching practices have great impact on the mathematics achievement level of students with disabilities (Witzel, Riccomini & Schneider, 2008). In the literature, it is stated that the incompetency of students with disabilities in mathematics stems from the creation and presentation of the instructional content of the programs implemented to these individuals rather than the students themselves (Yıkmış, Öncül &Acar, 2013).

Being qualified in mathematics is contingent upon improving conceptual and procedural knowledge. Even though the two kind of knowledge may not be indistinguishable all the time, it is crucial to examine their purport in detail. Conceptual knowledge refers to concepts of knowledge and meaningful learning is critical to acquire it. This means that the person creates new information by using his/her existing knowledge. Procedural knowledge is a kind of information consisting of routines and rules to solve problems (Rittle Johnson, Schneider & Star, 2011). Baroody (2003) stated that conceptual and procedural knowledge have an effect on each other. In other words, enhancement in conceptual knowledge leads to an increase in procedural knowledge, and similarly, development in procedural knowledge results in an increase in conceptual knowledge. However, certain studies assert that conceptual knowledge have stronger impact on procedural knowledge (Hecth & Vagi, 2010). Thus, giving priority to developing conceptual understanding can make more sense to acquire efficient mathematics education. Many studies reveal that conceptual understanding can be promoted by using concrete manipulatives influentially since students have a chance to practice and strengthen mathematics concepts (Uribe-Florez & Wilkins, 2010). Moreover, McNeil and Jarvin (2007) state that concrete materials make contribution to improving students' memory considerably, and this is crucial for students with MLD who suffer from memory impairments (Kroesbergen & Van Luit, 2003).

Apart from concrete manipulatives, technology may be used to develop conceptual understanding in mathematics education. The National Council of Teachers of Mathematics (NCTM) has established a number of principles for the preparation of an effective mathematics curriculum, and one of them is about the use of technology owing to the need of students to learn by understanding mathematical knowledge (2000).

Researches indicate that, students with MLD particularly have gaps in the skills which are from the field of four arithmetical operations and problem solving (Geary, Hamson, & Hoard, 2000; Hanich, Jordan, Kaplan & Dick, 2001). However, students with MLD have to acquire the skills they need to have in their daily life in order to survive as productive and independent individuals in society. For this purpose, some of the basic academic skills aimed at equipping students with special needs are four basic arithmetical operations and problem solving (Özkubat & Özmen, 2018). Mathematics is a tool used to find solutions to problems encountered in daily life and it is important because four arithmetical operations skills form the basis of problem solving (Nar, 2018). Since the problems encountered during life are in a rapid change, critical thinking, reasoning and problem solving instruction should be taken to the center of in order to equip individuals with these skills (Lester, 1994). However, it is seen that individuals with intellectual disabilities and individuals with learning disabilities have trouble in shopping and problem solving which require basic mathematical operations knowledge (Yıkmış, Öncül & Acar, 2013). Certain number of students with MLD, does not have meaningful learning in arithmetical operations since they are not able to construct their conceptual understanding. For instance, it is revealed that students with MLD spend almost all the instructional time without conceptual understanding when they perform standard algorithms (Maccini & Gagnon, 2000).
Many studies emphasize the significance of using teaching strategies which enhances the conceptual understanding of students with special needs in mathematics education (Baykul, 2016; Uribe-Flórez & Wilkins, 2010). Teachers must be knowledgeable and experienced with teaching strategies implemented on students with disabilities (McLeskey & Billingsley, 2008). Furthermore, in the

literature, there are many studies regarding teaching strategies which enhance conceptual and procedural understanding of students with MLD. The main strategies for teaching four basic arithmetical operations and problem solving are Concrete-Representational-Abstract (CRA), Virtual-Representational-Abstract (VRA) and Touch Point (Bouck, Bassette, Shurr, Park, Kerr & Whorley, 2017; Milton, Flores, Moore, Taylor & Burton, 2018). These strategies are based on teaching mathematics from concrete to abstract. They consisted of three stages, which are concrete, semi-concrete and abstract, respectively. In the concrete phase, while concrete manipulatives are used in CRA sequence, virtual manipulatives are used in VRA sequence; however, semi-concrete and abstract stages include the same procedure in both strategies. In semi-concrete stage, the subject is visualized by using drawings or representations and in the abstract stage, only numbers are used (Agrawal & Morin, 2016). Similarly, touch point strategy includes three stages: in concrete stage, the numbers are represented by three-dimensional materials, while they are described by two dimensional images in semi concrete stage. Finally, numbers are used in the abstract phase (Vinson, 2004). Bruner (1966) claims that being more competent in relevant subject, firstly the students need to be educated with concrete materials, and then with abstract phase. Therefore, mathematics teachers need to use CRA, VRA and touch point strategies and to provide the students with necessary skills regarding four basic arithmetical operations and problem solving.

Briefly, getting high quality mathematics education has critical importance for students with special needs. Especially four basic arithmetical operations and problem solving skills should be gained by students with disabilities since the skills are necessary in daily life, and also they are prerequisites for later topics in the mathematics education. Mathematics teachers have a great role in equipping students with MLD with these skills by using appropriate teaching methods and strategies. However, teachers' perceptions of inclusion affect their preferred teaching strategies. In addition to this, teachers' fulfilling the responsibilities regarding inclusion and their attitudes toward the students are also related to their perception of inclusion. In detail, teachers' adverse attitudes toward students with

special needs may give rise to negative experiences among these students while positive attitudes lead to an increase in self-esteem and achievement (Daane et al., 2000; Palmer, 2006). Therefore, it is important to investigate mathematics teachers' perception of inclusion for successful inclusive education. In the current study, since the factors like school conditions, trainings, experiences of mathematics teachers influence the teachers' perception, they are examined in detail. Moreover, perception of mathematics teachers has an effect on their certain responsibilities such as preparing individualized education plan and motivating these students and their preferred teaching strategies. In this research, mathematics teachers' used strategies while teaching basic arithmetical operations and problems are studied.

1.1 Purpose of the Study and Research Questions

The purpose of this study is to investigate mathematics teachers' perceptions of inclusion and to learn about their teaching methods, techniques and strategies for basic arithmetical operations and problems. Moreover, it is aimed to learn their difficulties they face about these subjects and their suggestions for solutions. In addition, there are some effective strategies known in the literature which are named as concrete-representational-abstract, virtual-representational abstract and touch point in teaching four basic arithmetical operations and problems to students with disabilities (Mancl, Miller and Kennedy, 2012; Özlü, 2016, Yıkmış et al., 2013, Bouck, Bouck & Flanagan, 2015). Another purpose of the study is that if mathematics teachers do not know these strategies, then through this study, they may learn about them since they will receive informative instruction about those strategies from the researcher. After receiving such an instruction, it was hypothesized that the teachers would use two of those strategies in their support-education lessons by taking into consideration their preference and their students' level. After those implementations, the participants' opinions about the strategies would also be considered.

The basic research questions and the sub-question that the study aims to answer are as follows;

1) What are the factors that play role in middle school mathematics teachers' perceptions of inclusion?
2) How does the process of teaching mathematics to students with MLD work?

a) Which methods, techniques and strategies do middle school mathematics teachers use to help students with MLD in their classrooms with arithmetical operations and problems?

3) What are the middle school mathematics teachers' opinions about the strategies which are implemented (CRA, VRA and touch point strategies) for teaching arithmetical operations and problems?

1.2 Significance of the Study

According to Turkish Statistical Institute (2009), number of individuals with special needs accounts for 12 percent of all people. This means that there are many individuals with special needs in Turkey. Some of them are trained in special education schools while some others are trained in general education classrooms. Although general education classrooms offer many advantages to students with disabilities such as improving social skills, it is crucial to satisfy the needs of the students. In order to provide the essential support for students with disabilities, general education classroom teachers play a foremost role in inclusive education (IDEA, 1997; Lindsay, 2007; DeSimone & Parmar, 2006). In particular, mathematics teachers have a significant responsibility for providing students with MLD with effective mathematics education since learning mathematics has critical importance in maintaining their life independently (Batu & Kırcaali-İftar, 2005; Özkubat & Özmen, 2018). However, the given training is mainly based on the perception of mathematics teachers since their perceptions are related to fulfilling the responsibilities such as using effective teaching strategies, preparing and implementing individualized education plans and motivating students with MLD to learn mathematics (McLeskey & Billingsley, 2008; Cooper, Heron & Heward, 2007). Therefore it is vital to investigate mathematics teachers' perception based on the teaching methods, strategies, techniques that they use on mathematical students

with MLD along with other responsibilities of them. In this research, mathematics teachers' instruction of four basic arithmetical operations and problems is investigated. The reason for studying this subject is that great many studies expressed that four basic arithmetical operations are one of the most challenging topics for students with MLD (Graham et al., 2007; Shin, Ok, Kang & Bryant 2018). Graham et al. (2007) stated that students with MLD make quite a slow progress and they have to sweat over four basic arithmetical operations. They usually cannot learn the necessary skills in the subject during their middle school continuum and so they do not catch up with their peers with normal development in terms of mathematical achievement (Hempenstall, 2005; Swanson & Hoskyn, 2001). Furthermore another reason for concentrating on the four basic arithmetical operations in the current study is that they are critical to helping the students with disabilities to be more independent and productive individuals. Moreover, there are various factors that affect the teachers' perception of inclusion some of which are school conditions, teachers' knowledge, experience, trainings (Avramidis & Kalyva, 2007; Mukhopadhyay, Nety, & Abosi, 2012; Woodcock, 2013). According to the results of the study, the possible factors that affect the perception of mathematics teachers negatively can be investigated and necessary arrangements can be made in inclusive education. Moreover, examining the mathematics teaching processes carried out by mathematics teachers with students with MLD and identifying the different applications they have made with the students with MLD in this process might be are very important both for the guidance of other mathematics teachers and for preparing a more effective education environment for the students. Moreover, in this study, teachers are expected to apply some strategies in their support education lessons with students with MLD. These strategies are concrete-representational-abstract, virtual- representational-abstract and touch point. If they have not used the strategies previously they have a chance to apply and evaluate these strategies by means of this study. Moreover, their opinions about the strategies can be guidance for other mathematics teachers.

Another significance of the study is that in the accessible literature, although there are many studies aimed to investigate teachers' perception of inclusion, there are not sufficient studies about the mathematics teachers' perceptions of inclusion in

particular. Similarly, the research related to basic arithmetical operations and problems teaching strategies that are used by middle school mathematics teachers in inclusive education is limited. Moreover, there are many research studies aimed to examine efficiency of CRA, VRA and touch point strategies in teaching students with MLD, but most of them do not focus on teachers' opinions of these strategies. However, the teachers may use them in inclusive education when they believe in their effectiveness. Thus, learning mathematics teachers' opinions of the strategies is quite significant. Considering the mentioned aspects, the present study may contribute to the literature.

1.3. Definition of Important Terms

Inclusion: Inclusion is a special education implementation which is based on the principal of students with special needs and typically developing students are educated together in general education classrooms wherein support education services are provided in the state and private preschool, primary education, secondary education and non-formal education institutions (Special Education Services Regulation 2006).

Learning Disabilities: Learning disabilities are difficulties in comprehending or using spoken or written language, which may affect the ability of listening, thinking, speaking, reading or doing mathematical calculations (NCLB, 2001).

Mathematical Learning Disabilities: Mathematical learning disabilities (MLD) refer to deficits concerning the acquisition of mathematical abilities (Ostad, 2015). For this study, MLD represents mathematical learning difficulties which result from both learning disabilities and intellectual disabilities.

Four Basic Arithmetic Operations: They are addition, subtraction, multiplication and division.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Certain topics are presented in the review of literature. These are place of mathematics in inclusive education, teachers' perception of inclusion, teaching basic arithmetical operations and problems to students with MLD.

2.1 Place of Mathematics in Inclusive Education

Students who are eligible for special education can take part in a nonrestrictive environment as much as possible with their typically developing peers according to the Individuals with Disabilities Education Act (IDEA, 1997), which is known as the least restrictive environment (LRE). According to this law, it is obligatory to offer a proper and free education for students, and it says that all students have education in LRE, which in most circumstances is the general classroom, and so the concept of inclusion becomes more well-liked (Zigmond & Baker, 1996). Similarly, in Turkey, in special education, students with special need stay far from the society, and they have adaptation problems when they come together with their peers who demonstrate normal development. This issue brings up "Inclusive Education" practices (Yıkmış, 2006). Although inclusion has drawn intense interest recently, there is no universal designation available for it (Graham-Matheson, 2012). Some definitions of inclusion emphasize additional support for the students with special needs. For instance, in Special Education Regulation issued in 2000 (MoNE, 2000), inclusion is defined as special education practices based on the principle that individuals with special needs carry on their education with their peers without disability by providing extra support services in state and private; pre-school, elementary, secondary schools and informal educational institutions. In addition, Pais (2014) suggests that providing equality of opportunity enables the people who are disadvantaged in terms of resources, teachers, mathematical

concerns in society and so forth to handle different challenges, which establishes the value of inclusion. Similar to Pais, Diaz (2013) also defines the inclusion by mentioning mathematics education. He states that inclusion means seeking equality in mathematics for all students.

The fact that students with special needs have the right of education at schools through inclusion and inclusive education is more effective for them are the two main justifications for supporting inclusive education (Lindsay, 2007). However, it is essential to meet educational needs of special individuals by improving their mental, social and physical skills in order to integrate them into society (Sucuoğlu & Diken, 1999). Mathematics education is essential for teaching students with disabilities since one of the common objectives of mathematics programs conducted at schools with children with intellectual disabilities is to prepare them for solving problems they face in their daily lives and with this objective, similar to the students with typically developing, mathematics class is also provided for the students with intellectual disabilities from the first to the last year of the schools they attend (Wagner, 1990). People who are efficient in mathematics use numerical strategies for organizing, analyzing and synthesizing information in solving problems of everyday life. Some people make up a template in their minds against the problems they experience or make analogy between the circumstances they face. For example, some people even make use of mathematical formulas in their daily lives to solve problems they encounter (Baykul, 2005). These people are usually those who started to learn mathematics in early childhood and preschool period, and they use it all their lives while performing daily activities. Functional academic skills are the abilities related to the application of mathematics, reading and writing skills in daily life (Snell & Brown, 2000). Teaching functional academic skills such as addition and subtraction will make learning similar academic skills easier for the individuals with disabilities. Thus, it will make a significant contribution to the individuals with special needs in terms of feeling comfortable in an inclusive environment and interacting with friends, and ensuring that their friends accept them. As a result, they will become more socialized (Batu & Kırcaali-İftar, 2005). However, mathematics requires understanding of content,

making comparison and establishing complex relations. For this reason, while teaching mathematics skills, it becomes more challenging to teach abstract concepts to the students with mental retardation by using only common techniques (MoNE, 2001). The students with mental retardation and learning disability have more difficulty in learning mathematics skills and adapting what they learned before to the new circumstances compared to students with normal development. Thus, in teaching mathematics skills to the students with special needs, it is required to provide special plans, materials, teaching methods and learning environment that is arranged based on their needs and capacities (Ünal, 2012). Accordingly, Kroesbergen and Van Luit (2003) advised to use effectual instructions which are varied and unusual for students with MLD due to students' certain characteristics related to learning mathematics. They argued that students with MLD have memory impairments causing to have hardships in both acquisition and remembering of mathematical skills, and also, they have great difficulty in associating the existing knowledge with a new task. Moreover, according to the study carried out in innovative mathematics, students with LD take an inactive position in classrooms and have challenges in cognitive learning and using effective strategies, and they demonstrate considerably low improvement compared to their more qualified friends (Baxter, Woodward, Voorhies, & Wong, 2002). In the last few years, providing a deeper insight into conceptual mathematics has come into prominence for the Common Core State Standards of Mathematics (CCSS-M, 2011) and The National Council for the Teachers of Mathematics (NCTM). In the process of teaching students with MLD, it is important to increase their conceptual understanding. Inability to acquire conceptual knowledge results in memorization. Understanding concepts and relating them to knowledge improve memory and make learning easier for students (Baykul, 2016). Conceptual knowledge is created by using concrete materials, which is supported by Piaget (1952) asserting that comprehending abstract concepts, especially when designated by symbols and words, is beyond children's mental capacity. It is essential to provide children with learning experiences through concrete materials. Researches supporting the Piaget' claim suggested that concrete materials specially designed for mathematics and adaptive teaching strategies promote students with special

needs to have an insight into abstract concepts of mathematics, thus to build relationships with concrete ideas (Uribe-Flórez & Wilkins, 2010; Moyer-Packenham, Salkind, Bolyard & Suh., 2013). A study was conducted by Kaufmann et al. (2003) on six pupils having difficulties in mathematics, who took part in a mathematical program three times a week for six months. Counting, symbols, addition and subtraction facts, and place value were taught to pupils by explicit instruction from the concrete to the abstract. The pupils with mathematics difficulties made a great progress throughout the program as compared to their typically developing peers.

Researches revealed that students with MLD have difficulty in especially counting skills and related to counting skills they also suffer from the comprehension of four basic arithmetical operations and problem solving (Powell, Fuchs & Fuchs, 2013; Passolunghi & Cornoldi 2008; DeChambrier & Zesiger, 2018). Four basic arithmetical operations are included in functional academicals skills required for individuals to live independently. Considering that mathematics is a means to solve problems of daily life and four operations are the basics of problem solving, the significance of four basic arithmetical operations is understood clearly (Nar, 2018). To carry out successful learning of basic arithmetical operations, Fritz-Stratmann et al. (2014) emphasized that students comprehend the strategies for solving arithmetical operations conceptually at first, and then, implement the strategies. However, in a study, it is revealed that students with LD are mostly instructed to follow algorithms procedurally, neglecting the conceptual principle of algorithms (Cawley, Parmar, Lucas-Fusco, Kilian, & Foley, 2007). This situation may lead students with MLD to poor conceptual understanding. Similarly, Fritz-Stratmann, Ehlert and Klüsener (2014) argued that most of the teachers are content to teach operations through procedural algorithms; however, they may underestimate the fact that it may prevent conceptual learning. When students do not acquire conceptual mathematics, they may have difficulties starting from the beginning because learning procedures at a high level does not assure that they grasp what they do. On the other hand, providing students with MLD with procedural knowledge is founded effectual in the research of Tournaki (2003). In the study,

both students with TD and students with MLD were separated as the control and experimental group. The experimental group was trained about basic facts by using drill and practice. According to findings, compared to control group, both students with MLD and students with TD in experimental group advanced in basic facts considerably. Based on the studies (Tournaki 2003; Stratmann et al., 2014) it is inferred that conceptual and procedural knowledge should be gained by students with MLD, but conceptual understanding should be focused primarily.

In the last few years, some researchers have put emphasize on specific deficiencies of students with MLD (Cawley et al., 2007, Powell, Fuchs & Fuchs, 2013). Counting skills are challenging for students with MLD. They often miscount by using ineffective strategies (Geary, Hamson, & Hoard, 2000). For instance, to perform counting all strategy, after students counted first and second attend respectively, they count both the first and second attend beginning from 1. It is generally primary counting strategy of addition performed by students. Considering that the answers usually turn out to be incorrect, counting all strategy is not highly efficient. Students usually stop using counting all to keep with "counting on" or "counting up" strategy which is more advanced (Fuson & Secada, 1986). However, Hanich et al., (2001) found out that students with MLD prefer counting all strategy instead of counting on strategy since regarding mental calculation, children with special needs use underdeveloped strategies, and they tend to use various counting strategies such as verbal counting, finger counting, etc. Indeed, Hightower (2018) asserted that with the help of finger counting students with MLD may convert the number representations from abstract to concrete. Since fingers are used as concrete materials, it is recommended to encourage students with MLD to use fingers in solving arithmetical operations by virtue of the fact that students with MLD are in need of visualizing the numbers, and using the fingers provides them with mental number representations. In addition, fingers symbolize the number system of base ten and so using finger based counting contributes to the calculation abilities of students with MLD (Hightower, 2018). Although finger counting has benefits in terms of making accurate calculations easier, students with MLD may choose erroneous and ineffectual counting strategies by using fingers (Chan &

Dally, 2001). For instance, Domahs, Krinzinger and Willmes (2008) found out that students with MLD have great difficulty in keeping the record of "full hands" when they are calculating or counting. However, it is revealed that giving training concerning finger counting leads to a decrease in the number of errors. Despite the benefits of finger counting, Simon and Hanrahan (2004) reported that a great number of students with MLD were embarrassed to use fingers in counting on or counting all strategies in regular education classrooms. Moreover, he recommended that students with special needs use other effective strategies which do not involve finger counting substantially in addition operation in particular since it is the most fundamental operation. In addition, Passolunghi & Cornoldi (2008) revealed that counting backwards strategy as well as counting down strategy are challenging for particularly mathematical disabled children. Similarly, Torbeyns et al. (2009) revealed that students with MLD struggle in solving subtraction problems by using counting backwards strategy. To overcome the drawback, counting up strategy may be used since disabled students are more capable of counting forward. While using counting up strategy, the students begin with the subtrahend and they continue to count forward until reaching the minuend (Powell et al., 2010). Moreover, Butterworth & Yeo (2004) reached the conclusion that the students with MLD get into trouble in rhythmic counting, and they are confused if they do not start counting from the first rhythmical number. For instance when the students are asked to skip counting by 2, but beginning from 6, they tend to start with 2 rather than 6. Additionally, when performing rhythmic counting, it is difficult for the students to make transitions. For example, it is difficult for them to think of 10 after 9 and 30 after 29. In such cases, as a solution, the students can be asked to count by ten first, and then, after they are accustomed to these numbers, they may be asked to count by one (DfES, 2001).

Related to counting difficulties, students with MLD also have difficulties in four basic arithmetical operations with multiple digits because of poor understanding of place value (DeChambrier & Zesiger, 2018; Thoules, 2014; Jimenez & Fernandez, 2016). DeChambrier & Zesiger (2018) revealed that students with MLD are different from their peers who are typically developing in terms of fluency and

accuracy in arithmetical operations with multi-digit. One of the basic concepts in mathematics is place value because our number system is based on the place value. After students learn number system regulation requiring to count, they start to comprehend the fact that ones, tens, hundreds and so forth convert into each other in that one ten includes ten ones or one hundred involves ten tens. Afterwards, the students master the multi-digit numbers by using place value knowledge. For instance, students interpret that two digit numbers are formed by ones and tens (Thoules, 2014). Researches revealed that insufficient conceptual understanding of place value leads to errors in basic arithmetical operations (Allsopp, Kyger, & Lovin, 2007; Thouless, 2014). Thoules (2014) carried out his doctoral thesis to investigate place value understanding of 15 students who had mathematical learning disability. In this research, students made errors. One of them is that students with MLD tend to ignore place-value, so they align the digits erroneously in standard algorithms. Another mistake is that students with MLD do not know the place holder meaning of zero. Moreover, Thoules puts forward another error which is that students always subtract the smaller number from the larger one even if the small digit is in minuend. For example, in his study, one child made the error when she tried to find answer of 33-16, she reached the wrong answer which is 23 since she subtracted 3 from 6 instead of regrouping. To overcome these errors, Jimenez & Fernandez (2016) suggested that the teachers should remind the students with MLD to how they solve the questions and they also prepare a guideline which includes the steps of they follow. Furthermore, they asserted that the students have more difficulties in division operation compared to other operations. One of the most common errors in division operation is that when the dividend consisting of two digits and the divider is single digit number, the students tried to divide by using both two digits in the dividend at first. For instance when they complete the operation of 24:2 by using standard algorithm, they consider that how many 2 in the number of 24 instead of how many 2 in the number of 2 (Saygılı, 2017). In addition, the students with MLD may confuse the dividend term with divider term (Butterworth & Yeo, 2004). Bird (2013) asserted that since division operation requires sufficient skills of multiplication and subtraction operations, it should be taught after the students acquired these skills. In teaching division operation both

partition and measurement meaning of the division should be emphasized. To illustrate, for the explaining the meaning of 12:4 operation, the following statements should be used, 12 cookies will share equally to 4 people or 12 stamps will be grouped by 4.

Problem solving is another challenging subject for students with MLD (Montague & Applegate, 1993). Shin and Bryant (2015) reviewed 23 studies and analyzed mathematics and cognitive performances of the students with and without learning disability. In the study, they described mathematics and cognitive performances of the students with LD by comparing them with the students of the same developmental age and with those younger than them. When the findings were analyzed in terms of mathematics performance variable, it was determined that in addition to counting skills, computing and using mathematics strategies, students with LD are at a lower level in problem solving. Moreover, Parmar and Singer (2005) examined the problem solving skills in detail, and they found that students with MLD have difficulty in both comprehending and commenting on the problem. To illustrate, in the study, the students with MLD misinterpret the meaning of "tallest" as "taller than". Similar to the study, Fuchs, et al. (2008) found out that the students with MLD have trouble in apprehending the problem, and so they do not use their problem solving skills in the word problems which involve irrelevant information. Furthermore, they exhibit poor performance in problem solving because they cannot distinguish between the givens and the desired ones in the problems (Jitendra et al., 2007). Although students with learning disabilities have difficulties understanding the problem, Stein (1998) suggests that when the students' language development is supported, then their problem solving skills also improve. In the beginning, she applied two pretest related to mathematics facts and mathematics word problems in order to evaluate students' ability. Afterwards, the training was provided with students on a daily basis. In the lessons, students were expected to rephrase the problems with their own words and using number facts by taking into consideration a problem solving plan. The plan includes 4 steps which are expressing the information, indicating the algorithmic rule, solving the problem and checking the result. Moreover, teachers prepared the materials for the

instruction and the students use them. After the training was completed, the students' problem solving and computation abilities were evaluated by implementing a post-test. The difference between the pretest and posttest revealed the significance of language development in achieving of mathematical word problems. In addition to language problem, impairments of procedural and conceptual understanding lead to having difficulty in word problem solving (Geary, 2004). Rosenzweig, Krawec, and Montague (2011) suggested that since students with MLD tend to use ineffective strategies when they solved problems, they do not focus on essential knowledge in the problems. Teachers should use effective strategies to develop problem solving skills of students with disabilities. Some of those strategies are CRA, VRA which are proved as effective strategies that enhance conceptual and procedural understanding in certain researches (Milton et al., 2018; Bouck et al., 2015).

Appropriate learning strategies and conditions should be provided to students with special needs to overcome difficulties they have in these areas. The success of inclusive education is based on certain factors which are principals, typically developing students, supportive education service and teachers (Ünal, 2012; Diler, 1998). As for the school management, if school management believes in the need of inclusion, it can provide support in helping teachers receive trainings, in the number of students to be assigned to the classes, in the preparation of classes, providing materials and assigning a special education teacher within the school. Encouraging teachers to support each other within the school and rewarding those helping one another and working in cooperation in various ways will increase the possibility of cooperative behavior and improve a shared environment within the school (Stainback, Stainback & Stefanich, 1996). Moreover, typically developing students also have a crucial impact on students with MLD. Downing and MacFarland (2010) carried out a study to reveal the perceptions of school managers who had taken part in inclusive education. The findings disclosed that each participant believed in the benefits of inclusion. The participants mostly focus on the inclusive educations' opportunities for students such as increased communication with normally developing peers on the part of the students with

disabilities and their developing acceptance for diversity. In addition to social interaction, some research proved that normally developing students help students with special needs via peer-assisted learning in mathematics. For example, Allsopp (1997) conducted a study on 262 students in middle school and 38 percent of them had difficulty in understanding mathematics. In this research, first of all, the teachers were given the instruction regarding peer tutoring strategies. Then, the teachers implemented peer tutoring methods to half of the students for 4 days. Based on the pretest and posttest scores, it is determined that although peer tutoring instruction did not have an effect on students' computational skills, it had an impact upon students' problem solving abilities positively. Furthermore, supportive education services are also crucial for success of students with MLD. There are three supportive services for students with special needs. They are support in class, supportive education room (resource room) and special education counselling (Batu, 2000). There are two options of learning environment for inclusive education, one of which is education in resource room which is executed by special education teacher on an individual basis or in small groups (Kırcaali-iftar, 1998). Vlachou, Didaskalou, & Argyrakouli (2006) conducted a study regarding considerations of students with disabilities about support education. The outcomes of the research found out that 53.7 % of the students gave preference to the support room while 38.9 % of them choose the general education classroom as a priority. The students who preferred the support training room reported that they understand the subjects more effectively because of not being crowded and spending more time with the teacher. Moreover, the study also revealed that students that are taught in resource room do not hesitate to ask questions if they have difficulty. Another research carried out by Ünal (2012) had the significant outcomes related to effectuality of resource rooms with regard to these students' achievement in mathematics. At the end of the study, it is found that under favor of resource room, students with MLD are more successful than their peers with special needs who are educated in regular classrooms.

The most important factor which affects the achievement of the inclusion is the teacher since other factors are mostly related to teachers. Effective and unbiased

inclusive education is mostly based on teachers' attitudes and beliefs, and so teachers' voluntariness of inclusion has a great impact on achievement of students with disabilities (Van Reuse, Shoho & Barker, 2001). Thus, teachers' perceptions of inclusion and the factors which affect the perceptions should be investigated to succeed in inclusion.

2.2 Teachers' Perception of Inclusion

Wildrodt and Claybrook (1995) suggest that the perception of teachers about inclusion is the fundamental of its success. Considering that there are various students with different abilities available in classrooms today, teachers are required to pay attention and take care to improve the level of inclusion (Hodge et al., 2004). To ensure prospering inclusion, teachers have some responsibilities, some of which are using effective teaching strategies for students with disabilities, preparing individualized education plans and using effective reinforcements in process of inclusive education (McLeskey & Billingsley, 2008; Cooper, Heron & Heward, 2007; Special Education Services Regulation, 2018). Teachers should prepare individualized education program for individuals with special needs based on the training programs they will follow (Special Education Services Regulation, 2018). Moreover, students' level of achievement is evaluated according to their individualized education program. Also, in all measurement and evaluation processes, necessary measures are taken by making arrangements in time, environment, methods, devices and materials in accordance with the type of students' inadequacy, developmental characteristics and educational performance (Special Education Services Regulation, 2018). Thus, teachers are expected to be capable of developing and executing IEPs (Sucuoğlu, Bakkaloğlu, Karasu, Demir, & Akalın, 2013). The research carried out by Simone and Parmar (2006) revealed that two-thirds of the participants who are mathematics teachers asserted that they had the greatest role to organize instruction for the students with learning disabilities. Although most of the participants talked about "differentiated instruction", they did not give a sufficient definition or examples about its requirements. There were no formal individualized education plans prepared for

students with LD by them. Moreover, Neary & Halvorsen (1995) recommend that motivation, active learning and instruction based on the classroom diversity are the most essential qualifications of an ideal learning environment. Reinforcements are required to promote a certain behavior in days to come. Therefore, in order to achieve an efficient instruction and behavioral change program, it is necessary to define powerful reinforcements for each student individually (Cooper, Heron & Heward, 2007). According to a study conducted on 114 pupils from 3rd to 6th grades, which consisted of both students with MLD and typically developing students, no predictive value for self-directed motivation was found when inspected with other predictors for mathematics. However, substantial variations in self-directed motivation were revealed by the study though no differences were observed in directed motivation between the students with and without MLD. It was concluded that the level of self-directed motivation for students with MLD was below the level of their peers (Baten & Desoete, 2018).

Various teaching methods are necessary based on the students' specific needs and the nature of the subject to be instructed. Thus, adapting various teaching methods and implementing them are essential to promote a favorable learning environment, which supports the students to gain the knowledge and skills of a certain objective (Kargın, 2010). Shin et al. (2018) found out that there is a link between teachers' perception of inclusion and their teaching strategies to students with LD. Similarly, some other studies found out that execution of competent teaching strategies by those with positive attitudes towards inclusion is more frequent than others with negative attitudes (Bender, Vail & Scott, 1995; Schumm & Vaughn, 1991). In a research carried out by Choi (2008) it was investigated that middle school mathematics teachers' perceptions about their students and the strategies that they used in word problem solving. In accordance with this purpose, Choi examined 293 mathematics teachers' most used strategies. The results put forward that nearly half of the participants claimed that the most efficient factor that determines teaching strategies for students with MLD is their experience rather than their previous training. Moreover, according to the results, 64.1 percent of the participants generally use teaching strategies involving various representations and concrete

manipulatives for arithmetic operations while 47.8 percent of them prefer to implement teaching strategies based on visualization for the topic of word problem solving. However, technology usage in training the disabled students is not common. A more current survey was performed by Shin, Ok, Kang and Bryant (2018). Their aim was to clarify both special education teachers and general elementary mathematics teachers' beliefs about perceptions and methods they used in teaching mathematics. In line with this purpose, they formed a survey, and they implemented it to 38 special and 55 general education teachers. The results revealed that general education teachers use textbooks, computers, and classroom board more often compared to special education teachers. However, the special education teachers give preference to the use of concrete manipulatives, and technological devices such as a tablet.

Considering the fact that teachers' negative attitudes towards inclusion of students may cause them to have negative learning experiences, it is essential to investigate teachers' perception of this issue in order to facilitate instruction to the students with LD (Daane et al., 2000). There are some specific factors that determine teachers' perceptions of inclusion (Hill, 2009; Leatherman, 2007). For instance, some research studies revealed that teachers' knowledge, amount of contact with the students, previous experience with inclusion and factors related to the school affect teachers' perceptions of inclusion (Van Reusen et al., 2001; Sart, Ala, Yazlık & Yılmaz 2004).

According to a research on the Greek teachers' perceptions, 'lack of knowledge on the special education field was the most significant restraints to execute inclusion successfully (Avramidis & Kalyva (2007). DeSimone and Parmar (2006) conducted a research to examine middle school mathematics teachers' attitudes, their preservice and trainings in terms of teaching pupils with MLD in special classrooms. Although the teachers faced several difficulties regarding mathematics inclusion, with the help of effective team work and collaborative strategies, they were able to benefit from such difficulties. Moreover, they did not acquire required skills to handle such difficulties in instructing students with LD in inclusive classes

for mathematics during preservice teacher programs. Most of the courses about special education were based on theoretical content including research on special education, definitions of terms representing disabilities and applicable laws. The participants of the survey were of the same opinion regarding methodology courses of mathematics that lacked inclusion and certain teaching strategies for students with LD. Similarly, vocational trainings did not concentrate on such teaching strategies and how to prepare individualized instruction plans in terms of teaching mathematics to students with special needs, which made such programs non-functional. Therefore, it was concluded that most of the participants were not proficient in terms of certain instructional strategies that enable the students with MLD to acquire mathematics skills. In addition, a research conducted by Van Reusen et al. (2001) on high school teachers revealed that teachers' supportive attitude towards inclusion and instruction in general classrooms regarding students with special needs, depended on the level of special education training in teaching students with special needs. Similarly, according to The National Center for Educator Statistics (2012), the leading entity that analyzes and reports data about education and training programs including professional development helped the teachers develop more efficient instruction skills. On the other hand, another research indicated that the lack of training and development programs was the major factor that increased negative attitudes towards students with special needs (Carroll, Forlin & Jobling, 2003). Further, Woodcock's (2013) study deals with the relationship between differentiation curriculum and attitudes of students with special needs. Once the teachers fulfilled the requirements of an undergraduate program, they proceeded with the teaching program included in a one-year training period. The content of the programs of each separate university was structured so that the students were included in teaching process, specific curriculum methods and practices. Training about inclusive education concerning teaching and addressing the students with special needs, and proficient classroom management and teaching strategies needed to be completed by the trainees. The levels of the participants concerning the training period varied at the time of the study. According to the study, those who were close to completing the program had more positive attitudes towards individualized curriculum and students requiring

individualized activities and tasks, compared to the trainee teachers who were at the beginning of the training program.

The analysis of a research conducted by Avramidis and Kalyva (2007), which included Greek teachers, 155 of whom were primary school teachers from Northern Greece, demonstrated positive attitudes towards inclusion, but the reviews on the challenges of including different disabilities in general classrooms varied. Teachers who were experienced in active instruction including students with special needs displayed more positive attitudes towards those with little or no experience. Similarly, the study of Lambe and Bones (2006), has found out that positive attitudes towards inclusion are proportionate to the interaction and experience of teachers with the students with special needs. However, Cochran (1998) recorded that inexperienced teachers who were at the beginning of their teaching career developed more positive attitudes towards inclusive education than their colleagues with more experience. This was as a result of the fact that teachers' education programs concerning teachers' attitudes towards inclusive education have changed, and that there is a difference between the standard and existing teaching practices (Cochran, 1998). There is another study whose findings are consistent with the result of Cochran's research' in terms of teacher experience. The study that was carried out on student teachers found no remarkable differences between the teachers' experience with the students with special needs and their attitudes towards them. Therefore, experienced student teachers who interacted with students with special needs did not demonstrate a great difference in their attitudes towards such students.

According to the research conducted by Avradimis & Kalyva (2007), teachers' attitudes towards inclusion are closely related to such school factors as lack of support from the society and school administration, lack of time and insufficient cooperation, which are considered to be restraints on an effective inclusion. Likewise, Mukhopadhyay, Nety, & Abosi (2012) conducted a qualitative research about the execution of inclusion by primary education teachers at their schools. The teachers complained about crowded classes and insufficient resources and facilities.

Moreover, in a research carried out by Sart, Ala, Yazlık and Yılmaz (2004) at a school located in Istanbul, teachers suggested that they are unable to include the students with special needs in the class effectively. Collaboration for inclusion has utmost importance. Special education teachers, individualized education programs, school counselors, supportive education and related materials are inseparable components of inclusion, without which teachers would only try to keep the class quiet and prevent students with special needs from disturbing the others in the class. The teachers argued that when they attempt to take care of the students with special needs individually in classrooms, they have limited time left for other students and instruction. Furthermore, certain reasons of negative perceptions are detected in Battige's study (2008). In this study, it is revealed that middle school general education teachers' negative attitudes towards inclusion created some negative outcomes such as less progress, less comprehension, more workload, and more obligations and stress for students.

Another research that was conducted to reveal high school teachers' attitudes towards inclusion in general classrooms focused on the correlation between high school teachers' attitudes towards inclusion of students with special needs in general classrooms, and specific factors such as gender, special education training, curriculum and amount of classroom experience. The participants consisted of 125 teachers working at a socially-disadvantaged school in San Antonio, Texas. The teachers' attitudes were assessed based on the following four different factors: Academic Capacity/Teacher Proficiency, Teacher Training, Academic Background and Social Adaptation (for students). It was found that teachers with efficient special education training or exposure to students with special needs are more likely to have positive attitudes towards inclusion of such students in general education classrooms, which indicates that teachers' positive attitudes towards those students with special needs are to some extent associated with experience, knowledge and training in this area (Van Reusen et al., 2001). Moreover, concerning teachers' beliefs, perceptions and feelings about inclusion based on the readiness of schools including school administration, school atmosphere, content to be taught, support for individual students, teachers' expertise and attitudes,

Shareefa (2016) carried out a research using diverse approaches of survey and focus group interview methods, including 153 participants that are made up of teachers, 10 of whom took part in focus group. According to the results, teachers were found to hold positive reflections to all of the readiness factors above, concerning inclusion. However, the study revealed some significant difficulties such as limited knowledge, skills and facilities, ignorance of those involved, and content and time restrictions, which may possibly restrain effective execution of inclusive education.

2.3 Teaching Four Basic Arithmetical Operations and Problems to Students with MLD

According to Yıkmış (2005), a part of the academic skills is made up of the numbers, arithmetic operations and computing skills that the children with intellectual disabilities come across in their daily life. Moreover basic arithmetical operation skills are prerequisites for teaching more complex math skills and problem solving skills (Miller & Mercer, 1993). Considering that mathematics is a gradually learned field, it is necessary to provide the prerequisites of the determined areas for the progression of students with intellectual disabilities in mathematics and then, to move on to the new teaching fields. The importance of four operation skills emerges when mathematics is used as a tool to solve problems encountered in daily life, and so four processing skills are the basis of problem solving (Nar, 2018). Investigating and implementing efficient teaching strategies are significant if learning disabled students have training in the general education classrooms (Jitendra, Edwards, Choutka, & Treadway, 2002). Some teaching methods and strategies which are used in teaching mathematics to students with MLD are direct instruction, errorless teaching method, role playing and drama method, game-based learning, diagram teaching, touch point strategy, concrete-representational-abstract strategy and virtual-representational-abstract strategy (Skarr et al., 2014; Öztürk et. al, 2016; Mead & Maxwell, 2010; Ayre, Tunbridge, Stollery & Sanders, 2015; Yan Ping Xin, Jitendra & Deatline-Buchman, 2005;

Yıkmış & Terzioğlu, 2018; Gibbs, Hinton & Flores, 2017; Satsangi & Bouck, 2015).

Direct instruction is a method that involves the process in which teaching is carried out in small steps and in a sequential order, the active participation of the students is ensured, the teacher gives corrective feedback, and the cues are arranged, applied and withdrawn (Rosenshine, 2008). Many studies brought out the fact that direct instruction is a highly effective method to provide training for students with MLD. For instance, Wilson and Sindelar (1991) conducted a study with 62 students with MLD to investigate the effectiveness of direct instruction in teaching addition and subtraction word problems. The study revealed that students' number of the accurate answers regarding problem solving increased considerably with the help of direct instruction. Therefore, the researchers suggest that direct instruction provides superior performance with the students with MLD. Different from the study in terms of including students with normal development as well as students with learning difficulty, there is a more recent study performed to investigate the efficiency of direct instruction in teaching multiplication facts. The participants were three elementary school students, and one of them had been diagnosed with learning disability. In this study, racetrack which is a board game and flash card procedures combined with direct instruction was used. The findings revealed that all students made acquaintance with multiplication facts (Skarr et al., 2014). Moreover, Heasty et al. (2012) explored the impacts of direct instruction methods on training basic mathematics skills to students with MLD. There is only one third grade participant who had learning difficulty both in mathematics and reading. She took lessons regarding her problematic areas five hours a week during the study. In mathematics lessons, the student got training related to expressing hundreds numbers, solving addition with regrouping problems including double-digit numbers. By the end of the study, the researchers observed that the student gained self-confidence in her ability concerning problem solving in mathematics. In addition, the result indicated the efficiency of direct instruction for the student with MLD in acquiring mathematics skills.

The other method which is proved as an effective for students with disabilities in some research is role playing and drama method. This method activates students by presenting real-life situations. It gives them the opportunity to learn mathematics by experimenting, doing and living. Besides, mathematics education given through drama method changes abstract and complex mathematical concepts that can occur in children's minds into concrete and interesting (Erdoğan, 2008). The study which was carried out to investigate the learning process in addition operation by using a drama technique supports the claim that it is interesting. In general, the students were very willing to participate in all dramas, but the students involved in the dramas were quite interested while students who acted as audience were bored and had disciplinary problems. In addition to being interesting, the students asserted that they could solve addition problems more easily by the aid of dramas. In addition, it is concluded that the students feel themselves like playing games while they are learning through drama and therefore they feel happier in the lessons that are taught with drama (Öztürk et. al, 2016). Similar to role playing and drama method, game based teaching provides students with more attractive mathematics lessons, and so the game-based learning leads to highly motivated students, which causes to learn more easily (Genç et. al, 2017). Mead and Maxwell (2010) conducted a research with nine students who had underachievement in mathematics. In addition, these students were not acquainted with place value concept sufficiently and they tended to choose ineffective counting skills such as counting all, and so, they had difficulties in solving arithmetical operations mentally. In the study, games created using counting on strategy were used to attract the attention of students and to enhance their counting skills. Two games were provided to the students in a week for a period of eight weeks. According to the findings, students found the games interesting and their post-test results evidenced to their increased success compared to pre-test outcomes. There is another study was carried out to make a judgement on the impact of gamification method on 5th grade students' success and position in Mathematics courses by Türkmen and Soybaş (2019). The total number of students is 50 (N=50), 28 of whom are in the experimental group while the rest, 22 students, are in the control group. The topic of fractions was taught using a game-based learning method, and

the teaching materials, games and applications were chosen from Educational Informatics Network (known as EBA in Turkey). The outcome is that in the experimental group success rate of the students was higher than the one in the control group.

Errorless teaching is an approach suggesting that learning skills and concepts well is only possible by the positive response and exercises during the instruction, not by the mistakes made during the instruction (Wolery, Bailey and Sugai, 1988). Being one of the effective teaching methods, errorless teaching is a technique promoting a positive relationship between the executer and participant, and reducing the rate of mistakes done during instruction by ensuring correct individual response. Errorless teaching methods are classified into two groups: one teaching method in which responsive prompts are used and the other one in which stimulus prompts are involved. The teaching method involving the use of responsive prompts is the one that allows the participant to give a correct response by providing prompts for him or her before s/he responds. The teaching methods involving the use of stimulus prompts are the ones in which systematical arrangements are performed on the target stimulus and the stimulus providing prompts (Tekin İftar & Kırcaali İftar, 2012). Somerville, Ayre, Tunbridge, Stollery and Sanders (2015) carried out a survey by implementing errorless learning elements within the intervention plan to improve comprehension and abilities in arithmetical development of students who have underachievement in the related subject. Their aim is to assess the effectualness of the intervention and in line with this target; they preferred to use a quasi-experimental design. According to the findings, the students who participated in the intervention enhanced their arithmetical skills considerably when compared to other children who did not attend the intervention. Moreover, among errorless teaching methods, simultaneous prompting procedure is an effective teaching method, a systematic adaptation of antecedent prompt and test. According to the conducted studies, simultaneous prompting procedure is an efficient method for teaching single or chain behaviors to the individuals from the groups of different ages and disabilities (Tekin & Kırcaali- İftar, 2004). Arı and Deniz (2010) conducted a study to study the

efficiency of simultaneous prompting procedure on teaching addition and subtraction processes using multiple probe design, one of the single subject research models, on a 9-year-old girl diagnosed with intellectual disabilities. At the same time generalization (inter materials in the same session, inter sessions and interpersonal) effect, and monitoring effect 1, 2 and 4 weeks after the implementation completed, are analyzed. Findings of the survey suggest that simultaneous prompting procedure is effective in teaching addition and subtraction operations. Moreover, in the study, it is observed that skills related to addition and subtraction operations taught by simultaneous prompting procedure stay permanent one, two and four weeks after teaching is completed.

In the literature, diagram is used in problem solving instruction for students who require special education (Jitendra et al., 2007; Doğmaz, 2016). Diagram is a technique of representation of information by drawing, symbol and images. Figure, diagram or charts are used to understand and organize the problem (Jitendra et al., 2007). Students with special learning difficulties have difficulties in understanding the problem. They exhibit poor performance in problem solving because they cannot distinguish between the givens and the desired ones in the problems (Jitendra et al., 2007). This strategy aids understanding the problem by using such techniques as concrete materials and dramatization. This strategy helps to explain the relationships between the given ones and the desired ones and to provide the mathematical models to be used in the solution. Doğmaz (2016) carried out a study to determine the effectiveness of using diagrams (picture diagram, line diagram, schema diagram, and part-whole diagram) method to improve two-step mathematical routine problem solving performance of students with special learning difficulties. The study was carried out with 20 students. Experimental group and control group were each assigned 10 students. The results revealed that the students in experimental group were more successful than other students. In addition, it was found out that students with special learning difficulties were able to generalize the use of diagram method to different types of problems. The results obtained from interviews with students and teachers showed that students and teachers' views on the use of diagram method in mathematical problem solving

were positive. Moreover, teachers expressed that students' confidence in themselves about solving mathematics problems increased. They claimed that the reason for this was that students were able to transfer verbal expressions into pictures and shapes, and so their concern about being unsuccessful in problem solving decreased. It was stated by the teachers that with the help of the diagram method, the students were more enthusiastic about solving mathematics problems, and this situation lead to more efficient lessons. On the other hand, another study aimed to compare the effects of traditional teaching methods and schema method in division and multiplication operations. In the research, it was stated that children who have learning difficulties had disability in multiplication and division while they are solving mathematical word problems. Twenty-two students with learning disability at secondary school age were the participants of this study. When the research findings were examined, it was seen that the experimental group had a positive difference from the control group at the post-test and maintenance stages. In addition, it was observed that the schema group reached the level of peers with typically development after the application (Yan Ping Xin, Jitendra & Deatline-Buchman, 2005). In addition to students with learning disabilities, there is another research aimed to investigate the effect of schema based problem solving strategy on the problem solving performance of students with intellectual disabilities. In this research in which one student participated, change, classification and comparison problems, which are among mathematical problem types were used. Research findings showed that the problem-based strategy of the schema-based problem improves the problem-solving performance, and this increase continued three weeks after the end of teaching. After the instruction, it was seen that the student solved more problems correctly in the three problem types compared to the starting level (Karabulut, Yıkmış, Özak, Karabulut, 2015).

Touch point is a strategy that involves the use of auditory, visual and tactual materials for teaching addition, subtraction, multiplication and division covered, and that appeal to multiple senses (Scott, 1993). The touch point strategy can be expressed in three stages. The first stage is concrete teaching stage, and at this stage, three-dimensional figures are used as tools. The students can touch the points

above the figures, and thus, the values of the figures can be concretized. In the second stage of the technique, which is a semi-concrete teaching stage, the figures and points are shown in two-dimensional pictures. At this stage, the points on the figures in the pictures are observed by the students for better comprehension. In the third stage, the points above the numbers are removed, and the operations are performed only through symbols (Vinson, 2004). When the studies are examined, it is clear that research studies about touch point are generally related to addition and subtraction operation. (Genç et al., 2017). Scott (1993) claimed that applying touch point strategy provides students with MLD with the skill of solving problems and four basic arithmetical operations more accurately and quickly since three stages of the strategy support the students' understanding visually, tactually and auditorily. There is a study performed by Kot et al. (2018) that aimed to supply with a general idea regarding influences of the Touch point strategy on the mathematics accomplishment of students with special needs. To achieve this goal, the researchers examined 11 related studies written between 1990-2017, and effect of all those studies was determined by implementing Percentage of Non-overlapping Data (PND) technique. According to the results, touch point strategy is considered as effective in ten of the studies while it is defined as moderate effective in only one research. Another study focused on not only the effectiveness of the touch point strategy but also comparing the effectiveness of number line strategy and touch point strategy. The participants of the study consisted of three students who were educated in middle school, and the students had moderate intellectual disability. There were two main aims of this research. One of them was the extension and repetition of the studies regarding use of touch point strategy in teaching addition problem with single digit. Other purpose was comparing number line and touch point strategy in terms of effectiveness in teaching problems including addition with single digit. At the end of the research, when all participants used the touch point strategy, they acquired more correct answers in a short time compared to number line strategy. Before the interventions, the students' answered 4 % of the questions correctly. After the number line instruction they solved 30 percent of them accurately. On the other hand, they had a 92% of accuracy after receiving touch point instruction. In addition to the effectiveness,

maintenance and generalizability of touch point strategy on students with autism disorder is investigated by Yıkmış and Terzioğlu (2018). Their study is based on the direct teaching method to teach basic subtraction operation to the students with autism spectrum disorder. Besides, another objective of this study was to study the monitoring and generalization effects of the instruction performed through touch point strategy and its social validity to understand teachers' point of views about touch point strategy. The participants of the study are composed of three male students between the age of 10 to 11, who are diagnosed with autism spectrum disorder. At the end of the study it has been observed that the touch point strategy when used together with the direct teaching method to teach subtraction to the students with autism spectrum disorder is efficient. In addition, it has been found that the students can maintain the permanence of subtraction operation they learned 7, 14 and 21 days after the instruction was completed, that all of the students can generalize this skill to different environments and people and that the teachers' point of view about touch point strategy is positive.

Concrete-Representational-Abstract (CRA) sequence is one of the most functional teaching strategies to teach mathematics to the children with LD (Witsel et al., 2008). This instruction process starts with concrete step including with three dimensional objects to support cognitive learning. The teacher instructs students to represent and solve problems by using objects relevant to the related skill. In order to enable students to learn how to solve problems with the objects and how to think while using these objects, the teacher uses the think-aloud technique. After the teacher completes demonstration, students practice using objects in order to solve the corresponding problems. After students become competent in using objects in solving relevant problems on the concrete stage, the instruction process proceeds with the second step, representational level, in which drawings and numeration are used in order to solve similar problems. In this sequence, the teacher demonstrates, and the student exercises again. However, during instructions, problems are represented and solved by only using drawings. After students become competent with this step, the instruction process proceeds with the third step, abstract level, in which problems are solved only with numbers without using any objects or

drawings. Concrete-representational-abstract (CRA) teaching method ensures children acquire a cognitive insight into addition, subtraction, multiplication and division (Miller & Kaffar, 2011). A study which is related to subtraction operation was carried out by Mancl, Miller and Kennedy (2012). In this study, 11 lessons about subtraction with regrouping which are made up of five concrete, three representational, one strategy and 2 abstract lessons on 13 students with MLD, who lack knowledge associated with solving subtraction problems. The students solved 10 word and 20 computation problems involving subtraction with regrouping. The students having an average score lower than 50% over the three assessment points (word problems, computation, think aloud) were appropriate for the research. The total number of the students who were appropriate for the study was five. Once the intervention lessons started, all of those five students demonstrated quick improvements in scores. All of the participants displayed a high achievement (80% or higher) in all of the 11 lessons. CRA strategy is proven as effective in multiplication operation. Gibbs, Hinton & Flores (2017) conducted a study on 15 students with special needs. The study aims to inquiry the CRA instruction's influences on teaching skip counting strategy to students with MLD. Upon completion of the study, it was determined that CRA sequence is effective in teaching counting to students with MLD in a more fluent way. Moreover, the students with MLD showed a better performance in solving problems involving multiplication. Furthermore, Milton, Flores, Moore, Taylor and Burton (2018) carried out a study about the impacts of CRA strategy on conceptual understanding of students with MLD related to facts used in both multiplication and division operations. A mixed method design was used in the study, and the findings of the study revealed that with the help of CRA strategy, students' achievement level increased in multiplication and division facts. All five participants fulfilled the accuracy and fluency criterion in multiplication and division facts. They also comprehended the inverse relationship between two operations. In some research studies, CRA strategy and cognitive strategies are used together. Morin and Miller (1998) conducted a research to assess the efficiency of teaching multiplication facts and associated word problems by practicing concrete-representational-abstract process on the secondary school students with intellectual disability. Three seventh

grade students engaged in this research. 21 written lessons involving advanced organizers, instructed and independent practice, demonstration and feedback are provided with the students. Only four performances out of 63 lessons were found to be below 80%. The first 10 written lessons were taught from multiplication facts 0 to 81 by the teacher. These lessons were executed by the planned teaching procedures and CRA process. Three lessons in the concrete step, three lessons in the representational step, one lesson about the use of mnemonical technical device (DRAW) and three lessons at the abstract level were taught. The result of the study shows that students with intellectual disabilities can acquire the skills for learning multiplication facts and associated word problems through CRA strategy and planned teaching procedures (written lessons including advance organizers, instructed and independent practice, demonstration and feedback). Furthermore, students with intellectual disabilities learned how to use mnemotechnical devices (DRAW and FAST DRAW) to order cognitive concepts required for solving word and computation problems. The result of the study showed that through the combined use of concrete-representational-abstract teaching process and planned instructions, students with intellectual disabilities can learn multiplication facts and associated word problems. Moreover, Carmack (2011), in her doctoral thesis, examined the effectiveness of the CRA strategy of teaching addition with regrouping process and word problem-solving skills. Nine students between the ages of 7-11 who were diagnosed with learning disability were included in the study. Base ten blocks were preferred as manipulatives to provide students with an understanding of addition with regrouping concept in the lessons. Use of base ten blocks enabled the students to visualize the “carry” concept. This means that students were able to comprehend the fact that ten ones are equivalent to a ten and ten tens are equal to a hundred. After representational lessons, two lessons were carried out by focusing on RENAME and FAST RENAME mnemonic so that the students could recall and implement the necessary steps of addition with regrouping.

Virtual-representational-abstract (VRA) strategy has the same process of concrete-representational-abstract strategy. One difference between them is that in the first

stage of the strategy virtual materials are used instead of concrete materials. Virtual manipulatives are shown on computer or touch screens such as phones, boards and tablets by means of various views and devices (Moyer et al., 2013). Virtual manipulative objects have some benefits in the classroom compared to the concrete ones. For instance, teachers, students and parents can access most of the virtual manipulatives simply by means of virtual manipulatives library on the internet whenever and wherever they wish to get support for homework and further practicing (Moyer et al., 2002). Furthermore, some studies conducted before show that especially older students can be embarrassed by concrete manipulatives (Satsangi & Bouck, 2015). Thus, virtual material can be more appropriate for elder students. In addition, thanks to virtual materials, the cost of buying concrete materials may be reduced dramatically as long as teachers and parents can access a device connected to the internet (Bouck & Flanagan, 2010). Bouck, Park, Shurr, Bassette and Whorley (2018) conducted a research to investigate the effectiveness of the VRA sequence to promote acquisition of mathematical behaviors which are place value, 1-digit addition with regrouping, 1-digit multiplication and subtraction with regrouping. The participants are two secondary students who have mild intellectual disability. In this study, virtual base ten blocks and colored tiles were used in virtual stage in order to solve problems including the relevant mathematics behaviors. At the end of the study, students' percentages of correct answers increased. This means that VRA sequence has a great impact on solving problems. Moreover, students reached the percentage of accuracy varying between 80% and 100% for all mathematical behaviors. The researchers also investigated the maintenance of VRA strategy and the students' maintenance scores were less favorable than intervention scores despite being successful in VRA sequence. Apart from four basic arithmetical operations, effectiveness of VRA sequence was examined on the perimeter and area concept by Bouck, Flanagan and Bouck (2015). They conducted a study on 11 middle-school students with LD, and they did not have any practice with virtual manipulatives. The pretest related to perimeter and area concepts was implemented to the students and then they received training on the same topics by using the VRA sequence. Afterwards, they took a posttest and they answered more questions correctly compared to the pretest.

Moreover, the researchers took the teachers' opinions related to VRA sequence and the teachers reported that virtual manipulatives had positive effects on both students' mathematical study and their motivation for learning. They also expressed that although students with learning disabilities enjoyed learning through virtual manipulatives, some of them felt the deficiency of concrete materials. In addition to these researches, there is another study which found out the efficiency of VRA sequence in terms of equivalent fraction. The sample consisted of students with disabilities from 6th, 7th and 8th grades, who are in the same class taught by a special education teacher. Researchers used a multiple probe across-participants design to determine the effectiveness of VRA framework to solve equivalent fractions. The study was conducted for fifteen weeks and sessions were held once or twice a week. Two models were designed by the related tools such as applications (virtual), drawings (representational) and abstract. The researcher enabled the student to try to solve two problems by providing instructions and cues as required. In the last phase, it was ensured that the student completed five problems independently. For each step of the research (virtual, representational and abstract), task completion and dependent variables of accuracy were evaluated only through the independent problems. Once the students' achievement of accuracy was 80 percent or more in one phase, they passed to the next one. It is found that all three students' performance improved from baseline during the VRA framework intervention, and the abstract phase was maintained for two of the three students. (Bouck et al., 2017).

In brief, students with MLD usually have difficulty in achieving counting skills, and related to counting skills, they also suffer from the understanding of four basic arithmetic operations and problems. Although it is often implied that they are not capable of comprehending those subjects by nature, it has in some studies been proven that certain teaching strategies can help students with MLD to succeed in four basic operations and problems. Mathematics teachers using these strategies have a great role in helping these students gain these skills. Especially, in inclusive education, general mathematics teachers' perceptions have an effect upon their preferred teaching strategies. Thus, in the light of mentioned studies above, the

current research aims to investigate middle school mathematics teachers' perceptions of inclusion and the strategies they used while teaching four basic arithmetic operations and problems.

CHAPTER 3

METHODOLOGY

This part of the thesis study consist of research model, participants of the study, data collection tools procedures, context of the study, and data analysis process.

3.1 Research Model

This is a qualitative study which aims to investigate mathematics teachers' perceptions of inclusion and teaching strategies in basic arithmetic operations and problems they used. According to Creswell (2013), qualitative study is carried out when a problem or a topic is explored instead of using predetermined information from the literature or relying on other research results as qualitative research requires data collection through idiosyncratic tools and multiple methods in its natural environment; analyzing the collected data by complex reasoning and interpreting it holistically. Qualitative research can be defined as a study involving observation of qualitative process to identify perceptions and incidents in their natural environment holistically by using qualitative data collection methods such as observation, interview and document analysis (Yıldırım & Şimşek, 2011).

3.2 Participants of the Study

The study was carried out at a state school located in Küçükçekmece, Istanbul during the 2018-2019 academic year. The participants consist of 6 volunteer mathematics teachers working at this school. Moreover, the participants are determined by taking into consideration the fact that they have students with special needs in their classes, and they also provide supportive education service for these students outside the class. The identity of the participants is kept confidential as they were not named but encoded by the researcher in order to

ensure the participants to answer the questions honestly. The participants in the study were specified as P1, P2, P3, P4, P5 and P6, and information about the participants is summarized in Table 1.

Table 1 Information about the Participants

Participants	Age	Gender	Year(s) of Teaching Experience	Year(s) of Teaching Experience in Schools Providing Inclusive Education	Educational Degree	The most common disability types of their students have
P1	33	F	8	8	Bachelor's Degree	Mild intellectual disability / learning disability
P2	32	M	10	9	Bachelor's Degree	Mild intellectual disability / learning disability
P3	35	M	13	13	Bachelor's Degree	Mild intellectual disability / learning disability
P4	28	F	6	6	Bachelor's Degree	Mild intellectual disability / learning disability
P5	39	F	16	10	Master's Degree	Mild intellectual disability / learning disability

Table 1 (continued)

P6	36	F	14	14	Bachelor's Degree	Mild intellectual disability / learning disability

According to the Table 1, the participants' experiences in schools which provide inclusive education are examined. It is revealed that P1, P2, P4, P5 have 5 to 10 years of teaching experience (8, 9, 6, 10 years respectively) and the rest have 10 to 15 years of teaching experience (P3 has 13 years of teaching experience while P6 has 14 years of teaching experience). Moreover, the participants have students with special needs in their classes. Furthermore, the participants had students with special needs from all the four grade levels. The number of the students with mild intellectual disability and learning disability is the most common type of disability observed among the students. In Turkey, learning disabilities are unfortunately not categorized into types such as mathematical learning disability. In this study, students with learning disability refer to students who have difficulty in mathematics.

3.3 Data Collection Tool and Procedure

A "Semi-Structured Interview Form" was developed and applied by the researcher as a data collection tool of the qualitative research method in this study. While developing questions included in the data collection tools, related body of literature was reviewed in order to determine what ways will be followed by the mathematics teachers while teaching basic arithmetical operations and problems, and to determine the perceptions of mathematics teachers about inclusive education. There were 3 different data collection tools available for this study (See appendix A). After the data collection tools were prepared, they were examined by another middle school mathematics teacher who was not one of the participants in order to check for the clarity of questions. The teachers were interviewed individually for each data collection tool. The interviews were carried out one to one at places which are outside school premises. The objectives of the first data collection tool

are to get detailed information about the teachers in terms of inclusive education and to acquire detailed inputs about the process of teaching mathematics to the students with MLD. There are 11 questions available in the first data collection tool. The first 4 of these questions consist of those including teachers' demographic information and information describing teachers in terms of inclusive education. These questions include inclusive experiences of the teachers, characteristics of students with MLD they have met throughout their teaching career, trainings on inclusive education they have had or wish to have, changes in their perceptions on inclusive education throughout their career and the causes of these changes. The aim of the other 7 questions is to investigate inclusive education processes carried out by the teachers. The education process includes special works done for these students, the environment where the teaching takes place, teaching mathematics within the class or in supportive education rooms, conditions of the educational environment (physical conditions, attitudes of administrators, having mathematical manipulatives etc.), the use of reinforcement throughout this process, and finally, the assessment and evaluation step at the end of the process. During the preparation of these questions within the assessment instrument, related studies in literature were used. Moreover, responsibilities of the teachers for students with MLD, indicated in the Special Education Regulation (2018) were used while preparing these questions. Each interview for every participant took a period of 10 to 35 minutes.

The objective of the second data collection tool is to understand how the teachers teach basic operations and problems to the students with MLD and with which topics they have difficulty and how they overcome these difficulties. Through this data collection tool, the teachers were asked to explain how they teach addition, subtraction, multiplication, division and problem solving skills to the students with MLD in detail by giving examples and specifying which teaching methods, techniques and strategies they use to teach those skills. In addition they were asked to specify which materials and technological applications they use within this process. Finally, they were asked to specify the difficulties they face in teaching each topic and suggestions they use as a solution. While preparing the second

assessment tool, the literature was used. In addition to the literature, the opinions of the mathematics teachers were received in order to identify the topic before creating a data collection tool. According to the inputs obtained from the teachers' opinions, it is concluded that teaching four operations and problems is a significant part of the inclusive education and the questions were prepared based on this fact. Each interview for every participant took a period of 15 to 30 minutes.

The third data collection tool includes 5 questions (see appendix A) formed to receive the teachers' opinion about CRA, VRA and touch point strategies they used during the lessons they gave to the students with MLD. The teachers used one or more of these strategies which were applicable to teach basic arithmetical operations or problems based on the level of the students with disabilities. They answered these 5 questions related to these strategies at the end of the lesson. These questions include teachers' opinions about the strategy, the materials they used, the effects of the strategy in terms of students' understanding, the points they want to add or exclude in case they wish to reuse the related strategy, and in which mathematics topics they wish to apply that strategy. These strategies were chosen as they had been used and proved to contribute to students' understanding of a given topic throughout the studies conducted on the education for students with special needs before. Moreover, each interview for every participant took a period of 10 to 15 minutes.

All the interviews were recorded with a voice recorder upon the consent of the participants. No problems were faced by the participants with understanding the prepared interview questions. Each interview was transcribed verbatim. The participants were not pre-informed about the questions of the first and second interview; however, for the third interview, they were asked if they had used the specified strategies before, and it was understood that P1 and P5 had used CRA strategy but VRA and touch point strategies had not been used by any of the participants before. The participants were informed about the strategies in detail. They received instruction and assistance on how to instruct. Next, the teachers used 2 of these strategies they found applicable to teach four operations or problems

based on the level of the students with special needs. P4 and P5 preferred to use touch point strategy since one student from each instructor had difficulty in adding numbers. Other participants did not prefer to use touch point strategy, since they considered that CRA and VRA strategies were more useful than touch point strategy for subtraction, multiplication and division operations. Only P3 preferred to use CRA strategy for addition operation since he considered that using base ten blocks is more effective than the concrete numbers used in touch point strategy. Moreover, the participants have chosen a strategy by taking into consideration the virtual and concrete manipulatives present in the strategies. During the lessons, the participants were not interfered, but only support on concrete and virtual materials was provided upon their request. The applications took 3 lessons. Then, the participants were interviewed about the strategies they had used. The websites suggested to the participants as virtual materials are given below:

- http://nlvm.usu.edu/
- http://www.glencoe.com/sites/common_assets/mathematics/ebook_assets/vmf/VMF-Interface.html

In addition to the interviews, teachers' supportive education lessons were observed during 2-hour classes by the researcher in order to enhance the validity of the study. The observations were carried out after the second interviews for each participant in order to be sure whether their expressions and their applications were consistent with each other. During the observations, the researcher took notes related to the teaching of mathematics to the students with MLD. Moreover, the data acquired from the observations is used in the analysis process and some pictures from the lessons observed were used in the findings.

3.4 Context of the Study

In the current study, there are six participants, and they have nine students with MLD who received supportive education. Teachers carried out the support lessons in resource room (see Figure 1), assistant manager room (see Figure 2) and

teachers' room (see Figure 3) since there is only one resource room, and it is inadequate. All participants teach students with MLD one to one in supportive education. However, there is not significant difference between the rooms in terms of available materials and resources such as concrete manipulatives, and technological instructional materials. Both rooms did not have any material or technological support. In terms of general education classroom, all classrooms have the same properties. They include smart board which is not used in inclusive education, but they do not have any concrete mathematical materials. There are 50 students per classroom among 5^{th} grade students while it is approximately 40 in other grade levels. Necessary information concerning the teaching environment and the relationships between participants and their students with MLD are given below.

Figure 1 Scene of the resource room

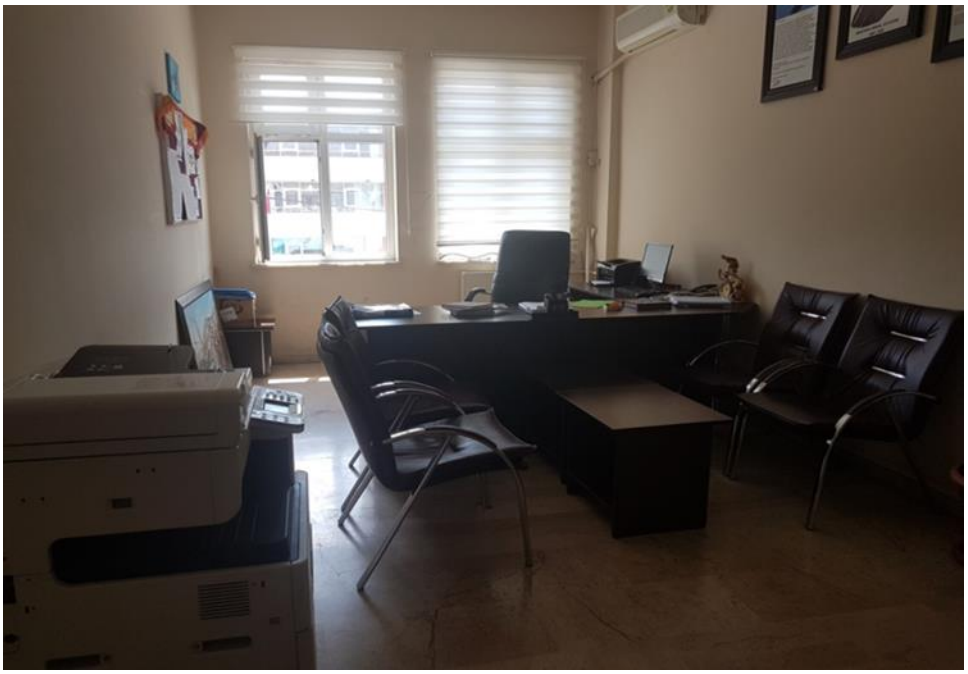

Figure 2 Scene of the assistant manager room

Figure 3 Scene of the teachers' room

P1 provided mathematics training for S1 who had learning disability and who was a 7th grade student. P1 gave a lecture to S1 only in resource room two hours a week. The lessons were taught in the support education room which did not include any mathematical materials and technological tools. The relationship between P1 and S1 was obvious. P1 stated that S1 was inclined to be in mathematics support lessons as he wanted to participate in the lesson as much as possible. Moreover, she added that at beginning of the support lessons, he did not fulfill the responsibilities, but after a while, he started to do so as required owing to the intimate relationship between him and P1. However, P1 did not communicate with the parents.

P2 had two 8th grade students, and S2 had learning disability while S3 had mild intellectual disability. P2 provided instruction for S2 and S3 in supportive education room one hour a week for each student, and also, P2 was their mathematics teacher in the general education classroom. He taught the students in the assistant principal's room which did not involve any concrete materials concerning mathematics and technological materials. P2 reported that the relationship between P2 and the students was sincere. P2 stated that both disabled students know their responsibilities in the lessons. However, he indicated that in the general education classes, he did not communicate with S2 and S3 sufficiently, but in resource room, the duration of communication increases, and he personally got involved due to one-to-one education. P2 reported that in general class, S2 sat at the very back of the classroom because of being tall, and he had social problems with students in the classroom and if P2 did not distribute a worksheet to him in the class, he distracted the other students' attention. Moreover, P2 stated that, S3 sat at the back of the classroom, had high absenteeism record, so he was not well-adapted to the class, yet he was not alienated by other students. In addition, P2 did not have any contact with the parents of S2 and S3.

P3 had an 8th grade student with mild intellectual disability, and he provided mathematics education for S4 both in resource room two hours in week and in general classrooms. He asserted that under favor of support room lessons, the relationship between them has enhanced, and students' attitudes have changed

positively, and although she was shy, she started to express herself. In classroom environment, she was well-adjusted and sat in the front seats in the classroom. P3 did not have any contact with S4's parents.

P4 had two 5th grade students, and she provided mathematics education for S5 and S6 both in support room two hours a week and in general classrooms. The support education sessions were carried out in teachers' room. P4 reported that S5 had mild intellectual disability, and although he had behavioral problems with their friends, he was not excluded by the other students. P4 asserted that the relationship between her and S5 was frank. He often came to visit P4 to chat with her. P4 contacted with the parents of S5 twice a semester in parents' meeting. Besides, P4 stated that S6 who had learning disability was silent and withdrawn and sat at the back of the classroom. He did not have any contact with P4 in the classroom, but he was sincere and not shy towards P4 in the resource room. P4 did not have any contact with S6's parents.

P5 only gave lectures to two-disabled students in support training room once a week in teachers' room. P5 reported that S7 had a learning disability and he was a 5th grade student. P5 also stated he had good communication skills; however, he was lazy and he did not fulfill his responsibilities. Moreover, P5 indicated that S8 had mild intellectual disability, and he was a 7th grade student. She also asserted that their relationship was distant because the student was not companionable. In addition, P5 reported that similar to S7, S8 was not hardworking and responsible. Furthermore, P5 did not have any contact with S7 and S8's parents.

P6 had a 6th grade student with mathematical learning disability, and she provided mathematics education for S9 both in resource room two hours a week and in general classrooms. P6 reported that the student was quite well-adjusted in classrooms, and he had good communication skills. The relationships between both classmates and P4 were intimate. He sat in the front row of the classroom. Moreover, P6 was in contact with S9's parents twice a semester in parents' meeting.

3.5 Data Analysis

The data was collected via 'Semi-Structured Interview Form' within the 'interview' method, which is one of the qualitative research methods. The interviews were recorded with a voice recorder, and the data obtained from the voice record documents were analyzed with the content analysis. The basic operation in the content analysis method is to gather similar data within the frame of the specified concepts and themes, and to interpret them by organizing them in such a way that the reader can understand them. In this study, the concepts underlying the data and the relations between these concepts were revealed through coding by using inductive analysis. The revealed codes (concepts) and the relations (themes) between these codes were used to explain the phenomenon underlying the data (Yıldırım & Şimşek, 2011; Strauss & Corbin 1990). In this respect the content analysis includes four phases which are (1) coding data, (2) finding themes, (3) organizing and defining the data in accordance with the codes and themes, and (4) interpreting the findings (Yıldırım & Şimşek, 2008). The data analysis was conducted individually for each data collection tool. The answers of the participants to each of the questions were coded within themselves and themes and sub-themes were determined according to the relations between the codes. The findings were interpreted, including the participants' own statements. The codes and themes identified in accordance with the data collected by each of the data collection tools are as follows:

During the analysis, the teaching strategies were coded based on the literature. Strategies that the participants wish to teach the students with MLD are counting on, counting back, counting up, skip counting, separating from. The teaching methods, techniques and strategies that the participants used are direct instruction, question-answer technique, making a drawing, drama and role playing, game based learning, CRA.

The factors which have a role in teachers' perceptions of inclusion were also coded based on the literature. Factors affecting teachers' perceptions are their experience,

teachers' training regarding special education, and school conditions. Moreover, the education process in inclusion while teaching mathematics were coded as additional works done for students with MLD, opinions on teaching mathematics to students with MLD based on teaching environment, process of teaching arithmetical operations and problems to the students with MLD, use of reinforcer while teaching mathematics and assessment of the students while teaching mathematics.

3.6 Validity and Reliability of the Study and Ethical Condition

The cogency of the results is regarded as one of the most significant measures of a scientific research. In this respect validity and reliability are two measures that are most commonly used in researches (Yıldırım & Şimşek, 2011). Generally, validity is a measure concerning the validness of the research results while reliability is associated with the repeatability of the research results (LeCompte & Goetz, 1982). In qualitative research, validity is a distinctive factor because a long time spent at the site, a detailed and intensive description, and relationship between the researcher and the participants during the study enhance the value and validity of the study. Qualitative researchers triangulate the data and make their findings valid when they provide evidence in order to document a code or a theme through various data sources (Cresswell, 2013). From this point of view, the researcher observed the participants' supportive education lessons during 2 class hours in order to support the validity of the data acquired from the interviews. Moreover, the codes were checked by another researcher. On the other hand the validity of this study was ensured by noting the findings of the study supported by direct quotations as required (Creswell, 2013; Yıldırım & Şimşek, 2008). Intensive description made accordingly helps to decide if the results of the study can be transferred to other environments or not (Creswell, 2013). In order to enhance the reliability (consistency/verifiability) of the study, the participants' answers to the questions were recorded by a voice recorder, and the records were transcribed verbatim (Creswell, 2013).

Before the interviews the objective and significance of the study were explained to the participants. The participants were told that their names would be anonymous and their identities would be kept confidential. Volunteer consent forms for the study were provided to all the participants.

CHAPTER 4

FINDINGS

4.1 Factors that Affect Middle School Mathematics Teachers' Perceptions of Inclusion

In this part, factors that have an effect upon the participants' perception of inclusion are investigated. These factors are experience, training, and school conditions for inclusive education.

4.1.1 Experience in Inclusion

The participants answered the questions "*Have you ever changed your perception of inclusive education since you became a teacher and why do you think changes occurred?"* Working with students with disabilities was stated as the main reason for the change. The participants emphasized that by increasing time spent with the students with special needs, they gained experience about inclusion and their perceptions of inclusion were affected positively.

All of the participants stated that their perception of the students with special needs changed during the period when they worked with the students individually. However, the rate of change differs from participant to participant. For instance P4 stated that she did not feel a significant difference with respect to inclusive education since she was a newly-graduate. However, she stated that teaching students with special needs during six years helped her understand those students better. For instance, she exemplified that some students with special needs felt offended when they were given an exam outside the classroom away from other students since they thought that they were being treated differently. She had information related to inclusive education and students with special needs during

her university education; however she had further detailed knowledge of them thanks to her six years of experience of face-to-face interaction with those students. She mentioned this as follows:

> There has not been a major change because we have already learned about working with inclusive students during our university education. That is to say, as teachers of new generation, we do not have any prejudice. However, working with the children within the progress brought us some different visions. For instance, while some students want to have the special exam in the classroom, others want to have the normal exam in the classroom and then have the special one outside the classroom; the students may feel frustrated when they feel they are discriminated against from the rest of the class. P4

Different from P4, other participants maintained that they have had a change to a large extent. Similar to P4, they said that experience is a fundamental reason for those changes. This means that by means of face-to-face interaction with the students with special needs, they realized that they had prejudice against them. For example P1 explained the change in her ideas about students with learning disabilities as follows:

> My opinion about the inclusive education has absolutely changed as I have noticed that it is possible to be efficient with those students if we individually work with them. In this school, I have a student who can communicate and share his feelings with me. I observed that he was trying to study and improve just because of the connection between us as I took care of him individually, not because of academic concerns. P1

As it can be understood from the quotations above, P1 stated that she observed that personal communications with the student with MLD enabled the students to be emotionally close to the teachers, which increased the students' academic achievement. Moreover, individual communication with those students changed her point of view.

The other reason for the change in their perception is support-education service provided in the resource room. In other words, the participants gave one-on-one training to students with learning disabilities in resource rooms by considering the students achievement level of mathematics through their individualized education plan. Giving lessons in resource rooms changed their perception of the students with disabilities as such a room provides an opportunity to work with those students individually, and so they gain experience in inclusion.

> 14 years ago when I started my teaching career, students with learning disability were not as cared as they are today. We did not make any special effort to work

> with them. The supportive education rooms that have been used recently enabled us to become more aware of those students and to provide more help for them. In my opinion they should be subjected to a different education. I believe resource rooms are serviceable for them. I noticed that one of my students in the class became more confident and motivated after he had education in the resource room. P6

The quote above reveals that resource room raised awareness about students with LD, which resulted in both more concern about these students and more help for them. Moreover, due to resource room, students with LD become more confident and motivated. This may stems from several reasons. To illustrate, since the students are educated through a special education plan by considering their mathematics level, they can achieve more than they are educated in general classrooms. Besides, teacher's one-on-one care makes them feel valuable and they are more motivated.

4.1.2 Teacher Training in Inclusion

Another factor playing a part in the participants' perception of inclusion is receiving training about inclusion. It was indicated that all the six participants attended the presentations regarding inclusive education and students, prepared by either the school counselors or the counselors from guidance research centers. These presentations focused on how to prepare individualized education plans. The participants suggested that these trainings are generally useful in how to prepare individualized education plans. For instance, P1 asserted that she participated in the counseling meetings which were arranged at the beginning of academic year and in a presentation which was organized by counselors from Guidance and Research Center for once. She stated that the meetings provided her with necessary information regarding preparing more accurate individualized education plan as in the following excerpt.

> We have counseling meetings at the beginning of each school year. The school counselor informs us about the individualized education plans during these meetings. Counselors from Guidance Research Center have visited our school once before. I had difficulty to prepare IEP, so I asked questions about this challenge. They explained us how to prepare IEP and what needs particular attention. P1

The participants stated that the trainings which were provided by counseling service changed their perspective of inclusive education by providing teachers with necessary information about students' disabilities and how they should treat the students. For instance, P3 stated that he could not spend time in the classroom for students with disabilities during his early years as a teacher since he believed that "*40 minutes for a class is not enough to take care of both the students with disabilities and the rest of the class*." However, he realized the unjustifiable of his complains under favor of school counselors' informing related to how the teachers contribute the students with MLD in the classroom and how they prepare and apply the individual education plans for each student with MLD. Moreover, P1 and P2 also put emphasis on the assistance of counseling service in preparing individual plan by indicating as:

> Guidance of the counseling service is very important. I was the only mathematics teacher at the first school of my teaching career and to be honest I was preparing superficial plans for the students with special needs. Today we try to prepare these plans in detail. I was preparing special exams in that period, but I was not able to care those students as much as I do currently. P2

As understood from the quote, although P2 prepares the individual education plan for the students with MLD, the current plans are more detailed with the help of the counseling-service. More detailed plans result in more organized instruction and more successful students in mathematics.

Moreover, no participants attended any in-service trainings or seminars regarding inclusive education. The possible reason of this may stems from that educational policy makers may not attach importance to inclusion sufficiently and so necessary trainings for the teachers may not be arranged or even if they provide trainings for teachers, they are not comprehensive and obligated for all teachers. Besides, two of the participants implied that they were informed about the inclusive education during university education**.** While P1 stated that the only training about inclusion is in *"pedagogical formation courses at the university"*, P4 pointed out that she received courses about methods of teaching mathematics and she gave details about the courses as *"The trainings were given as elective courses at the university. We had an associate professor of Special Education, who gave lectures on special teaching methods."* Although P4 took the course about the methods of teaching

mathematics in special education, she is in need of receiving additional workshops about the methods of teaching basic mathematics such as addition operation in particular.

> As I work at a secondary school, I have difficulty in teaching basic mathematics, i.e. in elementary level. For instance it is hard to teach the addition operation at a basic level for us. Thus I believe it is necessary to have trainings regarding mathematics taught in elementary schools. P4

In this study, the participants were asked which trainings they prefer to improve them in terms of inclusive education and both two participants emphasized the insufficiency of the trainings in their university. Thus, they stated that they would like to receive further training on inclusive education and methods and techniques of teaching mathematics in special education. In addition to P1 and P4, all participants demand workshops about special trainings on teaching methods and techniques in mathematics in special education. For instance P5 stated that:

> We may learn how to teach four operations practically, but mathematics is not only made up of four operations, so it is necessary to teach other subjects those students gradually. How can we teach practical methods by concretization? I mean a training practically setting how to simplify most of the mathematics subjects may be helpful to me to reach out to disabled students. P5

The quote above indicates that she demands to learn practical teaching methods by concretizing in particularly teaching four basic operations. Similarly, P6 describes the training as "*a training that offers key information on how to teach the students with MLD by simplification and visualization*."

Moreover, P3 also stressed the need for training about methods of teaching mathematics for students with MLD since he believes that they can understand the concepts by using other teaching methods and strategies which are more beneficial for these students than other strategies. In this way, they may comprehend the mathematical subjects more easily. He mentioned this as follows:

> It is surely beyond doubt that such trainings must focus mostly on mathematics. I believe there are several methods associated with those students who have special needs and it is necessary to introduce these methods to the teachers as not all the students may possibly understand a specific subject by the same method and some different strategies may be necessary. Thus, a training must be provided in order to introduce those strategies. P3

By considering the participants' comments about mathematics teaching strategies for the students with MLD, it is clear that the participants do not feel themselves as qualified enough in using effective strategies. They are aware of this situation and

they demand the necessary training about the strategies. Additionally, the participants know that the students with special needs can comprehend the mathematics subjects by concretizing and visualizing. This means that they aware of the fact that the instruction should be from concrete to abstract for these students. However, it may be concluded that feeling incompetent about teaching mathematics to these students cause their negative perception of inclusion.

Besides trainings in methods of teaching mathematics teaching methods trainings, P3 stated that he would rather have training from more professional trainers than school counselors regarding individualized education plans and assessment and evaluation of those students within the process of teaching mathematics.

> We have had a school counselor for eight or nine years and he holds informative meetings on how to prepare inclusion plans, how to asses them per student and how to manage students' examination processes. The school counselors inform us on what to do but in my opinion we have an opportunity to receive a better training from professional trainers in this context. It is surely beyond doubt that such trainings must focus mostly on mathematics. P3

As understood from the excerpt, although P3 believes that school counselor helps them prepare the IEP and exam for each student with special needs, he still feels the need for more professional help for that aims mathematics education.

4.1.3 School Conditions

Another factor playing a role in the participants' perception of inclusion is school conditions. When participants were asked about their views related to the school conditions, they made their remarks on the conditions of the institution generally based on the attitude of the administration and the facilities of the school. Only P2 indicated that he is mostly pleased with the school conditions while the rest of the participants pointed at insufficiencies in the resource rooms and regular classrooms. P2 stated that since he teaches basic mathematics, he does lack materials since he can make his own materials.

> We follow basic skills in general. I mean we do not have much deficiency; we have sufficient materials from shapes to numbers and the physical conditions, namely facilities of the school regarding mathematics are adequate. In any case we can make our own materials. P2

The difference of the participants' opinions regarding opportunities of the school such as concrete and technological tools may be due to individual differentness. In other saying, P2 may be more experienced and willing to prepare teaching materials and so he does not need readymade materials excessively or contrary to this, he may not prefer to use materials frequently.

In terms of attitude of the school administration, all of the participants expressed their appreciation about the attitude of the school administration towards inclusive education. They asserted that the school administration is aware of the importance of supportive education services and the school counselors provide necessary support for teachers.

With respect to conditions of educational environment, participants commented with regard to in-class and resource room education conditions. The conditions of the classrooms in terms of teaching mathematics were reviewed by P1 and P4. Both of the participants emphasized that the classroom conditions are inadequate for teaching mathematics. P1 evaluated the in-class environment in terms of instructional technology and although she believes that smarts boards have such benefits as visualizing the information for students with special needs, she means that smart boards are not sufficient and so there is a need for additional materials and resources for teaching mathematics. She explained her ideas as:

> I find state schools are definitely inadequate in teaching mathematics. Thanks to 'Fatih Project', our school was supplied with smart boards, supporting hearing impaired students with more visual materials. I agree that it is an advantage for students, but I think nothing additional has been done for the students. P1

P4 commented on the schools' in-class conditions. She pointed out the classrooms' physical conditions as "*Currently I work with the 5th grade students. There are 50 students in each classroom so it is hard to reach out to all of the normal students, and things get even harder with the disabled students."* Excessive number of students in classrooms poses serious problems in teaching mathematics not only for the students with special needs but also for the rest of the class.

Participants assessed the conditions of resource rooms. Supportive education services are provided at the participants' school, and all of the teachers teach

students with MLD in resource rooms. Participants provide supportive education at school or other places different from the supportive education rooms and they emphasized that those rooms and other places are not well-equipped enough with materials and technological facilities to teach mathematics.

> We provide supportive education hours wherever available because the number of the resource rooms is not enough for the school. We work in the teachers' room, assistant principals' room, school canteen and conference hall, and we need more than one rooms on a regular basis. In addition to the lack of supportive education rooms, we are disadvantaged in terms of technology and materials. P5

As understood from the quote above, P5 is not pleased to give the support lessons in different rooms such as school managements' rooms and conference hall because of lack of resource rooms. Additionally, all of the rooms including resource room do not have adequate resources such as mathematics materials and technological devices. Similar to P5, P1 also mentioned the insufficient materials in the rooms. Thus, she used "*whatever material was available around her whether it be a pencil, an eraser or a paper in resource room or administration rooms*." On the other hand, P5 stated that if they have a special supportive room with a smart board, computer then they have a chance to teach with games and visual materials.
It can be said that five participants suffer from lack of technological and concrete mathematical manipulatives such as base ten blocks, geoboards and so forth. This may give rise to not using the materials or using non-mathematical materials as seen in the comments of P4. Since utilizing effectual concrete and technological materials are vital in teaching mathematics to students with MLD, this situation may lead teachers to poor instruction for these students. Also, inadequate school conditions leads to have negative perception of inclusion.

4.2 Education Process in Inclusion While Teaching Mathematics

This part of the study is about the education process in inclusion while teaching mathematics and it includes additional works done for students with MLD, opinions on teaching mathematics to students with MLD based on teaching environment, process of teaching arithmetical operations and problems to the students with MLD, use of reinforcer while teaching mathematics and assessment of the students while teaching mathematics.

4.2.1 Additional Works Done for Students with MLD

Based on the data collected, the additional works are categorized as individualized education plans, examination of individualized education applicable to these plans, and materials. All of the teachers prepare individualized education plans and exams in line with these plans. Some of the teachers indicated that they prepare materials for the subject.

All the participants stated they individually prepare an individualized education plan for mathematics according to the students' levels at the beginning of each year. They added that they determine the students' levels first, and then they set possible learning objectives that an individual student may be capable of achieving during the academic year. P1 explained the process of forming IEP as follows:

> First, I talk to the student individually for almost one week. I find an opportunity to talk to the students three or four times a week. Within this week, I set my long term and short term objectives I exclude the objectives which have already been acquired by the student. And the ones the student is not capable of are included in the plan. I prepare a plan based on the student's level and duration of the term. As I said before, evaluating the performance requires meeting for three or four times. I ask questions to the student based on specific learning objectives. P1

As seen in the excerpt above, firstly she interviews the students one-on-one three or four times in the first week of the academic year, and she determines the level of the students by asking the students relevant questions about the subjects. Then she sets the long and short term learning outcomes. In this process she follows the procedure that if the student answers the question easily, P1 move on to another question. If s/he has difficulty in answering the questions, P1 provide some support; if s/he still has difficulty, P1 add the learning objective associated with the related question into her list of objectives. Moreover, she primarily makes decisions on whether the students know rhythmic counting and four basic operations or not. She also pays attention not to put excessive number of objectives because she cannot spare enough time for the child during the year.

Furthermore, among the participants, P2 and P3 pointed that the class level of the student is not criterion to determine his mathematics level. P2 stated as "*No matter*

what the class level of the student is, it is possible that he may not have learned the basics of mathematics." In addition, P3 indicated the plans downloaded from the internet based on the class level are misleading because the grade level of the students with special needs does not demonstrate their mathematics level.

> I seek to prepare IEPs that are more appealing to the individual student rather than those available on the internet. For example we download an IEP for a 7th grade student and it says: "S/he can add two of the two-digit numbers". However, the student in question may be in a higher or lower level. Thus I make several modifications on the plan. P3

In addition to IEP, all participants also prepare the examination in accordance with the individualized education plan and for all participants indicated that they hold an examination twice a semester. Another additional work is the preparation of materials for the all participants. Although the type of materials differs from participant to participant, the most common material is worksheets. This stems from the fact that students with special needs comprehend the mathematical subjects by solving multiplexed questions. In terms of generating concrete material, P3 implied that he only uses worksheets while teaching mathematics to the students with MLD. Moreover, using worksheets more frequently than concrete materials may result from giving more importance to procedural understanding rather than conceptual understanding. This circumstance may impede meaningful learning and prompt to learn by rote education system.

4.2.2. Opinions of the Participants on Teaching Mathematics to the Students with MLD based on Teaching Environment:

When the participants were asked about how having students with special needs in their classroom affects their mathematics lessons and what their adaptations in curriculum for these students in the general education classrooms are, participants explained the process in their mathematics lessons with students with MLD in detail. They described the processes in teaching mathematics in both general education classroom and resource room.

First of all, participants mentioned mathematics teaching process of the students with special needs in the general classroom. Teaching mathematics process of these

students is explained in terms of both individual training in class and adaptations to mathematics lessons in general classroom. In terms of individual training in the classroom, P2, P3 and P6 said they prepare individual worksheets in accordance with the student's level and they apply those worksheets in the class. During this process, P2 and P3 explained that at the beginning of the lesson, they submit the worksheet to the student and then they spare 5 to 10 minutes for him while the other students in the class solve questions and at the end of the lesson they check the student's answers. P2 mentions this continuum as:

> At first, I sit next to him, and demonstrate by some examples and I wait until he does some by himself while the other students solve questions. At the end of the class I expect him to finish all on the page. After he finishes his work, we check together and I sometimes assign homework. P2

Different from P2, P3 and P6, the participants P4 and P5 said they can spare time for the students with MLD in the class though not always. P4 argued that following two different syllabuses within the same class at the same time is not always possible. She stated that *"we can spare any time for maximum 10 minutes for each student a week."* In other words, she does not spare any time for students with MLD in general classroom due to lack of time and difficulty of implementing two divergent plans.

The participant P1 reported that she does not spare extra time for the student with MLD in the class. She asserted the duration of a class is not enough to spare extra time for these students and the other students are distracted even if she can spare time for the student with MLD.

> We have 40 students in each class and the duration is 40 minutes for each lesson. Of course we cannot teach individually, but it is necessary to take care of the inclusive students individually. If we spare one minute for each student, it is not enough for the student with special needs. I mean even if I prepare worksheet for him/her I need to give instructions about it for at least 5 minutes, so for the rest of the class I have just 35 minutes. In addition, taking care of these students means the concentration of the other students is disturbed. P1

As understood from the quote, P1 does not spare any time for students with MLD due to limited class time, and also she believes that if she prepares the worksheets for the students with MLD, she will have to instruct the students for at least five minutes and this will distract other students' concentration during that five minute instruction. However, P2 and P3 had the opposite view. They stated that if they do

not give the worksheets to students with MLD then these students get bored and start to talk and so the other students in the classrooms are bothered by the students with disabilities. Indeed, P1 may have the classroom management problem while lecturing the students with MLD for five minutes, and she may overcome the problem by assigning questions to other students within the 5 minute instruction.

When teachers are asked whether they have made adaptations, among the participants P6 specified that she does not make any adaptations in the curriculum for the students with special needs but follows the regular syllabus for the other students and also she believed that lessons taught in the resource room is adequate for teaching mathematics to students with MLD.

> To be honest I cannot make any adaptations on the subjects during the class because we are responsible for a curriculum to be followed and there are other students in the class apart from the disabled students. I believe we provide the required education in the resource rooms to a large extent. P6

Other participants recorded that they make adaptations for the students with MLD in the classes when necessary, and they adapt their questions to involve all the students in the lesson. However, the questions asked by the participants vary based on the subjects. The participants P1 and P2 indicated that they enable the students with MLD to solve a part of a specific question in line with the objectives that the student with MLD is responsible for. P1 engages the student with special need in the process partly based on his ability. In other words, she does not change anything in the classroom curriculum; however, she provides the students with a chance to participate in the lesson by making the student go to the blackboard when he/she is able to solve the part of the problem. She gave an example as

> Let's assume that our subject is problem solving in 7th grade and an addition or subtraction operation is required to solve a given problem. I ask my student with special needs to perform this operation if it fits to his level and carry on asking the other students to solve the rest of the problem. This is how I make adaptations for him within the class. P1

Different from P1, P2 engages the student in the whole process of solving a problem and indicates he helps the student by giving some examples when the student has difficulty. For instance:

> Multiplication, division, addition or subtraction operations are usually required in calculation of geometric solids. If I have set four basic operations as an objective and taught this subject to the student, he can perform addition, subtraction, multiplication or division when I give the right directions; for example in calculation

> of the area of a triangle, I instruct him to multiply the height with its base and divide by two, and provide some practical examples so that he can solve the question. P2

It is inferred from the quote that although the students do not know the subject, P2 helps the student throughout the process of solving the question, and he directs the student until she/he finds the solution. For instance, as it is indicated in the excerpt, when P2 asked the question about the area of a triangle which is not known by the student with MLD, P2 explains what the students can do to solve it. P2 gives simple directions such as *"multiply the height with its base, and then, divide the result by 2."*

On the other hand, among the participants P3, P4 and P5 recorded that they solve problems about the related subject on the board with the student, yet these problems are the easiest and basic questions about that subject. In other words, they do not engage the students with MLD in subjects which are not known by them. They engage these students in the more basic parts of the current subject discussed in the general classroom. The specific example is stated as

> We carry on the course with the most simplistic questions. To give an example, when we discuss sets in the 6th grade, I teach union of sets, set intersection or other detailed operations to the ordinary students, but I only expect the student with mental disability to draw and identify a set and its elements. P3

Other example indicated by P5 is that

> That is to say we teach from easy to difficult in mathematics, starting from the most simplistic numbers. I give fewer complex numbers and help the student make calculations. For instance, on the subject of percentage I give highly simple numbers that can easily be divided by 100 such as 30% of 600. I mean I ask questions in which he can easily perform multiplication or division rather than those requiring calculation of percentage by abbreviation.P5

Moreover, P1, P3 and P4 referred to the positive effects of enabling the disabled students to solve more problems on the board. The participant P4 suggests that engaging these students in the process within the class will improve their self-confidence by saying "*I try to contribute to their self-confidence by helping them solve the most simplistic problems*." while P3 believes such circumstances both improve the students' self-confidence and the communication with the teacher.

> I call the student to the board, improving his self-confidence and surprising his friends because he has probably never gone to the board. I ask him questions associated with the objectives of the related academic year. I feel so pleased to see his self-confidence and the communication between us improve. P3

Furthermore, the participant P1 emphasized the reinforcer as one of the positive impacts by saying "*As the student participates in the question partly and his friends motivate him as well, he feels good and more concentrated thanks to such a reinforcer*."

Moreover, participants mentioned mathematics teaching process in the supportive education lesson to the students with special needs. Most of the participants pointed that they could spare only five to ten minutes for the students with MLD individually or as adapted to the class within the ordinary class hours. Nevertheless, they argued that sparing time within the class is significantly hard and this amount of time is neither sufficient nor efficient. For instance;

> Actually I have so much difficulty sparing time for the student in a 40-minute period. If the student has mental disability, teaching mathematics becomes harder compared to other branches. P4

All of the participants suggested that supportive education service results in positive developments concerning teaching mathematics to the mathematical disabled students. Among such developments, the participants specifically referred to an increase in the students' academic performance in mathematics. P1 explained the benefit of resource room as *"We can plan a course hour wholly and individually for the students with special needs and reach the objectives faster with the students thanks to the supportive education room."*

> I observe that the performance of the disabled students is much better and they make faster progress thanks to the resource rooms. We clearly see the favorable outcomes of practicing corresponding methods and techniques individually for them. P6

It is deduced from the excerpt, that supportive education services enable mathematical disabled students to be more successful in mathematics education since more appropriate education for these students may be ensured under favor of individual attention. In addition, P3 and P6 indicated that the students develop positive attitudes towards the teachers and mathematics as a result of the increase in their motivation.

> I provide individualized education to a mathematical disabled student, who is a member of my regular class as well and for two or three weeks I have been observing that there has been a great deal of change in his behaviors and attitude towards me. P3

It can be inferred from the quote that P3 observed that a disabled student who is a member of his regular class has developed positive attitude towards P3 thanks to supportive education. Similarly, P6 emphasized that supportive education has many benefits, and one of them is motivating the disabled students since "*Firstly, the students feel better and more valued. Secondly, they become more interested in the course, communicating with the teacher individually. Thirdly, their performance improves".*

In other words, P6 observed that working with students with disability individually causes the students to feel more valued, and so their relevance toward Mathematics starts to increase, and they become more successful in this field.

4.2.2 Process of Teaching Arithmetical Operations and Problems to the Students with MLD

In this part, teaching methods, techniques and strategies which are used by the participants in teaching basic arithmetic operations and problems to the students with MLD were examined. The strategies which the participants' aim to teach the students with MLD were also investigated. Moreover, this part includes these students' challenges in the basic arithmetic operations and problems.

4.2.3.1 Teaching Methods, Techniques and Strategies Used in Addition Operation

It was determined that all 6 participants use direct teaching method while teaching addition to the students with MLD. All of the participants indicated they usually teach the subject to students step by step from easy to difficult while teaching addition. As for the addition operation, this stage can be composed of, firstly, the sum of two one-digit numbers, secondly, sum of two-digit and one-digit numbers, and finally, sum of two two-digit numbers. In other words, once the students succeed in addition operation based on the numbers of digits, they are led to perform addition operations by only increasing the number of digits step by step.

The steps of direct teaching method are demonstration, teacher-guided practices and practices without guidance. When teaching addition operation to the students with disabilities, the participants stated that they explain how to perform addition operation by providing examples through direct instruction, and then, help the students do addition operations by giving prompts when needed, and finally, expect the students to do addition operations independently without any prompts. P3 summarized how he uses the direct instruction in addition operation as follows:

> I use the direct instruction strategy. Firstly, I teach the addition operation by giving examples. Then, I ask questions similar to mentioned examples. Based on the feedbacks, I skip the more difficult part. To illustrate, I teach addition without carry, and then, if the student can solve the problems independently, I start to teach addition with carry. P3

Although all of the participants use this method, the strategies and materials they use together with this method vary.

In addition, it was determined that the participants make use of question-answer technique, especially at the stage of teacher-directed practices, and after the stage of practices without direction in order to provide feedback on student's mistakes. Moreover, the participants indicated that they use this technique to assess students' level of knowledge while revising a given subject before proceeding to the next objective.

P2 said he assesses student's level of comprehension by asking how the student answered a specific question related to his mistakes while checking the homework at the end of the course. P3 and P4 asserted that they ask questions about the parts they have taught to the students after teaching addition operation, and then, proceed with the process of addition with regrouping depending on the feedback given by the students. Though she tries to teach the logic of addition operation, P5 emphasized that the subject can be learned through question-answer technique by practicing on a number of example questions. This might stem from the fact that P5 observes the students with MLD did not learn any mathematical subjects without solving plenty of problems. In other words, she thinks that the students learn procedurally, and so they should solve more problems and memorize the procedure

of the addition operations although she makes an effort to teach the logic of addition operation.

4.2.3.2 Strategies that the Participants Aims to Teach the Students with MLD for Addition Operation

All of the participants reported they use counting on strategy both in addition without regrouping and addition with regrouping. They indicated that they implement this strategy by instructing to count the small number on the larger one by using fingers or materials. The participants P1 and P5 use this strategy by using concrete materials such as pencil, bead etc. in teaching addition without regrouping. Moreover, they use the same strategy by making students use their fingers in addition with regrouping. P2 said he rarely uses abacus in addition without regrouping for those students having difficulty and then instructs them to count by fingers. Other participants implied they only instruct the students to use fingers for both of the addition operations with and without regrouping. To illustrate, P2 teaches an addition operation such as 9 + 7 by using fingers. He asserted that he requests the student with MLD to generate 9 by using fingers. Then he wants the student to add 7 to 9 "*while keeping 9 ready with the fingers, and then, adding 7 numbers on it.*"

P1 indicated that she makes use of the materials around her while teaching addition without regrouping in order to explain addition operation to the student by using counting on strategy and then proceeds with the abstract operation of addition without regrouping on a paper. She reported that she proceeds with addition without regrouping with two-digit numbers once she decides that the student can add one-digit numbers on a paper independently without using any materials. She indicated that the students can generally successfully perform addition operations without having any problems at this stage. As for teaching addition with carry, she noted that, firstly, she teaches counting on strategy using fingers, and then, the rules of addition with carry.

> Similarly, we start with the easiest operation such as adding the numbers 19 and 4. I ask my student to count the smaller number on the larger one. Generally I ask

> such operations that he can calculate using his fingers. Firstly, we identify the larger number, which is 19 in this case, and then I tell him to count the smaller one, which is 4 in this case, on the larger one. I instruct him to count 4 fingers. By doing so, he can find the result of 23. The operation does not include addition with carry because he does not understand the concept of 'carry'. After that, I show how to do it on a paper; and I instruct him to add 4 to 9. Once he finds the result of 13, I say we take the 3 and note the carry 1. As he usually forgets the carry 1, I ask him to write the number 1 on the top and then add 1 to 1 and find 2. Thereafter, we proceed with 3- to 4-digit numbers. As I said before, I do not use any materials at this stage. At the first stage, I instruct him to use his fingers so that he is not afraid of the number, and then, we usually perform the operations on a paper. P1

As it is inferred from the quotation above, P1 prefers teaching the concept of 'carry' to the students with MLD through memorization by emphasizing which digit is the carry. Moreover, she uses the strategy of counting on from the larger one since it is more practical than counting from smaller one. Similar to P1, P5 starts to teach addition without regrouping by making use of small numbers and she uses concrete materials in this stage. She explained this process as:

> I start with addition without carry of very small numbers to determine the student's knowledge of numbers and readiness level. First, I instruct him to perform an addition operation. If he can't do that, I show how to add using counters or whatever I have at that moment in order to visualize the operation. We practice a lot with such operations; first. I describe how to conduct these operations, and then, let the student solve a plenty of similar problems. P5

P5 stated that she leads the students with MLD to practice a lot in this way and proceeds with the operation of addition with regrouping once she observes that the student perform addition operation independently. At this stage, she explains the student where the concept of 'carry' comes from to the student after she uses the strategy of counting on the numbers of one digit with fingers:

> He will add 16 to 27. He usually adds 6 to 7 by counting fingers, but I encourage him to do it in mind as far as possible. I say it is 13 and carry one which is a tens. I have to place a number into each digit and we have two numbers in 13. The number 1 is extra. We calculate 13 as 10+3 and we need to write it into tens digit. In this case, I explain 2+1 = 3, and we have 1 more and in total tens of 4. P5

Unlike P1, P5 stated that she tries to explain the logic of the concept of 'carry' in addition with regrouping to the students. The difference between their preferences may result from distinctness of their experiences, trainings and beliefs about students with MLD being able to understand of the logic.

In addition to counting on strategy, P5 use 'add tens, add ones, then combine them strategy'. Using this strategy in addition with regrouping, the participant P5

implied that she tries to enable the students to comprehend the logic of addition operation. However, she emphasized that even though she seeks to teach the logic, students with MLD like learning through memorization so she teaches the concept of carry by plenty of examples and questions. She expressed as "*First, I instruct to add tens; we have tens of 3 in total. If I add the ones, it is 6 + 7 = 13; if I decompose it again, it is 10+3, how many tens do we have now? We have tens of 4, so the result is 40 + 3 = 43*" As, it is inferred from the quote, P5 tried to student acquire the carry concept, by indicating that if sum of the ones exceed 10, then it is discriminated the acquired tens and the remaining ones, afterwards acquired tens is added to the tens digit. For example, when calculating 27+16 addition operation, P5 decomposes the numbers as seen below:

27=10+10+7

16=10+6

Then, she wants the student with MLD to combine ones and tens separately and adds all ones and tens in themselves as seen below:

10+10+10 =30

6+ 7= 13

Since the sum of ones exceeds 10, she decomposes the sum again. Then she adds the acquired 10 to ten's digit and remain ones still in ones digit.

13= 10+3

Ones=3

Tens = 30+10= 40

The result = 40+ 3 =43

4.2.3.3 Challenges in Addition Operation Faced by the Participants and Their Solutions

The participants asserted that the students with MLD make mistakes mostly in 'carry' in addition operation. Carry-related mistakes of these students are specified by the statements of the participants.

Firstly, P1 alleged that the students have trouble identifying the correct digit as 'carry'. P1 explained the error as "*When adding 48 to 55, the students say 5 plus 8*

equals to 13 with carry 3 instead of carry 1". As a solution, she stated she writes the number 13, explains the ones digit is 3 and tens digit is 1, so the student needs to add 1 to the tens digit. Furthermore, she asserted that she tries to overcome this challenge by practicing plenty of sample questions.

Secondly, P1 and P2 claimed that mathematical disabled students make an error regarding writing the number together with carry to the result. P2 clarified the error as "*For instance when the students calculate 49+67, they think that 9+7 is equal to 16, and they write the result as 1016."* P1 and P2 stated they handle this challenge by starting to teach the subject from the beginning once more.

Thirdly, P2, P5 and P6 reported that some students with mathematical disability totally forget to add carry to the next digit. P6 reported that she makes the student remember the carry by verbal prompts. Examples of the prompts are "*I think you were supposed to add something", or "I think you forgot something".*

Lastly, P6 asserted that *"some students adds the carry to other digits as well",* and to overcome this error, she asks them to cross out the carry after using it.

The cause of the carry related mistakes may be the insufficiency of students' conceptual understanding since none the participants do not concretize the teaching process of addition operation with carry and the students may did not visualize and comprehend the logic of carry concept.

In addition to carry-related mistakes, P2 mentioned the error concerning the alignment of digits. He expressed that *"We have no problem with the addition of one-digit numbers, but the students may misalign the ones digit while adding one-digit numbers to two-digit numbers."* As a solution, he suggested placing a box on the right for the second number and instructing the student to write the number into this box until he learns to align from the right side. Misalignments errors may occur because of lack understanding of place value concept. This means that since the learning disabled students do not comprehend the ones, tens, hundreds etc. and

their relationship each other, they may tend to consider all numbers of the digits has equal value so they do not need to put and align the digits in terms of their value such as ones, tens or hundreds.

4.2.3.4 Teaching Methods, Techniques and Strategies Used in Subtraction Operation:

Similar to addition, it was determined that the participants use direct teaching method in subtraction. It was concluded that the participants strive to enable the students with MLD to reach the objectives of subtraction progressively from easy to difficult. It is stated that they teach subtraction without regrouping at first stage, and then proceed with those requiring regrouping, and they continue to teach subtraction starting with one-digit numbers, and then increasing the number of digits as the student reaches the given objective. For instance, P2 summarized the subtraction instruction as follows:

> If the students can subtract one-digit numbers from one-digit numbers, I move on to the subtraction one-digits numbers from two-digit numbers. I start with the subtraction without requiring regrouping. If I am convinced that the students can solve the operations of subtraction without requiring regrouping, I teach them the subtraction with requiring regrouping. Then I increase the digit numbers.P2

The participants used the direct teaching method by using demonstration, teacher-directed practices and practices without direction steps respectively. When the participants teach subtraction operation to the students, they explain how to perform subtraction operation by giving examples through direct instruction, and then help the students do subtraction operations by prompting when needed. Finally, they expected the students to do subtraction operations independently without any prompts.

Additionally, it was determined that, in subtraction, the participants make use of question-answer technique especially at the stage of directed practices and after the stage of practices without direction in order to provide feedback on the student's mistakes. Moreover, the participants indicated that they use this technique to assess students' knowledge level while repeating a given subject before proceeding to the next objective.

4.2.3.5 Strategies that the Participants Aims to Teach the Students with MLD in Subtraction Operation

The participants P1, P2 and P5 use 'separated from' strategy and they specified that they use materials for subtraction without regrouping. While using such materials, they stated that they reduce the materials in an amount that is equals to the subtrahend, and they identify the remaining number of materials as the result. In addition, all of the participants noted that they practice this strategy by instructing them to use fingers in subtraction without regrouping.

> We start with subtracting one-digit number from the other one-digit number, not requiring regrouping. For example, we subtract 4 from 7. We sometimes ask students to bring some concrete materials such as pencils, beans and macaroni, and we may make use of colorful pins on the board, if available. I had mathematics sets in my previous school and I chose appropriate ones from those sets. For example, I chose 7 beans and asked the student to count by himself. He put 7 beans in order and then I asked him to separate 4 of them. After separating 4 beans, he could easily see what is left and find the result as 3. Thereafter, we could perform the same operation with those two-digit numbers. For instance, I asked him to separate 3 beans from 28 beans. He put the beans in a similar way, improving his counting skills as well. After counting one by one until 28, he separated 3 beans and said 25 beans were left. Thus, we could carry on subtraction not requiring regrouping with those small materials that are easy to count. P1

As understood in the excerpt, P1 begins to subtraction without regrouping instruction with single digit numbers and then she passes the subtraction without regrouping with two digit numbers. She uses the objects such as beans, macaroni to visualize the process of subtraction. She requested from the students with MLD counting the objects to reach the amount of minuend then she asked them to separate the objects by the number of subtrahend. In this strategy, P1 also provide the students with enhancing counting skills. Just like P1, P2 indicated that *"In general, we practice the strategy of using fingers or beads of an abacus in those cases not requiring regrouping."*

P1, P2 and P5 start with using materials in order to teach subtraction not requiring regrouping to the students. In addition, P5 stated that at first stage, she tries to teach subtraction with regrouping without using any materials (through counting back or counting up strategy) and then in case the student cannot comprehend sufficiently through these methods, she applies the strategy of reducing objects using materials.

This may be confusing for students with MLD because teaching should be through concrete to abstract to carry out meaningful learning.

All of the participants reported that they implement counting back strategy by instructing to use fingers in the process of teaching the students with MLD subtraction without regrouping. Moreover, in the observation lesson of P2, the student used this strategy when the subtrahend was small numbers and the students did not have any hardship in counting back. For instance, when the student subtracted 8-3, P2 reminded that *"you should count back 3 times, then the student count as 7, 6, 5 by using fingers."*

Moreover, it was observed that P1 used counting up strategy. In the observation lesson of P1, the student tried to count back strategy when he subtracted 8 from the 13. Then P1 suggested that *"it is more sensible that instead of counting back 8 times, you can count up from 8 to 13. In other words you can count by using finger as follows: 9, 10, 11, 12, 13."* At first, the student had difficulty in understanding and then P1 gave more examples about the strategy. Afterwards she asked the student to find 11-9 by using counting up strategy and the student reached the accurate answer.

4.2.3.6 Challenges in Subtraction Operation Faced by the Participants and Their Solutions

Except from P3, all of the other participants noted that they face a challenge in teaching subtraction with regrouping to students. The challenge is that the students with MLD subtract the small number from the larger one in cases of requiring regrouping. The participants suggested various solutions to the mistake of the students subtracting the smaller number of the minuend from the larger number of the subtrahend instead of performing regrouping when required. For instance, P4 asserted that she instructs her students to subtract the difference from 10 again if they subtract the number above from the one below. She added this method may be simple to understand and use for some students while it may be complicated for the

others. Moreover, P4 suggested another solution which is that she gives an example of dividing a pizza or a cake into 10 slices from the next digit as a method of converting the tens in the next digit into ones so that they can envision regrouping. She said the student can imagine the method of regrouping with verbal prompts such as *"my slices are over, and then I need to take another pizza from the next digit and divide it into 10 slices again"*. Moreover, P6 reported that she can cope with this challenge by providing continuous prompts to make the student remember that he needs to get a ten. Furthermore, other participants remarked that they overcome this challenge *"by practicing a lot" (P5) and "giving homework to the students in order to correct this mistake."* (P2)

In addition, the participant P1 underlined that the same misconception is quiet common with the number 0 in the ones and tens digit.

> Also the number 0 seems horrible to them, I mean subtracting any numbers from 0 is too complex for them, especially with those numbers having more 0s such as 500. Let us suppose that a student needs to subtract 192 from 500. He must go to the tens digit, but there is 0 again and he must go to hundreds digit. At this point, he gets more confused. Transferring numbers from one to one is a very difficult process for them. As a result, they do exactly what I said before; they invert the operation. If it is impossible to subtract 2 from 0, then he thinks he can subtract 0 from 2, inverting the numbers. P1

It can be inferred from the excerpt that P1 observed that students with MLD make the same error with the number 0 in particular. To illustrate, when the students calculate the operation of 500-192, since it is difficult to convert 1 hundred to 10 tens and then again convert 1 ten to 10 ones, they tend to subtract the small number from the larger one instead of regrouping. She added that she promotes the students to solve more problems by giving them worksheets so that they correct the mistake. Secondly, except P3 and P4, participants alleged that the mathematical disabled students are liable not to reduce the value from the digit where a ten is taken. As a solution, they added that they instruct the student "*to cross the number and write the new value immediately after taking a ten*". (P6)

Similar to carry concept, the reason of struggling the subtraction with regrouping may stem from the deficiencies of students' conceptual understanding since the participants did not use any concrete or virtual manipulatives to concretize the instruction.

In addition to the concept of regrouping, P2 and P4 asserted that the students have difficulty in aligning the digits of the minuend and the subtrahend during subtraction. P4 noted that she can solve this problem by practicing on a great deal of problems. Besides, P2 suggested that "*placing a box on the right for the second number and instructing the student to write the number into this box until he learns to align from the right side.*" This suggestion may be helpful for memorizing the place of numbers; however, it may not be a solution for teaching the place value concept.

4.2.3.7 Teaching Methods, Techniques and Strategies Used in Multiplication Operation

It was determined that the participants use direct teaching method in multiplication, as well. It was specified that the participants begin with assessing the mathematical disabled students' addition and rhythmic counting skills in order to enable them to comprehend multiplication and then teach multiplication step by step from easy to difficult. For example, P5 stated that she starts to teach multiplication by explaining that *"multiplication is the shorter version of addition through this strategy. 2+2+2 =6 that is 3 times 2 which is the same as 3x2"* (P5). Moreover, the participants noted they start with multiplication of one-digit numbers first, and then multiplication of two-digit and one-digit numbers and finally proceed with multiplication of two-digit numbers. For instance, P2 explained the multiplication instruction process as follows:

> Firstly, I teach multiplication of one-digit numbers by one-digit numbers. We found all the multiplication operations in the multiplication table. If the students do not calculate them, I do not move on to multiplication of two-digit numbers. Also, I move on to multiplication with carry if the students are able to calculate multiplication without carry. P2

The participants used the direct teaching method by using demonstration, teacher-directed practices and practices without direction steps respectively. It was understood that the participants firstly demonstrate the objectives to the students by setting examples, and then providing feedback on the students' mistakes by solving multiplication problems together with them. Finally, they proceed with the next

objective once they decide that the student can solve questions without any prompts.

Moreover, it was determined that the participants also make use of question-answer technique especially at the stage of directed practices and after the stage of practices without direction in order to provide feedback on student's mistakes in multiplication. Moreover, the participants indicated that they use this technique to assess students' level of knowledge while revising a given subject before proceeding to the next objective.

Furthermore, P1, P2, P3, P4 and P5 noted that they use the mathematics game in EBA with both the students and the others as reinforcement after teaching multiplication process. Using games in multiplication process may arouse students with MLD interest and motivate them. Additionally, since the students have memory deficiency problems, under favor of games they may do more practice without getting bored and they keep in mind the multiplication facts easily. In addition, the participant P1 recorded that she gets help from game based learning while teaching the multiplication table (see Figure 4).

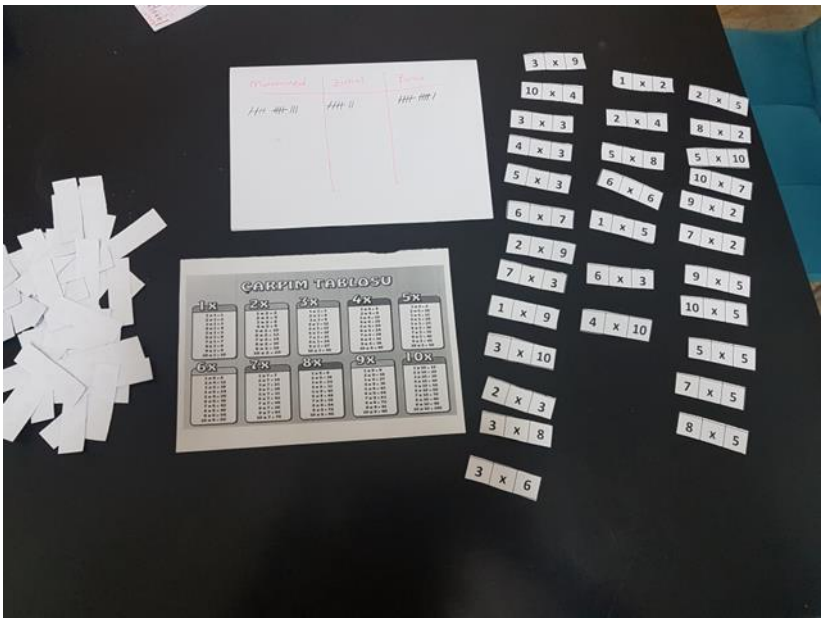

Figure 4 The game applied by P1 in the supportive education lesson

P1 asserted that she competes with the students so that they learn by making an effort to win, and she sometimes makes mistakes deliberately. In this game, there are multiplication facts, and the students choose one of them. Then, they give the answer of this multiplication fact while P1 checks the answer on the table of multiplication. Afterwards, P1 select one multiplication fact and tell the result of this multiplication while the students check the answer by using multiplication table.

> We write multiplication questions from 1 to 9 on papers. Then, we gather them together, and we draw one by one as is in Bingo. We draw papers in turn. For example, I draw 9 times 2. Then, I tell the answer, and the student checks it on the multiplication table. Occasionally, I give the wrong answers intentionally. We score points in our game so that the student can compete with me and learn while competing. P1

4.2.3.8 Strategies that the Participants Aims to Teach the Students with MLD in Multiplication Operation

It was determined that P1 and P5 use CRA strategy in teaching multiplication operation. After using concrete materials in multiplication, P5 teaches multiplication by drawing as seen Figure 5 and Figure 6. After the students with MLD can solve the questions by drawings then she teaches to multiplication abstractly.

Figure 5 The student's usage of concrete material when multiplying 3 by 6 using CRA strategy

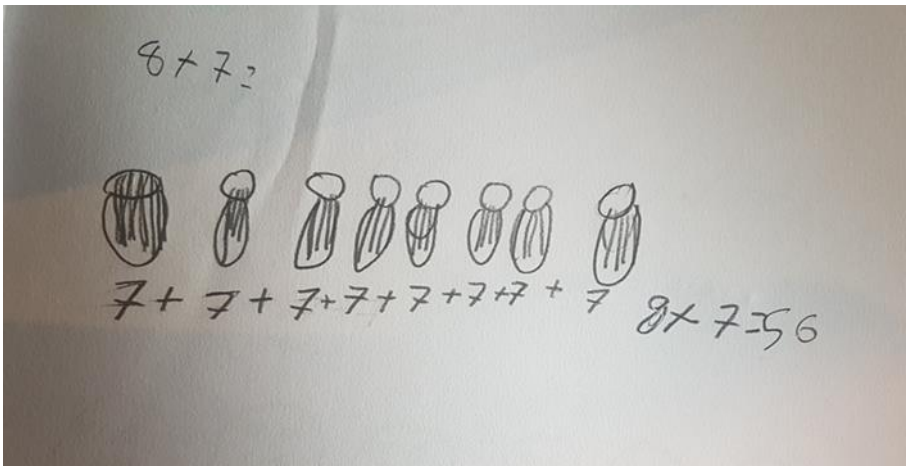

Figure 6 The student's usage of drawings when multiplying 8 by 7 using CRA strategy

All of the participants stated that they apply rhythmic counting strategy by using fingers in order to teach multiplication to the students. P1 and P5 said they use this rhythmic counting strategy in multiplication of 2 single digit numbers and in multiplication without carry by using concrete materials such as beads, ball of papers.

> We use countable objects such as beans, balls of paper and beads. For example while teaching, I instruct the student to make three separate groups of four. He makes the first, the second and the third group of four. Thus, I explain that multiplication is the shorter version of addition. Then, I ask him to count and add those groups considering that he can already perform rhythmic counting at the preparation stage of multiplication. We start practicing by rhythmic counting such as 4, 8, 12... in multiplication without carry. After I decide he can perform rhythmic counting, I ask him to memorize the multiplication table. P1

As inferred from the quote, P1 take into consideration the necessity of memorizing multiplication table and similar to P1, P4 and P5 also think the same. However, P2 does not agree with the P1, P4 and P5 in terms of requirement of memorizing the multiplication table. He indicated that "*I teach multiplication by using rhythmic counting rather than memorization of multiplication table*." On the contrary, other participants asserted that memorizing multiplication table is significant for students with MLD after learning the rhythmic counting strategy. For instance, P4 thinks that rhythmic counting decelerates the students and she exemplified that *"when a student multiplied 17 by 19, he tried to write 17 times 19 by using rhythmic*

counting strategy." In addition to P4, P5 alleged that *"if the students cannot memorize the multiplication table, then they have great difficulty in division operation."* Besides, in order for the students to memorize the multiplication table, P4 stated that she asks the students to draw a watch on their arms to display the multiplication table, starting from multiplication by 1 and proceeding by changing the numbers as they learn in order to enable them to memorize the whole multiplication table. In addition, P5 indicated that *"I suggest some websites to the students to memorize the multiplication table easily".*

Considering multiplication with carry and, the participants uttered they use rhythmic counting strategy in teaching standard algorithm again. However, they revealed they do not use any materials in multiplication with carry and requiring shifting.

4.2.3.9 Challenges in Multiplication Operation Faced by the Participants and Their Solutions

P1, P2 and P6 reported that as in addition operation, the students with MLD have the same difficulties in carry concept and the same solutions are created accordingly. Moreover, all of the participants stated that the students with MLD have trouble with the stage of shifting digits in multiplication. The methods used by the participants in order to overcome this challenge vary. To illustrate, P1 asserted that explaining the logic of shifting digits does not work out because they are unable to understand its logic, so she sets shifting digits as a rule. She noted that *"I warn the student to write the numbers in a cross pattern when he makes mistakes in shifting digits so that he can keep it visually in his mind".* Contrary to P1, P4 and P5 told they explain the logic of shifting digits. Besides, P2 suggested *"giving multiplication as a template until the student becomes accustomed to do it"*. In addition, P4 explained she can overcome this challenge *"by solving a great deal of problems."*

Furthermore, P1 claimed that when I asked the multiplication operation with two-digit numbers, some students multiply second multiplier by unit digit; however, they forget to multiply second multiplier by tens digit. The mistakes related digit shifting may result from the fact that the students do not comprehend the meaning of multiplication and they do not distinguish between the values of each digit. To illustrate, they consider as the values of the numbers in ones and tens digits are equal. The misconceptions may be prevented by promoting the students' conceptual understandings.

4.2.3.10 Teaching Methods, Techniques and Strategies Used in Division Operation

It was found out that all of the participants use direct teaching method in teaching division to the students with MLD. Before proceeding to teach division to the students, the participants reported that they evaluate the students' rhythmic counting and multiplication skills that are prerequisites for division. Moreover, they added that the number of digits is increased step by step in teaching division.
The participants used the direct teaching method by using demonstration, teacher-directed practices and practices without direction steps respectively. It was understood that the participants firstly demonstrate the objectives to the students by setting examples, and then, by providing feedback on the students' mistakes by solving division problems together with them. Finally, they proceed with the next objective once they decide the student can solve problems without any prompts.

Moreover, it was determined that the participants also make use of question-answer technique especially at the stage of directed practices and after the stage of practices without direction in order to provide feedback on the student's mistakes in division. Moreover, the participants indicated that they use this technique to assess students' level of knowledge while revising a taught subject before proceeding to the next objective.

Furthermore**,** the participant P1 and P5 use CRA strategies with small numbers at the first stage of teaching division to the students. They used both partition and measurement meanings of the division. P5 indicated that she makes use of this strategy in division without remainder and then in division with remainder. She stated that she starts division with small numbers of fewer digits such as 10:2 and demonstrates this operation with concrete materials, and then makes the student do the same. She said, for example, she places 10 straws into 2 plates one by one and she finds out that there are 5 straws for each plate. Afterwards, she indicated that in order to teach the logic of division by concrete materials to the students, she explains the students that the number of straws is the dividend, and the number of the plates is the divisor (the number of group) while the number of the straws in each plate is the quotient (see Figure 7). Thereafter, she uttered that she has the student perform division with remainder by the same materials. After the student split up the straws equally in each plate, she explains the student that if the straws cannot be shared in plates equally, they are the remainder. Then, she teaches the same instruction by drawing, and finally, she moves on to the abstract stage.

Figure 7 An example of the student's usage of the partition meaning of division using CRA sequence

P1 indicated that in teaching division to the students, she implements the strategy by using concrete materials at first and then making drawings. She added that she makes use of this strategy in division without remainder and then in division with remainder. P1 reported that she begins with demonstrating division without

remainder with small numbers such as 8:2 with concrete materials. She said she uses countable objects such as 8 beads or beans to explain the student that the operation 8:2 is just grouping 8 beads with 2. After separating the beads into the groups of 2, she tells the students that the number of groups is the answer of the division operation. Moreover, she noted that she explains the students that the number of the beads is the dividend, that the number of the objects in each group is the divisor, and that the resulting number of the groups is the quotient. After division without remainder, she indicated that she follows the same process in division with remainder, explaining the students that the number of the objects left is not sufficient to make a group, so it is called the remainder. Increasing the value of the dividend and divisor in such a way, she said, she solves at least 8 to 10 division problems together with the student, using concrete materials after which she applies the same strategy by making drawings. Afterwards, in order to find the number of groups, she instructs the student to count rhythmically considering the number of objects in each group (the number of divisor) until he reaches the total number of the objects (the number of the dividend) or the closest number to the total number of the objects. For example, for the operation of 12:4, she asks the student *"You have 12 dolls and you need to place them in groups of 4 into the boxes. How many boxes do you need?",* and then drawing 12 dolls and placing 4 dolls into each box, she enables the student to find the result of 3. Thereafter, she said, she explains the student that it is possible to reach the number of 12 by counting by 4s by, distributing 12 dolls into the groups of 4, and in this case the number of the steps from 4 to 12 designates the number of boxes (see Figure 8).

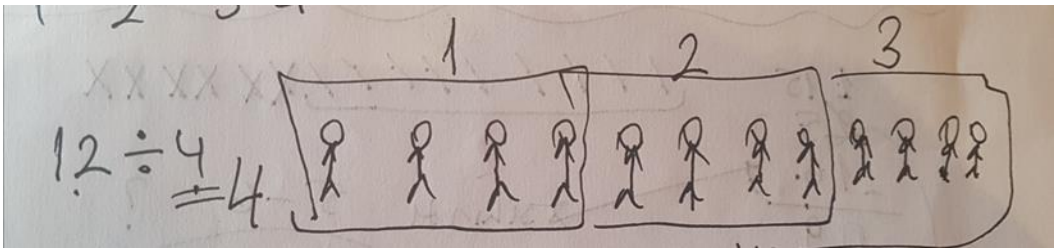

Figure 8 An example used by P1 in teaching the measurement meaning of division.

Moreover, although P4 does not use representational stage of CRA sequence, she stated that she used concrete materials such as counters, beads for division operation instruction since she observed that the students have more difficulty in comprehension of division operation so even if she does not use concrete materials in other operations instruction, she put to use concrete materials in teaching division operation. Furthermore, it was revealed that all participants make use of rhythmic counting in the abstract expression of division operation.

4.2.3.11 Challenges in Division Operation Faced by the Participants and Their Solutions

As a challenge, P1 and P2 asserted that students with MLD start the division operation from ones digit. P2 explained the reason of this error as "*other operations start from ones digit causes the students to start from the ones digit instead of the largest digit in division process, as well* ".

In order to overcome this challenge, P2 indicated that until the students get used to starting from the leftmost in division process, he marks the largest digit, i.e. the leftmost digit, with a sign or symbol and instructs the students to start the operation from the symbol. However, when P1 faces such challenges, she revealed that *"I explain the students that they need to start division process from the largest digit, and I make them practice plenty of division operations."*

Moreover, P1 and P5 claimed that students with MLD confuse the elements of division operation (dividend, divisor, quotient and remainder). In order to avoid such problems, P1 stated that she asks the students what the dividend, divisor, quotient and remainder are in each question during the whole teaching division process and corrects their mistakes. Moreover, she added that she assign a different color to dividend, divisor, quotient and remainder and instructs the student to paint them.

4.2.3.12 Teaching Methods, Techniques and Strategies Used in Problem Solving

Most of the participants use problems consisting of one single operation in teaching relevant operations while they teach problems requiring multiple operations at the end of teaching four operations. Similar to teaching four basic arithmetical operations, the participants use the direct instruction methods and question-answer techniques while teaching problem solving. Different teaching methods, techniques and strategies used by the participants in solving such problems are given.

P1 stated that she makes use of 'drama and role playing' method while teaching problem solving to the students with MLD and added that this method attracts the students' attention and makes learning easy for them. The following is an example of a case related to the topic of percentage, including the students with MLD in classroom environment, provided by P1 using this method.

> We were making percentage calculations in a class including students with special needs. Everybody founded their own shop. There was a sale by 20% in one of the shops while there was 30% in the other. In these shops, there were products made of cardboard or brought from home. While making percentage calculations, one or two students with MLD in the class learned to get half of the marked price of a product with a discount of 50%, and also some others made other minor contributions. I mean some of the disabled students participated in the activities held in the class, attracting their attention. P1

It is inferred from the quotation that P1 used drama-role playing method in teaching percentage concept and the students with MLD participated in the lesson since the activity attracted their attention. Each student set up their own shop by bringing his/her object from home and various rate of discount such as 20%, 30% and 50% were used in the shops. P1 alleged that, by the help of the drama-role playing method, mathematical learning disabled students comprehended the fact that 50 percent of a product' price is equal to half of the price.

Moreover, P1, P5 and P6 revealed that they get help from 'making a drawing' strategy in teaching problem solving to students with MLD, enabling the students to visualize the question perceptibly and understand better. For instance, P6 explained that *"I ask them to read and understand a given problem thoroughly and draw a picture of what are given in it so that they can materialize and understand*

an abstract problem". Similarly, P5 reported that she wants the students to visualize the problem by drawing pictures. She exemplified as *"there are 16 apples. Four friends will share them. If necessary, he can draw apples one by one and make groups of four. To sum up, I try to help him solve the problem by visualization."*

As it can be understood from the quotations, the participants used making a drawing strategy so that the students can understand the problem by visualizing it. It might be effective to increase students' conceptual understanding.

Furthermore**,** the participants P2, P4, P5 and P6 indicated that they provide prompts to the students with MLD in order to solve problems while teaching problem solving, enabling the students to understand which operations they need to perform. For example, P2 stated that *"*It is necessary that *the student is able to decide on which operation he or she will perform when the case arises. Some critical words in a problem such as spending, using, total, etc. provide clues for him or her."*

Moreover, P4 expressed that "*We solve problems by giving prompt. We provide prompts by intonation in case he doesn't understand what to write where or what is asked."* Similar to P2 and P4, P6 explained how she uses prompting as follows:

> We direct them to the required operations while solving problems. For example, he understands that he is required to perform addition with the help of some questions such as "The number of walnuts in your hand increases. Which operation should you perform?" P6

As understood from the excerpts of participants, they give the prompts in key words such as sum, increase, spend, use, when the students do not understand the problem, and so they do not know which operation they should perform. By means of prompting, the students may distinguish the given and the asked information in the problem.

4.2.3.13 Challenges in Teaching Problem Solving Faced by the Participants and Their Solutions

All of the participants argued that students with MLD have difficulty in understanding the problems they read. There are some strategies and proposed solutions used by the participants. For instance, in order to overcome such difficulties, P1 stated that she enables the student to solve a given problem through a conversation with the student instead of writing it on a paper and suggested that *"a student who is unable to understand any written problems understands the question better in verbal form, breaking down his prejudices against problem solving."* Moreover, P4 reported that she inspires the students to think aloud, enabling them to comprehend the problems more easily. Moreover, she added that she asks the students to produce questions, giving her insight to what statements they use where and why, which makes comprehension of the problems by the students easier. As a solution to this challenge, P5 and P6 pointed that *"it is essential to ensure the students to read more books."* (P6)

4.2.4 Use of Reinforcer while Teaching Mathematics

Using efficient reinforcers is significant for special education since positive reinforcement may lead to increase in the desired behavior. Therefore, in the interview, the participants were asked whether they use the reinforcer with the students with special needs while teaching mathematics and what type of reinforcer they use. The participant P1 reported that she makes use of both primary reinforcers, through which biological requirements such as food and beverage are met, and secondary reinforcers, which are non-vital but yields pleasure while the others use different types of secondary reinforcers.

> I usually reinforce by motivating words such as "well done" or if he demonstrates higher performance than expected, I reward him by tangible materials such as chocolate or his classmates reinforce his favorable behaviors by applauding. P1

As it is inferred from the quotation above, P1 stated that she uses primary reinforcer (chocolate) when the student can solve the problems that are beyond his ability and secondary reinforcer (applause) for other behaviors. She added that she

makes use of tangible and social reinforcers as a secondary reinforcer. Types of reinforcements used by the participants are given in Table 2.

Table 2 Types of Reinforcements Used by the Participants

Participants	Primary Reinforcer	Secondary Reinforcer			
		Tangible	Activity	Social	Symbolic
P1	X	X		X	
P2				X	
P3				X	X
P4				X	X
P5				X	X
P6				X	X

Social reinforcer including praising statements such as “Well done”, “Very good”, “You are great” and reactions like smiling is the most common reinforcer type preferred by the participants. The most commonly used reinforcer type after social reinforcer is the symbolic reinforcer. P3, P5 and P6 specified that they give extra point to the students for each correct answer as a symbolic reinforcer while the participant P4 uses badges for as a symbolic reinforcer, promoting their achievement. She explained *“We have badges for achievement in mathematics and I give these badges to the students when they answer questions correctly or participate well in the class.”*

4.2.5 Assessment of the Students with MLD while Teaching Mathematics

When participants are asked to explain the measurement and evaluation process of students with special needs, they mentioned this process as formative and summative assessment. In terms of summative assessment, all of the participants pointed that they conduct exams for the students twice in a term based on the individualized education plan and prepared at the beginning of term. Additionally, P4 implied that she pays attention to the exam format and enables the student to think aloud in order to understand how he answers the questions. Therefore, she asks the open-ended questions instead of multiple-choice questions since she

concentrates on the process rather than the outcome. She mentioned the evaluation process as:

> I carry out the evaluation process by two written exams based on the subjects that I teach specifically. Besides, I prepare exams including open-ended questions rather than multiple-choice questions in order to observe calculation errors. I mean instead of outcomes, I conduct the examination in a way that is focused on the process by asking him to answer the questions so that I can evaluate how he reasons. P4

In terms of formative assessment, P1, P5 and P6 recorded that they carry out the assessment and evaluation within the class as a part of supportive education process.

> We assess and evaluate the student progressively in any case. I ask what he learned a week before, and I evaluate to what extent he learned and forgot about the subject. In addition to such evaluation, I apply tests as well. P5

According to the explained evaluation process, P5 believed that assessment should be continuous, and so she assesses the student learning on a regular basis. She checks the student learning about previous topic before moving on to the next topic. It is necessary for effectual learning since mathematics subjects are comprehended gradually. This means that if the students do not understand the initial subjects adequately, then they may have difficulty comprehending subsequent ones.

> I check whether he can answer the questions without any need of verbal prompts after I teach the subject. If I see that he can, I assume that he has achieved the objective. Also, we apply IEP exams twice in a term; and thus, we complete the assessment and evaluation process. P6

Different from P5, P6 does not focus on checking the previous lesson's subject. She mostly focuses on the current topic, and she confirms whether the student understands the subject by asking relevant questions, and if the student can answer the questions without any prompt, P6 accepts that the student has learnt the subject well. Although this strategy is effective in determining students' comprehension level of the current topic, it can be insufficient for long-term assessment since while moving on to the other subjects, students may have already forgotten the previous ones.

4.3 Participants' Views on Teaching Strategies

In this part, the participants' views regarding the strategies they used (CRA, VRA and touch point strategies) were examined.

4.3.1 CRA (Concrete-Representational-Abstract)

P3 carried out the process of teaching addition to the student with special need using direct teaching method and CRA strategy. The student has a mild intellectual disability, and she has great difficulty in addition with carry.

In the concrete part, base ten blocks are used. P3 indicated that P3 had never used this strategy while teaching mathematics to the students with MLD before; however, he plans to use CRA sequence from now on. P3 commented on the lesson during which he taught addition using this strategy as follows:

> It is not a method that I have used before. I used to explain and demonstrate and then expect the student to do the same. Now, I become aware that teaching with materials is quite useful. Although I have never used this strategy before, I am planning to apply it from now on. At first, we used blocks with the aim of concretion for the student. Firstly, I showed the student how to use them and then asked her to perform similar operations. After that, I instruct the student to draw what we have concreted, proceeding to the abstract one gradually. Finally, we neither used the blocks nor drew. I instructed the student to perform operations of addition as we do in usual classes, and I observed that he succeeded in it. P3

With respect to the excerpt above, P3 realized that using concrete material has considerable effect on the learning of students with special needs. Firstly, P3 used base ten blocks and tried to teach the logic of carry. Then, he moved to representational part, and he explained the same addition procedure by drawing base ten blocks. Lastly, he moved on to the abstract level by associating the concrete and representational level. In addition, P3 used direct instruction, and during all three stages, at first, he demonstrated how to perform addition with regrouping, and then the student carried out the same procedure by the help of his prompts, and finally when the students could solve the addition questions independently, P3 moved on to the other stage.

When P3 was asked about his views on the material, he implied that base ten blocks that he used as a concrete material attracted the student's attention towards the lesson. Moreover, he added that the student understood the concepts of 1s, 10s and 100s better thanks to these blocks. At the beginning of the lesson, she sometimes added 100s instead of 10s while counting 10-by-10 after 100, and she overcame this problem with the help of base ten blocks (see Figure 9).

> The student had great difficulty in counting 10-by-10 after 100; I noticed he said 120-130-200 instead of following the pattern of 120-130-140. However, with this method, the student started to count more correctly, taking the blocks and concreting the process of counting such as 120-130....I observed that he can count rhythmically by pointing with his finger and telling the numbers. P3

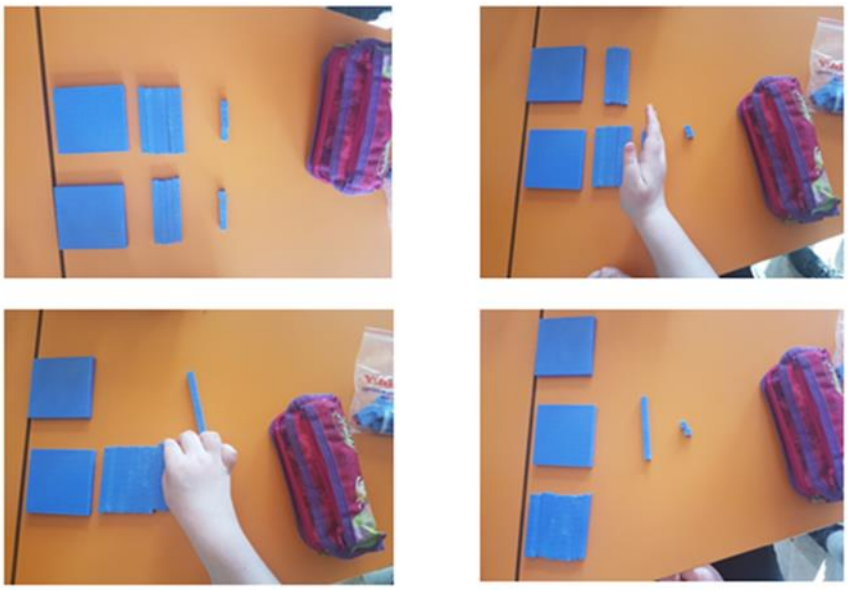

Figure 9 An example of the student's process of solving a question requiring addition with regrouping

When P3 was asked about reviews about its effects on the student's level of comprehension, he conveyed his opinion as *"It attracted the student at first sight, since her attitudes and behaviors changed at once. I think her comprehension rate increased and enabled her to find the solution faster, so I think it is useful"* (P3). However, he stated that effects of this manipulative vary from students to student. He thinks that this strategy may slow down some other students with higher mental skills who are better at addition and subtraction." Moreover, the participant P3 underlined the fact that his student had difficulty in addition, especially with the

concept of ‘carry’, but he could understand the logic of ‘carry’ in the concrete and representational part of this strategy.

> She started to visualize the blocks in her mind. I mean she used to forget the carry in particular. However, he started to imagine that “a block was left, so we had to add that block to 10s”, visualizing 1 or 2 that we had written on the numbers in operations of addition with carry. P3

Moreover, he is considering using this strategy with 4 or 5-digit numbers for next use.

> We conducted addition with 2- and 3-digit numbers, but in my opinion, it will be more practicable with more-digit numbers. It may be more useful with 4 or 5-digit numbers, yet I have question marks in my mind. I don’t know if it becomes more complex to add or subtract with the blocks as the numbers increase for the student, but it seems like it will be more convenient with multiple blocks. P3

Although P3 considers that using base ten blocks in addition with 4 or 5-digit numbers may be confusing for students with MLD, he wants to try it another time. The reason of the regulation may be the fact that P3 gets into trouble in teaching addition with multi-digit numbers to students with MLD and so he wants to try using base ten blocks while he teaching the addition with 4 or 5-digit numbers.

P4 carried out the process of teaching subtraction to a student with special needs using direct teaching method and CRA strategy. The student has learning disability, and he had difficulty in subtraction with regrouping. In the concrete part, she used base ten blocks. P4 commented on the lesson during which he taught subtraction using this strategy as follows:

> It works. We worked on subtraction with regrouping. He had difficulty in regrouping before. He could understand how to regroup by the blocks. He proceeded from the concrete to semi-concrete very easily. Yet, he had difficulty in the abstract part. Actually he could do it during the lesson. However, I noticed he forgot most of it a week after the lesson, so he needs to revise it frequently. To begin with, we need to teach how to make numbers with the blocks. P4

P4 stated that the CRA is a highly useful strategy in the process of teaching subtraction to the students. She reported that her student had great difficulty in subtraction with regrouping before, but he could overcome this challenge under favor of the base ten blocks.

However, P4 argued that at first stage, it is required to explain how to identify the numbers with the blocks (see Figure 10). It may stem from the students’ lack of place value concept. Because the student has difficulty in the place value concept,

he had difficulty in comprising the numbers with base ten blocks. Moreover, P4 indicated that the most challenging part is abstract phase for the student even he was able to solve the questions in the lesson, after a week he had difficulty in remembering. The possible cause of this situation may be the student did not practice sufficiently in the former parts so he did not visualize the regrouping process in his mind. Although he performed the questions by means of memorizing in the abstract lesson, owing to not having permanent learning the students begins to forget after a certain time. To overcome this drawback, concrete and representational parts should be longer.

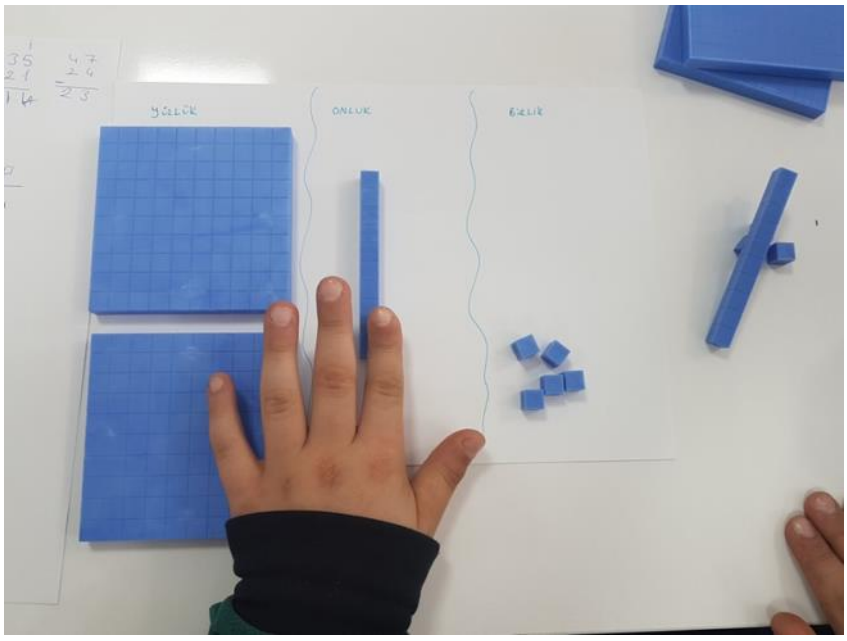

Figure 10 An example of the student's process of constituting numbers using base ten blocks

When P4 was asked about opinions about its effects on the student's level of comprehension, she noted that the student experienced misconceptions as he was unable to understand the logic of regrouping before, but he could understand regrouping concretely with the blocks thanks to this strategy. Moreover, the common misconception, which is that students try to subtract smaller from larger

while large number is in minuend, could be made compensation by the help of CRA strategy.

> For example, he used to subtract 2 from 6 while subtracting 56 from 72; that is, he used to subtract the number above from the one below. And, he was unable to understand that regrouping was required. Even if he managed to do it, he couldn't understand that the value of the next number decreased. He understood more easily that a number taken from tens digit is equal to 10 units. P4

When P4 was asked about her views on the material, she indicated that the base ten blocks are helpful especially in teaching the concept of number and four operations. On the other hand, she stated that *"It may be better if blocks of 1000 are included and except from that, it has no negative aspects"*. Moreover, the participant used this strategy in subtraction mostly with 3-digit numbers. However, she suggested that it would be more practicable if she could use blocks of 1000 in subtraction with 4-digit numbers in the next application. Maybe the students with MLD find the subtraction with multi-digit numbers as perplexing and so P4 takes into considerations to use manipulatives in them.

P5 carried out the process of teaching multiplication to the students with LD using direct teaching method and CRA strategy. He had difficulty in multiplication with multi-digit numbers. In the concrete stage, P5 used base ten blocks in teaching multiplication of two-digit numbers. Indicating that P5 had used this strategy before, P5 commented on the lesson during which she taught multiplication using this strategy as follows:

> Beginning with concrete materials, I asked the student to draw what he envisaged in his mind, and we practiced on such drawings. Finally, we proceeded to the abstract stage. Drawing and applying the operations on drawings makes the student faster and I think it improves his mind as a helpful method to proceed to abstract thinking. To me, it is a useful method. P5

As it is inferred from the statement above, P5 reported that this strategy is helpful in teaching multiplication to the students with MLD, and in providing a meaningful learning enabling them to visualize multiplication in their minds by concrete materials and drawings, and in facilitating proceeding to abstract stage.

When P5 was asked about her views on the material, she indicated that in teaching multiplication table, she uses beans, sticks or straws; however, the materials are not efficient in multiplication with two-digit numbers because it takes too much time,

and so she preferred to use base ten blocks in teaching multiplication of multi-digit numbers, and she observed the student succeeded.

> Beans, straws and sticks improve the process of teaching multiplication table in particular. Its use is more convenient in 1-digit numbers. As it takes too much time to count 2-digit numbers one by one with sticks, we used unit cubes and I observed he also succeeded in it. P5

When P5 was asked about reviews its effects on the student's level of comprehension, she reported the student tried to count by fingers and had many mistakes before; however, she observed that the student could comprehend the logic of multiplication at concrete (see Figure 11) and semi-concrete stages (see Figure 12), enabling him to process multiplication operations mentally, to multiply tens and ones respectively, and then to add the results, in a shorter period in the abstract stage, as well. She mentioned this process as follows:

> The student used to make too many mistakes in multiplication while counting by fingers. After this method, he started to process mental multiplication operations and I also observed he accelerated in the process. I clearly observe that it is truly effective to ensure the student to process mental multiplication operations because he multiplies tens first and then ones and adds those two. In any case, it is an effective mental multiplication strategy. P5

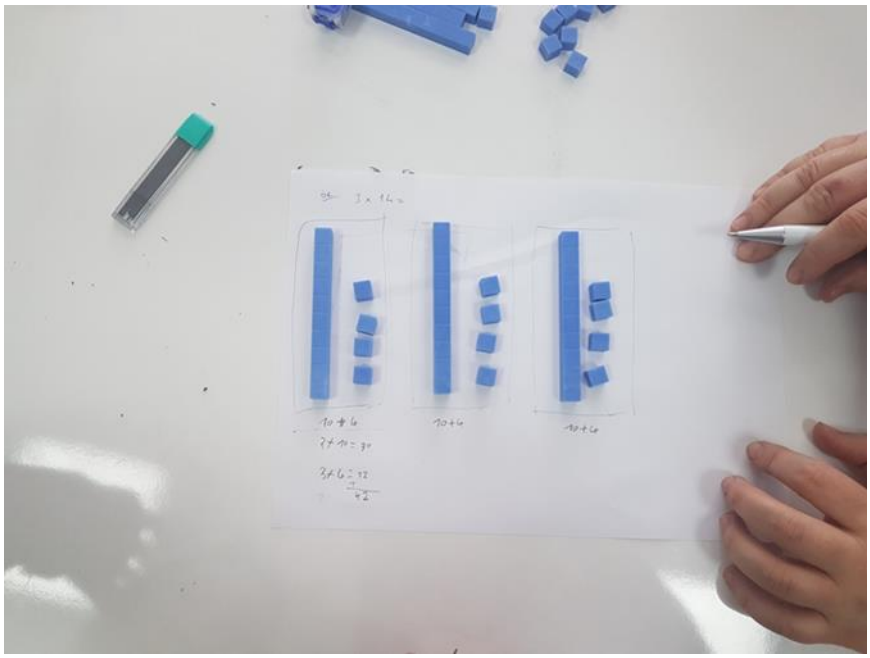

Figure 11 An example of the student's solution of multiplication using base ten blocks.

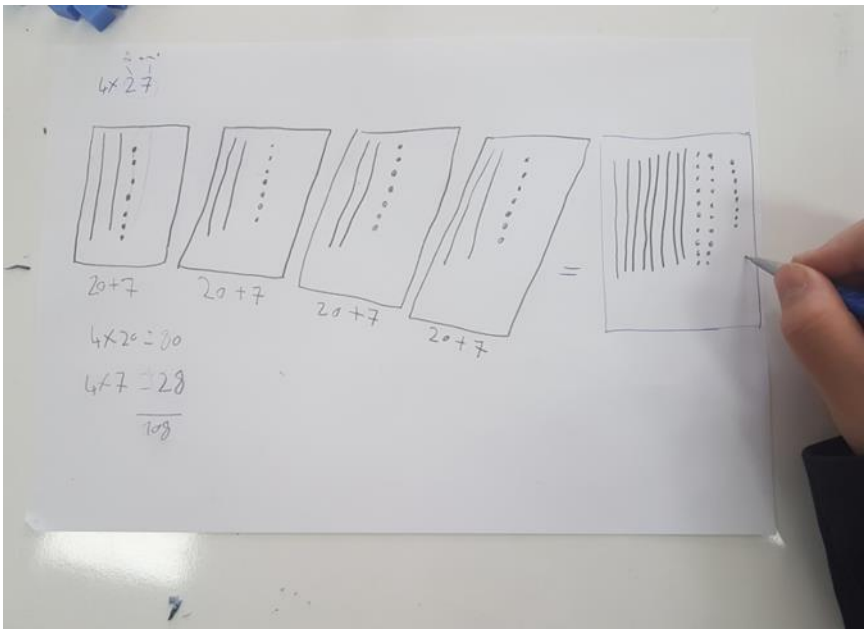

Figure 12 An example of the student's solution of multiplication using drawings

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Moreover, she considered using this strategy in the future without any great changes. She planned to increase the *"number of questions about multiplication of a two-digit number by a one-digit number."*

When the participant was asked about in which various mathematics subjects could CRA to be used, she thought that *"concerning the subjects in mathematics, it must be used mainly in four operations. Besides, it is a method required to be used more frequently in geometry to serve visual purposes"*. On the contrary, she does not believe in the effectiveness of this strategy in teaching 3 dimensional objects owing to difficulty of drawings. Thus, students have difficulty in semi-concrete stage of this strategy.

> It may be problematic in 3-dimensional objects as it is hard to draw them. It is required to provide a faster transition from the concrete stage to the abstract one. It may turn out to be challenging to enable the student to reduce drawing into 2 dimensions. To sum up, it is hard to move geometric objects to semi-concrete stage. P5

As it can be understood from the excerpt, P5 considered that although CRA strategy may be beneficial in teaching 3 dimensional objects for concrete stage, it

may be problematic for representational stage. She asserted this problem may stem from the challenges in drawing 3 dimensional objects.

P1 carried out the process of teaching division to student with disability using direct teaching method and CRA strategy. The student had learning disability and he had difficulty in division operation. Indicating that she had used this strategy before, P1 commented on the lesson during which she taught division using this strategy as follows:

> When working with the disabled students, I concreted first as far as possible and then proceeded with drawing. Finally, we started to perform abstract operations, putting materials aside. I mean, I always applied this method before. I think it is reasonable and helpful to students. First, we enabled the student to understand the concrete material. We performed division operation. Considering that the student stored division visually in his mind, understanding its logic once he saw the concrete materials (beans). After that, we proceeded with drawings. I believe the student's level of perception improved with drawings. He made better sense of it. Contrary to direct instruction method I used before, I observed he could perform division at the abstract stage more easily. To me, such an application is highly favorable. P1

As it is inferred from her words above, according to P1, CRA strategy is more effective than direct teaching of division to the student with abstract rules, and the concrete and representational stages helped the student understand the logic of division, enabling him to remember as visuals easily. Moreover, she observed that representational stage provides the student with the logic of performing division. Thus, he started to divide more easily in the abstract part. However, the participant underlined the two negative aspects in the concrete stage of this strategy. First of all, she observed that the students with MLD had difficulty in counting so he made error when using counting all strategy. *"For example, he took 18 beans where he was required to take 17, leading to an inaccurate result. That's why we had to repeat once or twice"*. Secondly, she considered that the division operation takes a minute by using standard algorithm, yet by using CRA strategy, it takes more time. Moreover, P1 underlined the negative aspect in the representational stage of the CRA strategy, as well. Though it does not pose a problem if the student has a ready-to-use material, she argued that the students may face challenges in drawing that requires creative thinking and may need instructions by the teachers. She

explained this drawback as *"he has difficulty in producing something by himself when asked to draw something. He is sometimes unable to organize it."*

When P1 was asked about her views on the material, P1 stated that she had made use of some other materials such as paper, cloth, etc. before, but she observed that the colorful beans attracted the student's attention, improving his level of participation. She concluded that materials which are formed with this purpose are more effective in attracting the students' attention, and also, they created more productive learning circumstances.

> We used the beans. I used to produce materials using paper or clothes before, but they were not attractive enough to the student. These special colorful materials attracted the student, making the learning environment more pleasant, so I observed the student participated in the class more. That is to say, the materials made for this purpose draw student's attention and make him more involved in the subject devotedly, providing more efficient learning environment. I highly appreciate such materials. P1

Although P1 finds the materials helpful in drawing attention and meaningful learning, she thinks they are impractical as it is hard to count larger numbers for the students with MLD. Thus she suggested that "*Base ten blocks sound reasonable with larger numbers, but most likely he will stop or have difficulty in dividing a million number by a two-digit number. Therefore, I think they provide a practical material until numbers of 1000.*"

When P1 was asked for reviews about its effects on the student's level of comprehension, she explained the induction process in the student's mind as follows:

> When we divide 17 by 3, the student gave one bean for three people at every turn after I instructed him to share 17 beans to three people. In dividing 17 by 3, he understood that it forms a 3-unit every time he gave three of the beans, which is the logic of how we count rhythmically 3-by-3 until 17 at the abstract stage. Thus, he could understand the real function of division, I think, because I had him count rhythmically 3-by-3 to make it easier. In abstract sense, it provided us an advantage, making sense to the student. P1

As inferred from the excerpt, she reported that CRA strategy is highly efficient in enabling the student to make sense of the rules at the abstract stage of division. In other words, she thinks, the student makes sense of division. He comprehended the partition meaning of the division by a real life example, sharing 17 beans to 3

people equally, and also he understood why rhythmic counting is used in division operation (see Figure 13).

Figure 13 An example of the student's solution of division using the partition meaning of division.

In addition, P1 stated that the student could make sense of the 'remainder' under favor of the concrete material, facilitating him to proceed to the abstract stage (see Figure 14).

> Besides, we had two beans left when dividing 17 by 3. The student proposed cutting the remainder of the beans and prorating them again. At this stage, he started to step into the abstract world and think about representations of tens. Thus, the material provided the student with a window to the abstract world. In other words, I believe the material works at the stage of transition from concrete to abstract. P1

When the participant was asked about various mathematics subjects that are thought to use CRA strategy, she thinks that P1 suggested, in addition to four operations, this strategy can be used in geometry, time measurement, length measurement and algebraic expressions, as well. Maybe she considered that the suggested topics require using tangible and visual representations, so CRA strategy may fulfill these entailments.

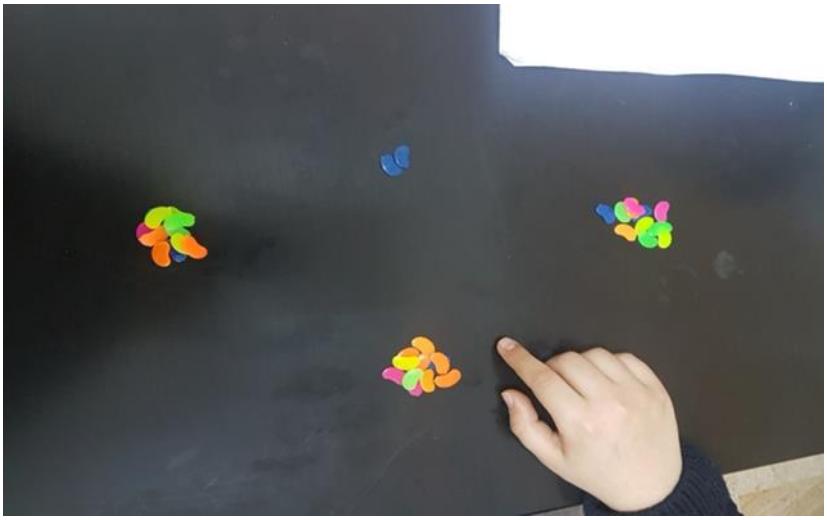

Figure 14 An example of the student's solution of division with reminder using the measurement meaning of division.

4.3.2 VRA (Virtual-Representational-Abstract)

P2 carried out the process of teaching subtraction to the student with special need using direct teaching method and VRA strategy. The student has mild intellectual disability and he had difficulty in subtraction without regrouping. Indicating that he had never used this strategy while teaching mathematics to the student before, P2 commented on the lesson during which he taught subtraction using this strategy as follows:

> As mathematics is full of abstract concepts, the students are possibly unaware of why they do what they do. At least they become more aware of that issue thanks to this strategy. We should teach mathematics from concrete to abstract as we teach a subject from easy to difficult. I think the students can use it more comfortably as they are consistently active in applications of smart phones and tablets offered by today's technology. As it turns mathematics, which is frightening for the students, into a game, it makes both the students' and our works easy. It helps them learn and comprehend better. As for its negative aspect, it may not be appealing to each student. I mean this method may not be efficient with all kinds of students. P2

As it can be seen by the quotation above, P2 found VRA strategy effective in teaching mathematics to the student since learning is carried out from concrete to abstract. In other words, he considered that students can learn the subject from easy

to difficult by VRA strategy. In addition, he emphasized that technology minimized students' anxiety about mathematics and enhanced teaching by turning the subjects into games, and VRA strategy also enabled students to better understand mathematics better. However, he argued this strategy may not be appealing to all students. This may result from that some students who are succeed at mathematics may get bored with using virtual manipulatives since they do not need and they have the ability of abstract thinking.

When P2 was asked about his views on the material, he replied as follows:

> When subtracting a one-digit number from a two-digit number, he had difficulty in forming the number. I mean as the materials by which he was required to form the minuend and subtrahend were adjacent, he assumed it was the process of number formation. P2

With regard to quote of P2, it is concluded that the student had some difficulty in applications where technology is used. Although the minuend and subtrahend are represented by different colors, provided side by side, they caused the student to get confused and make mistakes in making numbers. "*For example, when he was required to write 98, she clicked on 9 blue squares and 8 red ones. Actually he performed 9 minus 8. He may get better if he practices more.*" (see Figure 15).

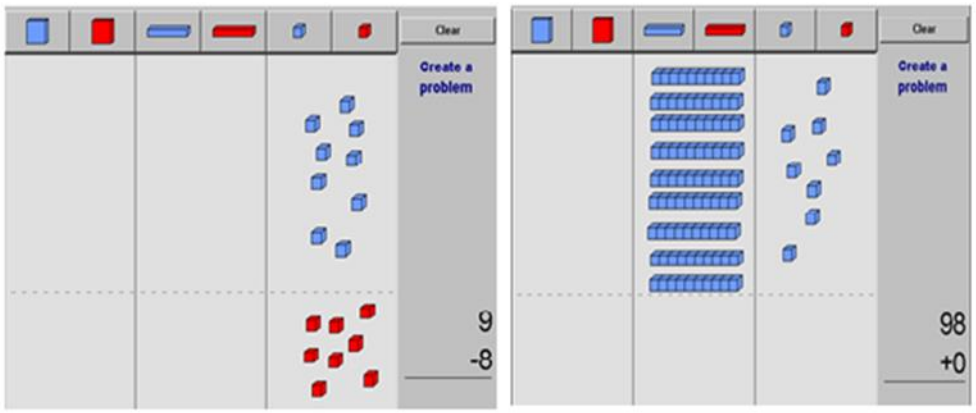

Figure 15 Screenshots from the application to reveal the differences between representations of the operation 9-8 and 98

When P2 was asked about reviews about its effects on the student's level of comprehension, he reported that the student had no difficulty in subtraction with

one-digit numbers *and "It was efficient as the student could perform 7 or 8 operations in subtraction easily." He clarified the process by telling that "we identified the blue squares as minuend and the red ones as subtrahend, and then he removed the matched colors. As a result, he could find the difference easily. The activity was fun as it looked like a game to him."* However, he stated that the student failed in subtracting a one digit number from a two digit number, since he is confused about making out the number. Moreover, the changes that the participant wants to make for the next use as follows:

> I will use it with simple numbers because they have difficulty in forming numbers. There are six areas to be clicked; two different colors for one's digit and two different colors for tens digit, making number formation confusing for the students. I may try another application instead of this one. P2

As it is inferred from the excerpt, P2 expressed that he wishes to apply the first stage of this strategy to the subtraction operations with two-digit numbers, with another technological application that will enable the student to form numbers more conveniently. Moreover, when the participant was asked to various mathematics subjects which are thought to use the VRA strategy, he indicated that in addition to addition and subtraction operation, this strategy might be used in creating and matching geometric objects. Moreover, he said his opinion *"technology contributes to mathematics not just with the disabled students but also with the others because visuals are always catchy."*

P1 carried out the process of teaching problem solving which requires multiplication and addition using direct teaching method and VRA strategy. The student had learning disability and he was able to solve four arithmetical operations. P1 commented on the lesson during which she tried to teach problem solving skills to the students by using this strategy as follows:

> One favorable aspect of virtual and representational stages is that the student feels good when we enable him to do visual things using computer. Doing something on computer is more fun for them. Thus, it will draw their attention. Considering other materials that are not convenient in terms of space and affordability such as base ten blocks, beans and sticks, I think a computer application is more accessible to the students. P1

As it is understood from the statement above, P1 emphasized that virtual and representational parts of VRA strategy drew students' attention as they offer visuals and, compared to concrete materials, technology is more accessible thanks

to the opportunities offered today. Moreover, P1 stressed that a good arrangement is vital for this strategy. She expressed that the transitions through the stages of VRA strategy must be well-organized; otherwise, the student may experience misconceptions in transitions, being unable to make sense of the subject. She asserted that *"it must be arranged as introduction-body-conclusion. If those transitions are not planned and supported by good questions, the student may be unable to understand the question in the abstract stage even if he could make sense of it in previous stages."*

When P1 was asked about her views on the material, she noted that the technological application used as a material is insufficient in some aspects. For example, she reported that displaying the groups individually is not possible in the application. It seems like an area questions rather than a multiplication question. However, the teacher considers that the student cannot comprehend the area concept of multiplication. Moreover, she added that the model in the application is not big enough and only those operations with multipliers that are smaller than 10 may be modelled. The unit squares of the application to perform operations with larger numbers are too small, disturbing the student's concentration (see Figure 16).

> The groups seemed to be area questions. Our question was "If the product of a multiplication of two numbers is 10, what is the minimum value of their sum?" The student tried to form an area of 10 unit squares. As those groups coexisted, it seemed like an area, but the student was not at a level to understand the concept of area. I think it would be technologically more practical if the groups were formed separately. P1

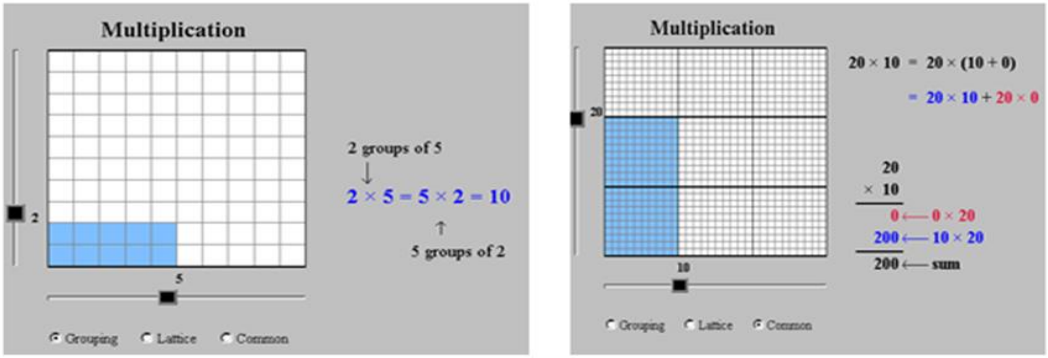

Figure 16 Screenshots from the virtual manipulative used in multiplication.

When P1 was asked reviews about its effects on the student's level of comprehension, she reported that it enabled the student to see the question more systematically and understand commutative property of multiplication as he used a table particularly at the representational stage.

> We made a table after the virtual application. Then, instructed him to write the data he found on the virtual application. Thus, the student could systematically see the numbers that he found. I asked the minimum alternative to the sum of two numbers and he could find it more easily with the help of the table. Otherwise, the student would be confused as there were three or four alternatives. Our results became more systematic with the virtual table. He also became aware of the commutative property of multiplication. P1

According to the excerpt, P1 preferred to use a table to represent the problem. She claimed that the solution would be confusing; however, through the use of the table, the student can comprehend the solution more easily. Moreover, she stated that the student became aware of the commutative property of multiplication (see Figure 17).

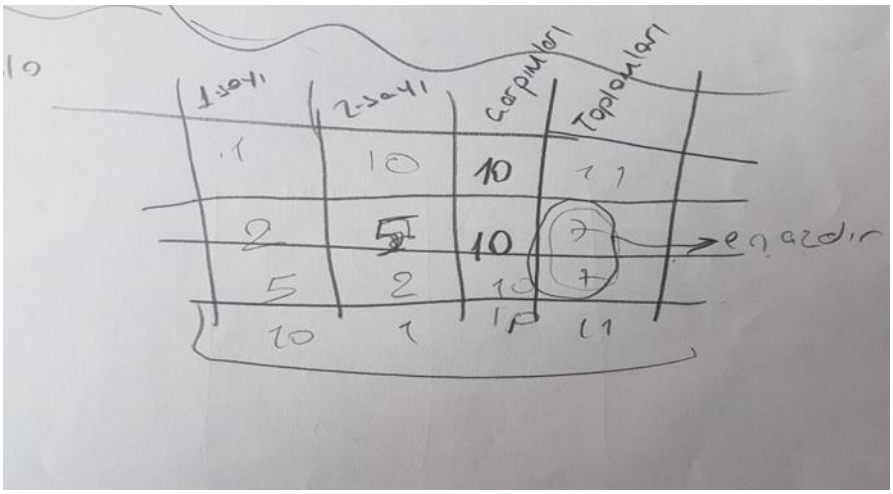

Figure 17 The student's solution at the representational stage of the VRA sequence.

P3 carried out the process of teaching subtraction to the student with special need using direct teaching method and VRA strategy. The student had mild intellectual disability and she had difficulty to understand subtraction with regrouping. Indicating that P3 had never used this strategy in the process of teaching

mathematics to the student before, P3 commented on the lesson during which he taught subtraction by using this strategy as follows:

> As it offers visuals, it drew the student's attention, enabling him to get more concentrated, which is appealing to me since I use technology in usual classes, as well. We live in an age of technology, so its use in the classes is highly appreciated by the students. I believe it is highly useful to motivate students. P3

As it can be inferred from the quotations above, P3 found VRA strategy practical as it appeals to the students and draws their attention. However, he emphasized that this strategy will not be sufficient with those students at a higher level.

When P3 was asked about reviews about its effects on the student's level of comprehension, he reported that by the help of this strategy, the student managed to learn that a tens turns into 10 ones concretely in subtraction with regrouping, which enabled her to observe the abstract statement "we borrow one tens from the next digit" (see Figure 18). Moreover**,** he expressed his appreciation about this technological application and he noted that the material helps the student comprehend the concept of regrouping.

> We could concrete the operation and get visual support, as well. Thus, I think it helped him learn more easily. When I compare it with the prior method, I observed that it is more efficient especially in questions with carry. Before, I used to say "we borrow a 10 or a 100 from the next digit" to teach, but now he understands it better with the help of concrete materials. That is to say the student observed that the 10 we borrowed was split into ones. P3

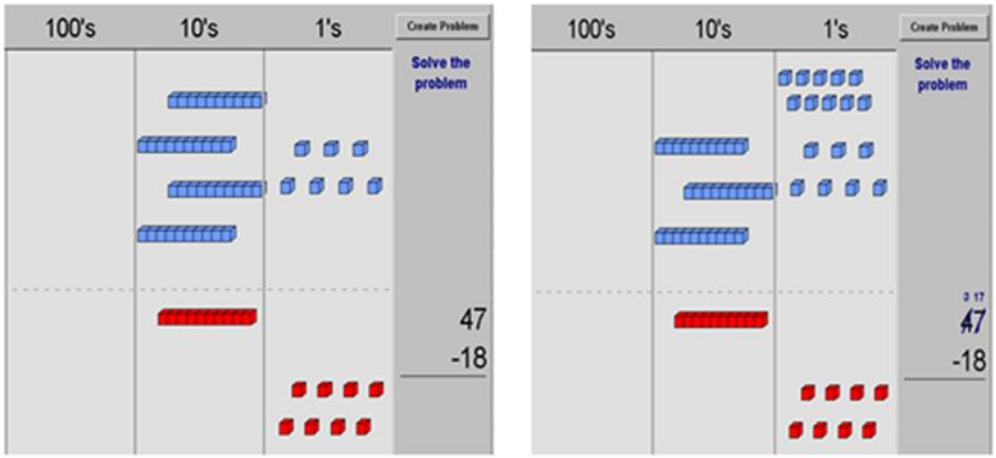

Figure 18 Screenshots from the virtual manipulative used in subtraction.

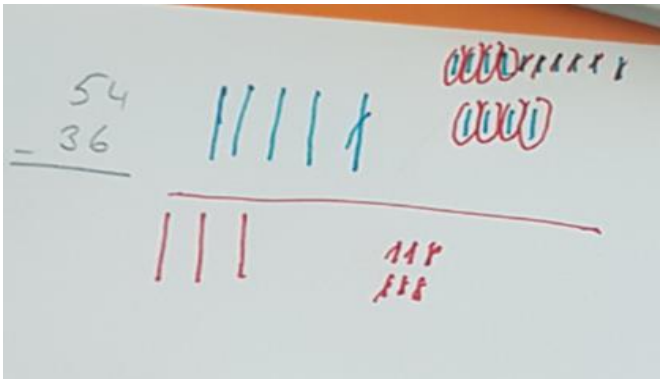

Figure 19 The student's solution at the representational stage of the VRA sequence

P3 said he was satisfied with the technological application at the virtual stage of the strategy, but he reported that the student had difficulty in removing ones or tens equal to the subtrahend at the representational stage. He expressed that the student sometimes made shifting mistakes. *"For example, she crossed 5 above while he crossed 4 below." P3 stated his solution as "by circling the remainders, we solved this problem. We tried to remove one by one. The student could do it more easily when we used colors. She didn't get confused."* As seen from figure 19, they used colors one by one and circled the remainders, and so, they carried out a satisfactory application.

4.3.3 Touch Point Strategy

P4 and P5 applied this strategy in teaching addition to the students who are at a lower level compared to the other students with special needs.

P4 carried out the process of teaching addition to the student with special need using direct teaching method and Touch Point strategy. The student has mild intellectual disability, and he has difficulty in addition without carry. Indicating that, P4 had never used this strategy while teaching mathematics to the student before, P4 commented on the lesson during which she taught addition by using this strategy. The participant suggested that the Touch Point strategy is practical with

the addition of two one-digit numbers without carry in general, but she argued it is not efficient with the addition of multiple-digit numbers with carry. She reported that the student, as the first step, had difficulty in points where he was required to touch and count twice with the numbers 6, 7, 8 and 9, but touching concrete numbers contributed to the student's learning of addition in any case.

> As he performed touching concretely that made our work easier. It worked efficiently with the student whose level was too low. He just knew the numbers. He was unable to tell two- or three-digit numbers. Besides, he was quite unaware of the logic of addition. Even if he had some difficulty in counting the dots especially with the numbers requiring counting twice (6, 7, 8, 9), he managed to add one-digit numbers comfortably. P4

P4 indicated that the student had difficulty with addition of two digit number since the student is unable to read two digit numbers. The student tried *"counting all of them in addition of two 2-digit numbers as he was not aware of the "place value" concept."* P4. Moreover, P4 reported that the student faced some challenges at the abstract stage as he was unable to proceed from representational to abstract dimension even though he could move to representational stage from the concrete one.

> I didn't face much difficulty in transition from concrete to representational stage. He managed that process, but we haven't been able to move into abstract stage yet. That may be peculiar to the student and we may move forward if we try with other students, but I can say that student was unable to move on to the abstract stage. P4

When P4 was asked about her views on the material, she stated that *"this strategy seems be working in visualizing the numbers, but considering we can do the same with fingers, I am not sure if it is a necessary material.* P4 agrees that the material is practical once visual for concrete learning are provided, but she thinks it is not essential based on its functions since finger based calculation has the similar function. However, P4 may ignore the fact that students with MLD sometimes did not use the fingers in the general classroom because they may shame on using fingers in addition operation.

Changes that the participant wants to make for future use are not trying to use this strategy with addition with multi-digit numbers. As it is indicated with the participant's reviews on the strategy, she asserted that this strategy is useful only with the addition of one-digit numbers without carry, but the student had difficulty

in other circumstances. Thus, she added, she would exclude the challenging parts in the next applications.

> I will not try to use it with two-digit numbers. Most particularly, it doesn't make sense with the one-digit numbers with carry. Yet, it may work with teaching addition of one-digit numbers without carry. P4

When the participant was asked about various mathematics subjects that are thought to use touch point strategy, she expressed that she might use this strategy combining by counting down strategy in subtraction operation, but she does not believe the effectiveness of this strategy in multiplication and division.

P5 carried out the process of teaching addition to the student with special need using direct teaching method and Touch Point strategy. The student has mild intellectual disability, and he has difficulty with addition with regrouping. Indicating that, P5 had never used this strategy while teaching mathematics to the student before, P5 commented on the lesson during which she taught addition by using this strategy. P5 made use of touch point strategy in teaching addition to her student, and she suggested it has advantages of helping the student understand the process of addition and reducing his mistakes and disadvantages as it requires too much time.

> The level of the one among my students was too low. He was unable to tell the numbers and made mistakes in addition even if he used his fingers. The amount of his mistakes reduced as he counted one by one touching the dots, but it took too much time. It has positive effects on student's understanding and reducing his mistakes, but we need to spare more time. P5

Contrary to P4, P5 argued that this strategy enabled her student to perform addition with one-digit numbers as well as addition with two-digit numbers, reducing the amount of mistakes. The difference may stem from the students' divergent level, maybe the student of P5 know the place value concept and so he was able to understand the addition with two digit numbers by using touch point strategy. Besides, she added that she instructed the student to count the dots, and then, add the small number on the larger one, and she did not face any challenges neither in concrete nor representational stages. Moreover, she expressed her satisfaction with the material as it facilitates touching and counting the numbers one by one by the student, but she said its preparation takes time.

When the participant was asked about various mathematics subjects thought up to use touch point strategy, similar to P4, she asserted that the strategy is not appropriate for multiplication and division operation since "*it will get more difficult and confusing. We don't have that much time. However, it may be used in subtraction. It promotes mental process as it requires counting down in subtraction.*"

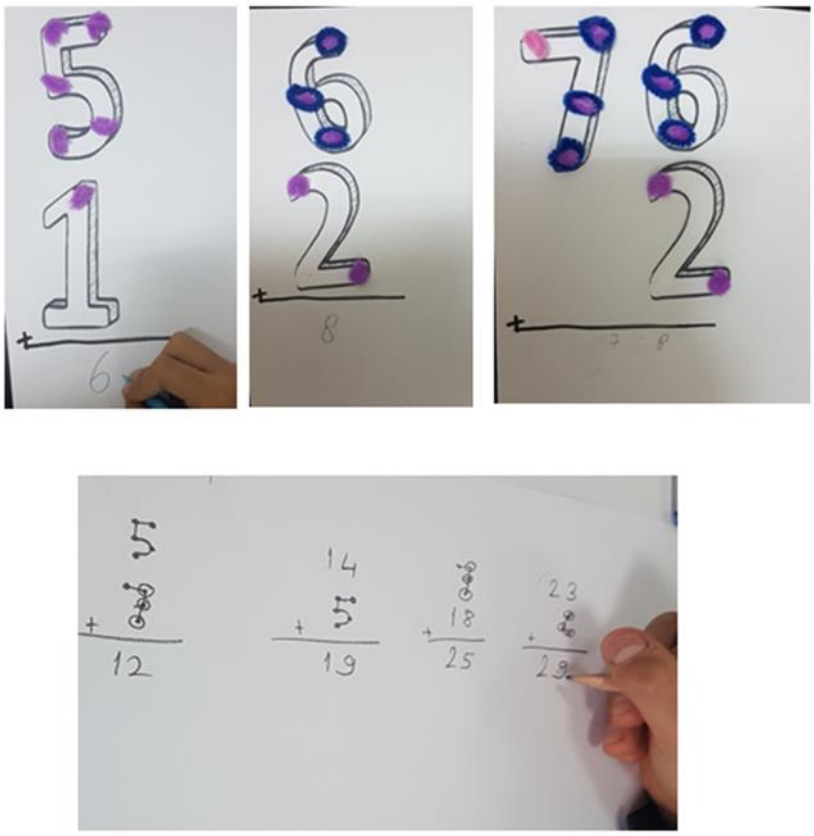

Figure 20 Examples of the students' solutions using touch point strategy

To sum up, according to the findings, all participants prefer to use direct teaching method and question-answer technique while teaching four basic arithmetic operations and problems. All of the participants make use of worksheets to solve many problems related to the topics which they teach, and they generally try to overcome the difficulties face by having their students solve many problems through these worksheets and emphasizing the rules of the operations. This reveals

that the participants give importance to having students with MLD gain procedural understanding. None of them used technological applications while teaching the mentioned subjects to the disabled students. Only two of them often use concrete manipulatives and they sometimes prefer to implement CRA strategy. However, they did not use concrete material and CRA strategy in some significant parts of instructions such as 'carry concept'. It may be inferred that even though they give place to conceptual understanding to some extent, it is not sufficient. On the contrary, when the participants used CRA, VRA and touch point strategies in their supportive education lessons, they indicated that these strategies help students to eliminate their misconceptions to a considerable extent. The reason for not using these strategies before may be these teachers' insufficient trainings because all participants claimed that they did not receive education regarding teaching mathematics to students with MLD adequately.

CHAPTER 5

DISCUSSION

The current study aimed to determine the perceptions of mathematics teachers about the inclusive education. Data was gathered in accordance with the factors affecting the perception of mathematics teachers according to the literature**.** In order to get to know the participants in terms of inclusive education, their experiences related to inclusive education, the changes in their opinions about the inclusive education since the beginning of their career, the causes of the changes, the trainings they received and the training they want to receive are examined. In addition, the education processes that students with special needs undergo take form by the perceptions of the participants were also investigated separately in terms of the conditions at the school they worked, additional works for the students with special needs, teaching the lesson in the classroom and support training rooms and the assessment-evaluation processes. In addition participants' teaching process of four basic arithmetical operation and problems were examined in detail. Their teaching methods, techniques, strategies, the materials, and technological applications they used in this process were examined, and the difficulties that students faced in four basic arithmetical operations and problems and the solutions offered for these difficulties by the teachers were also examined. Then, teachers were asked about the CRA, VRA and touch point strategies that they use in their support room, and at the end of the lessons, teachers' opinions related to the strategies were received.

5.1 Discussions of Findings Related to Participants' Perceptions about Inclusive Education

It was revealed that one of the major causes of the positive change in the opinions of the participants about inclusion is the opportunity to stay in touch with the

students individually. They think that this situation helps to get to know the disabled students, so they can make arrangements for them. In addition, they realize that these students have increased their academic achievement once they have a necessary support. This result is consistent with previous studies which asserted that enhanced experience and getting in touch with these students give rise to more positive attitudes (Avramidis & Kalyva, 2007; Lambe & Bones, 2006). On the contrary, Woodcock (2013) concluded that teachers' experience and the amount of time spent with students with special needs did not affect their attitudes towards them. The reason of the difference may arise due to teaching in the support room. While a lot of time is spent with students with MLD in the classroom, it may not be as effective as the one-to-one instruction in the support room. Similar to Ünal (2012), in current study, participants emphasize the effectiveness of resource room for their positive attitudes towards inclusion. They also stated that the support training rooms are important in terms of giving opportunity to take care of these students individually. In this way, they stated that besides their academic success, the students' motivation and self-confidence increased. The opinions of the participants are in concordance with the study of Vlachau, Didascalou and Argyrakouli (2006) in which they found that with the help of resource room, both mathematical achievement of students with MLD and their communication with the teachers were influenced positively. In addition, it was revealed that the guidance service also contributes to the change in the participants' thoughts about the inclusive education. Especially, guidance service contributes to preparation of the individualized education program and exam.

In the literature, training teachers about inclusion is accepted as another reason for affecting teachers' perception of inclusion (Avramidis et al., 2000; Van Reusen et al., 2001). In the current research, the trainings of the participants related to inclusion were limited to the presentation of the guidance counselor and it was found that only two participants took undergraduate courses on special education at university. The guidance teacher's presentation focused on how the individualized education plan should be prepared and the participants found the presentation beneficial while preparing the plan. However, similar to the findings in DeSimone

and Parmar (2006) study, all the participants thought that they have not received sufficient training at the university about the inclusion and methods of teaching mathematics to students with MLD. Moreover, P3 emphasized that he would like to have a more professional training on the preparation of individualized education plan preparation and assessment in addition to special education methods of mathematics. This finding is in accordance with the studies of DeSimone and Parmar (2006) which uncovered that majority of the participants in the study stated that the education received at the university did not satisfy the need of acquiring necessary skills to teach mathematics to students with MLD. However, in his study, Avramidis et al. (2000) stated that teacher education is very important to develop positive attitudes towards inclusion and to gain the necessary confidence in preparing individual education plan. In general, even though the participants close the gap in the undergraduate education with the help of the guidance teachers in the preparation and implementation of the individualized education plan, they think that they may not get the necessary training both in the undergraduate education and during their professional teaching career. Therefore, they want to receive additional training on this subject, so their perception of inclusion may change in a positive way. For instance, in various studies, teachers who receive little or no training on inclusion and special education have a more negative attitude than those with more training on inclusion (Bender, Vail & Scott, 1995).

Battige (2008) found out that other factors influencing perception of general education teachers about the inclusion were workload, having too many objectives to achieve for students with MLD and rise in stress level. Different from the current study, in this research all participants prepare individualized education plan, exam and worksheets for students with special needs; however, they do not consider the preparation as workload, so it may be suggested that the participants' perception of inclusion was not affected in a negative way by the tasks which were done only for disabled students. It might be inferred that since the participants received the training on IEP from the guidance service, they did not have difficulty in preparing and applying the IEP, so their perception of inclusion is not affected negatively.

School factors also affect the teachers' perceptions of inclusion (Avramidis & Norwich, 2002). The participants stated that they were satisfied with the attitude of the school management, especially thanks to having supportive educational services and the guidance counselor's help. However, due to the lack of adequate number of resource rooms, they indicated that they provided support education services in different places such as administrators' room, counselors' room and teachers' room in addition to the support training room. Moreover, almost all participants stated that there were no materials and technological facilities to teach mathematics in any room, including the support training room. These findings are consistent with the study of Shareefa (2016) which revealed that most participants of the research said that they do not have sufficient and necessary resources, crucial materials and the necessary physical conditions for the students with MLD, and they believed that the inadequacies cause to a negative perception of inclusion. In addition, lack of material leads to using such objects as pencils, erasers, pipettes, plates and paper, which are not created for mathematics lesson, so they may not be as effective as the materials which are specially created for mathematics learning such as base ten blocks. Moreover, some participants did not use any concrete materials. Although the participants stated that they were satisfied with the attitude of the school administration, it might be concluded that the school administration failed to provide the necessary resources for the inclusion education. Since teachers did not use manipulatives efficiently, students with MLD might not have meaningful learning. In order to enhance the students' comprehension of the mathematical concepts, students should be engaged with concrete objects and manipulatives (Maccini & Gagnon, 2002). In addition, the participants stated that it was difficult to reach the students with MLD because of the class size, which was approximately 50 students in the 5^{th} grade and about 40 students in the other grades. Similar to findings of Avramidis & Kalyva (2007) and Shareefa (2016), participants emphasized that crowded classes cause less time for students with special needs in the general classroom.

In the present study, the time spent individually with these students in the classroom varies from teacher to teacher. Three participants periodically spend 5-

10 minutes in each lesson for students with special needs. They give the students a brief lecture, and then distribute them the worksheets. Afterwards, the students solve the problems during the lesson, and after the lesson, participants check their answers. On the other hand, two participants rarely spend time for these students in the general classrooms, and one participant did not spend any time with students with special needs in the general classrooms. They think that if they spend time with these students, they get into trouble in terms of both classroom management and time management. However, some participants think the exact opposite. They stated that if they do not pay attention to students with MLD individually, they start to talk and distract the other students since the students with MLD are bored, so classroom management problems occur. Similarly, in Sart, Ala and Yazlık's (2004) study, teachers who participated in the study assumed that caring about learning these students cause not to lecture and to neglect other students. The duration of one-to-one engagement of the participants with students with disabilities in the classroom and the differences in classroom management process may be due to the individual experience and knowledge of the participants (Carroll, Forlin & Jobling, 2003). Moreover, the participants' individual differences in terms of voluntariness in training students with MLD may have an impact on their behaviors and attitudes towards these students in the general education classrooms. For instance, Reusen, Shoho, Barker (2001) claimed that teachers' willingness to undertake responsibility for the success of students with disabilities and their skills to teach these students influence the efficiency of inclusion education.

Moreover, all participants except P6 pointed out that they made adaptations for students with MLD in the classroom. However, their adaptations are not about the curriculum which is applied in the regular classrooms. They are related to participation of the students with special needs in the lessons in accordance with their individualized education plans. They stated that participation of students with MLD in the lessons of the general education classroom increased the self-confidence of these students as well as enhancing the teacher-student relationship. In addition, their friends motivated these students. Different from other participants, P6 believes that the support education lesson is sufficient for the

students with MLD, so she does not make any adaptation for the students in the general classrooms. However, in terms of the benefits of support education, P6 agree with the other participants who stated that support education lessons are much more efficient than general classroom lessons because general classroom lessons have some problems such as time limitations, the difficulty of applying two different curricula at the same time and classroom management. The results are accordance with the findings of Mukhopadly, Nety and Abosi (2012) in terms of that crowded classes, inadequate resources and opportunities conduce to teachers' negative perception. Moreover, in the current study participants assumed that students with MLD are able to progress more in mathematics courses since the curriculum is arranged based on the levels of the students and teachers allocate more time for students with MLD in the support education lessons. In addition, because of getting individual attention, students have a more positive attitude towards both the teacher and mathematics lesson in the support education lessons. These findings of the research are similar to the results of Ünal's study (2012) which revealed that students with special needs mathematics achievement and self-efficacy changed positively by means of individual support education.

5.2 Discussion of the Findings Regarding Four Basic Arithmetic Operations and Problems

All participants actively use the direct teaching method and the question and answer technique in four arithmetical operations and problem solving instruction. When the literature is examined, it is seen that direct teaching method is one of the most effective methods in the teaching of mathematics to students with MLD (Heasty et al., 2012; Wilson and Sindelar, 1991; Skarr et al., 2014; Kroesbergen, 2003). Although the participants use direct teaching method, they do not use certain other methods as much as direct method. These methods and strategies, which are game-based learning, technology-based teaching, role playing and drama, touch point, CRA strategy, VRA strategy have been proven to be effective for teaching mathematics into inclusive education (Erdoğan, 2008; Türkmen & Soybaş 2019; Carmack 2011; Bouck et al., 2017; Xin et al., 2005). According to

the results of the study, technology-based teaching, touch point strategy, VRA strategy and errorless teaching methods are never used while drama and role playing, game based learning and CRA are rarely used by some participants. The reasons for not using these methods or using them inadequately may be the fact that they do not have sufficient knowledge of the teaching mathematics to students with MLD. This situation may result from the fact that most of the participants did not take any courses about teaching mathematics in special education (Witsel, 2012; Simon 2004, Van Garderen, 2006). Another reason may be that even if the participants take the course about teaching mathematics to students with special needs, the courses are inadequate. Similarly, another study revealed that the participants did not mention instructional strategies which are efficient in special education and most of the participants had the same opinion about the insufficiency of their preservice education program in terms of teaching mathematics to students with MLD (DeSimone & Parmar, 2006).

School conditions also make it difficult to use some of these methods and strategies. For example, the lack of opportunity for using technological applications in support rooms and the absence of materials aimed at teaching mathematics may result in not using certain methods and strategies such as CRA and VRA. The absence of materials for teaching mathematics may also cause participants to select the concrete materials from their daily life objects such as glass, plate pipet and beans. Participants using these materials do not use them in every stage of the instruction of four basic operations since these materials are not functional enough. The fact that there is no or insufficient use of material may lead to problems in conceptual understandings. For instance, Pape and Tchoshanov (2001) assert that qualified teaching in four basic operations require the use of concrete and hands-on modelling of operations so that the students can develop mathematical thinking. When the errors and misconceptions of students with MLD are examined, it is clear that their conceptual understanding about four operations is insufficient. In the continuation of the study, it was stated by the teachers that there were decreases in the number of students' mistakes and misconceptions after the lessons they conducted by using touch point, CRA and VRA strategy in the support room. The

reason of reduction in the number of errors and misconceptions may be the correct use of concrete and virtual materials and the effectiveness of the instruction from concrete to abstract. The result of the study is consistent with the research conducted by Carmack (2011). In his study, nine participants which have difficulty in addition with regrouping received education about CRA strategy and then, it was found out that all nine participants enhanced their conceptual understanding thanks to the instruction. Moreover, like other studies, in this research, when we look at the comments of the teachers after these lessons, we see that especially the concrete part of the CRA, VRA and touch point strategies attracted the attention of the students, and they were more positive towards the course (Satsangi & Bouck 2015).

While teaching addition operation, participants used the counting on strategy while teaching addition operation to students with MLD. Only three participants used concrete material while using this strategy. The used materials are mostly objects such as pens, erasers and paper that can be reached in daily life. Only one participant put to use counters which are created for mathematics instruction. In addition, these materials are used at the beginning of teaching addition without carry. Participants asserted that these students' main problem about addition operation is lack of understanding of addition with regrouping. The reason of the problem is inadequate knowledge of place value (Yorulmaz et al., 2017). Difficulties related to place value concept might stem from the fact that while teaching addition operation, the participants do not pay attention to teaching conceptual meaning of the place value and carry to the students. Non-use of mathematics teaching materials, such as base ten blocks, which are designed to teach the concept of numbers and place value, may cause drawbacks in the conceptual understanding of the addition process (Yorulmaz et al., 2017). The participants' solutions to the problems of the students who have difficulty in addition operation are emphasizing the place of the carry, crossing out the carry in order not to use the same carry in other places, giving verbal clue to remind to add carry to the necessary place and giving a prepared template for accurate alignment of places. When these solutions are examined, it is seen that they are based on

memorization, and they do not support conceptual learning. However, after the participants taught the students with MLD by using CRA and VRA strategies with base ten blocks, they thought that the students comprehend the place value and can imagine the logic of carry concept. Thus, they were able to reduce the number of errors in the addition operations. The outcomes are similar to the Carmack's (2011) research which revealed that CRA sequence enhances the students' conceptual understanding of addition with regrouping, so they can solve the questions more accurately.

While the support training courses, two participants applied the touch point strategy to students with MLD in teaching addition. They found this strategy beneficial since it helped to understand the logic of addition operation and attracted the attention of students. Participants' views are in accordance with the other studies in which teachers with more than 20 years of experience pointed out that touch point strategy is quite effective in addition operation and that children are less concerned about finding the right answer (Yıkmış et al., 2013). However, one participant stated that this one is not a very necessary strategy since counting by fingers can be used instead of the strategy. Unlike this idea, Simon (2004) considered that students with MLD prefer touch point strategy to using fingers. Since students with special needs offended when they use their fingers in the regular classroom, and they try to conceal the fact that they were doing addition questions by using their fingers. Thus this strategy had an advantage for the students in terms of integration into the general education classrooms.

While teaching subtraction operation, participants used counting back and counting up strategies and three of the participants use concrete materials which are pencil, bead, and bean while they teach subtraction without regrouping. One participant asserted that she used materials in subtraction with regrouping if the student does not understand the subtraction with regrouping. However, the instruction should be from concrete to abstract (Kaufman et al. 2003). As in the addition operation, most of the materials used are not specially prepared materials for teaching mathematics. In addition, participants only use concrete material for teaching subtraction without

regrouping. Therefore, this instruction supports students in learning the subtraction without regrouping but they have difficulty in subtraction with regrouping. For this reason, participants asserted these students' most difficulties regarding subtraction with regrouping. Students' inability to understand the concept of carry also causes not to understand subtraction with regrouping. The underlying reason of these two problems is that the place value cannot be taught to the students conceptually, and consequently, alignment errors occur (Thoules, 2014). In addition, almost all of the participants claimed that they encounter the misconception which is if the number in minuend is smaller than the number in subtrahend, the students subtract the bigger from the smaller without paying attention to which one is minuend or subtrahend. This misconception results from the misunderstanding of subtraction with regrouping. For instance, Mancl, Miller and Kennedy (2012), conducted a study with students who had never been instructed the regrouping and place value concept using base ten blocks. It was revealed that the students had very little conceptual understanding regarding regrouping and place value. Thus, they made an effort to memorize the procedure of the subtraction operation. Since they had insufficient conceptual understanding, they made errors mentioned above (such as 43-17 = 34). Similar to the study of Mancl, Miller and Kennedy (2012), in the current study, participants using CRA and VRA strategy with base ten blocks stated that this strategy provides the students with meaningful learning. Thus, the students reduce their errors related to subtraction with regrouping. They also claimed that base ten blocks enable students with MLD to understand that a tens is equal to 10 ones, so the students enhance their conceptual understanding and they have more permanent learning.

While teaching multiplication operation, most of the participants use game-based learning in teaching of multiplication table. Gamification plays a role in motivating children and also it helps them increase their attention for mathematics, so the students learn mathematics in an easy and entertaining way (Genç, Issı & Yıldız, 2017). These views are consistent with the participants' opinions of game based learning. They think that students with MLD pay more attention to mathematics lessons thanks to the game based learning. Participants stated that they used the

rhythmic counting strategy while teaching multiplication. Only two of these participants prefer to use concrete material used in daily life such as beans, pipettes, beads and plates. However, they stated that they did not use any concrete materials while teaching multiplication with numbers involving two or more digits, so the students may have trouble calculating multiplying of two digit numbers. For instance, one of the problems experienced by the participants in the multiplication process is that the students forget the step shift. The reason for this may be the fact that teachers do not pay enough attention to conceptual learning. Only one participant tries to explain the logic of the step shift, but this is not supported by concrete materials. The other methods used by the other participants to solve this problem were giving the step shift as a rule, solving plenty of problems and memorizing the step shift as a template. As it is understood from this point of view, participants give importance to procedural understanding instead of conceptual understanding. On the other hand, when the opinions of the participants using the CRA strategy in multiplication with two digit numbers by using base ten blocks were examined, it was stated that the student was able to visualize the multiplication process in his mind. Hence, he learned more meaningfully and could solve the problems faster. Moreover, student with MLD started to solve multiplication problems with two or more digit numbers more accurately. This result is similar to the study of Özlü (2016) who revealed that by implementing CRA strategy, all three students carried out more effective conceptual and procedural understanding in multiplication operation.

While teaching division operation, it is inferred from the interviews and observations that the participants used two meanings of division which are partition and measurement. Two participants used concrete-representational-abstract (CRA) strategy in teaching division operation to students with MLD. In the concrete part, the participants used plate, glass and beans as concrete material. One of the participants used this strategy in support education lesson, as well. She reported that CRA strategy is useful and beneficial in terms of increasing the students' attention, helping to comprehend the meaning of division operation and helping to make it easier to pass onto abstract learning. Similarly, it was revealed that CRA

instruction enables students with MLD to improve conceptual understanding in division operation. In this study, researchers found out that using CRA strategy is helpful in increasing the number of questions solved correctly in division for students with special needs (Milton et al., 2018). Based on the literature and the participant's ideas regarding CRA strategy. It might be inferred that using this strategy prevented the students from making mistakes which stems from the unperceived reasoning of division operation.

Research studies revealed that the biggest challenge experienced by the participants in instructing problem solving is the inability of students to understand the problem (Doğmaz, 2016). Therefore, they should choose their teaching strategies in a way that will enable students with MLD to enhance their understanding. In particular, they emphasize keywords and try to comprehend which operation to do. In addition, certain participants asserted that they try to concretize the problem so that the students can comprehend the problem. They reported that they only use drawing for solving the problem rather than concrete material.

Similar to Bouck et al, 2018 and Milton et al. 2018, in the present study the participants who used the CRA and VRA strategies in problem solving instruction at the resource rooms asserted that the concrete part is significant for attracting the attention of the students and the virtual and concrete materials enabled the students to visualize the problem and to increase conceptual learning as well as drawings. Only one participant reported that she used drama and role playing in problem solving instruction; however she implemented this method in the general education classroom including students with MLD. She indicated that the students with MLD were interested in the lesson and they can comprehend the problem by envisaging and experimenting. The results are in accordance with the other studies which asserted that drama method converts the abstract mathematical concepts into interesting and concrete concepts and the method also offers the students an opportunity to learn mathematics through experience (Erdoğan, 2008).

5.3 Implications

In the current study, participants indicated that support education has a great impact on having a more positive perception of inclusion. They emphasized that they have limited time, and they are obligated to implement regular curriculum in the general education classroom. Therefore, they do not pay enough attention to students with MLD. On the other hand, they enable the students to have more qualified mathematics education in support education room since they have a chance to implement individualized education plan. Therefore, support education services need to be imperative for all schools and necessary support such as mathematics materials, technological tools, and sufficient number of rooms needs to be provided with mathematics teachers.

There are many research studies which suggest using concrete materials to improve conceptual understanding of students with MLD (Witsel, 2008; Milton et al., 2018; Carmack, 2011). When significance of enhancing conceptual understanding is taken into account, mathematics teachers need to use efficient and appropriate concrete manipulatives for related subjects. However, the present study revealed that some participants never use concrete materials in teaching basic arithmetical operations to students with MLD. Although some participants used concrete manipulatives in teaching students with MLD, they often do not use them for all necessary parts of the subject because of choosing improper material. In addition to concrete manipulatives, none of the participants use technological tools while teaching mathematics to students with MLD. One reason for this might be the fact that teachers are not aware of the benefits of using concrete manipulatives and technological applications for students with MLD, and they may not be well-equipped to use effective concrete materials and technology since they did not undergo the required training in their undergraduate education. To overcome this drawback, seminars about using efficient concrete materials and technological applications for students with MLD need to be organized. In addition, mathematics teachers need to collaborate with special education teachers. To carry out this, educational policy makers need to make the necessary adjustments. Another reason

of not using concrete materials and technological tools is explained by participants as they do not have sufficient resources in the school. To cope with this, especially, support training room need to be well-equipped with essential materials and smart board by the help of school management. Furthermore, mathematics teachers might be given training regarding how to create manipulatives to aid in the teaching of necessary subjects in mathematics.

Moreover all participants indicated that they regard themselves as inadequate in terms of teaching students with MLD. Similar to their remarks, the results of the study also indicate that the beneficial strategies in teaching mathematics to students with MLD are not employed sufficiently. To illustrate, VRA and Touch point strategies are never used, and only two participants sometimes implement the CRA strategy in teaching four arithmetic operations. Similarly, only one participant rarely uses drama method, and, similarly, game-based learning is rarely applied. Teachers need to be trained about teaching strategies aimed at students with MLD by special teacher educators. In addition, special and mathematics teacher educators need to prepare a guidebook about teaching mathematics to students with MLD, and it need to be enriched in detail by various activities, teaching strategies and lesson plans for students with MLD. It might be an essential guidance for mathematics teachers. Furthermore, an undergraduate course about methods of teaching mathematics to those students needs to be rearranged to fulfill the needs of students with MLD in particular.

According to the findings, most of the participants have difficulty in adapting their lessons for the students with MLD in the general education classrooms. To overcome this problem, both in-service and pre-service middle school mathematics teachers need to undergo training regarding adaptation of the mathematics lessons for students with MLD.

5.4 Recommendations for the Further Research Studies

The purpose of the study was to examine the middle school mathematics teachers' perception of inclusion as well as their preferred strategies in teaching basic

arithmetical operations and problems. To achieve this goal, the study was conducted with six middle school mathematics teachers in İstanbul. Thus, the findings of the research cannot be generalized for all middle school mathematics teachers, so further relevant studies need to be conducted in different cities in Turkey. To increase the generalizability, studies need to be conducted with both qualitative and quantitative data with more participants. Moreover, apart from middle schools, similar studies need to be carried out in other levels such as high schools. Furthermore, since one of the most difficult subjects in mathematics is four arithmetic operations and problems for students with MLD, this study focused on this topic, but other studies might be performed in different mathematics subjects that are challenging for students with MLD.

Another aim of the current research is to acquire middle school mathematics teachers' opinions about CRA, VRA and touch point strategies. In parallel with this purpose, the participants are expected to implement some of these strategies on students with MLD in support education room. However, because of limited time, they implemented each strategy for three hours. Other research need to be conducted by allocating longer time for each strategy to acquire more detailed and accurate information concerning mathematics teachers' views about the strategies. Moreover, apart from the strategies, there are other strategies such as diagram method and errorless teaching method might be used in alternative studies. In addition, this study concentrated on mathematics teachers' opinions related to these strategies. Further studies might be conducted on students with MLD. Their achievement and opinions regarding these strategies might be examined.

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APPENDICES

A. DATA COLLECTION TOOL

1. GÖRÜŞME SORULARI

1) Kaç yıldır matematik öğretmenliği yapmaktasınız? Kaynaştırma uygulamasının olduğu okullarda kaç yıllık tecrübeniz var?

2) Öğretmenlik yaptığınız süre boyunca kaç tane özel gereksinimli öğrenciniz oldu? Bu öğrencilerin sınıf seviyeleri nelerdi? Bu öğrencilerin özel gereksinimli olma nedenleri nelerdi? (Zihinsel yetersizlik, fiziksel yetersizlik, öğrenme güçlüğü)?

3) Öğretmenliğe başladığınız zamandan şu ana kadar geçen süreçte kaynaştırma uygulaması hakkında algınızdaki değişimleri nasıl değerlendiriyorsunuz? Algınızdaki bu değişimler hangi olaylardan ya da nedenlerden dolayı meydana geldi? Görev yaptığınız okullardan örnekler verebilir misiniz?

4) Kaynaştırma uygulaması ile ilgili herhangi bir eğitim aldınız mı? Ne kadar süreli bir eğitimdi? Aldığınız eğitimlerin kaynaştırma uygulamasına yönelik algınıza ve özel gereksinimli öğrencilerinize matematik öğretim sürecinize yönelik etkilerinden bahseder misiniz? Özel gereksinimli öğrenciler ile ilgili kendinizi nasıl değerlendiriyorsunuz? Ek olarak özel gereksinimli öğrenciler ile ilgili eğitim almak isterseniz hangi yönlerden sizi destekleyecek eğitimleri tercih edersiniz?

5) Çalıştığınız kurumların koşullarını özel gereksinimli öğrenciler için matematik dersi açısından nasıl değerlendirirsiniz? (destek eğitim odası/ eğitim ortamı/ teknoloji olanakları/ materyal olanakları/ idarenin tutumu) Önerileriniz varsa nelerdir?

6) Özel gereksinimli öğrenciler için yaptığınız ek etkinliklerden/iş yükünden bahseder misiniz? (Materyal/ ders planı/ bep sınavı/ etkinlikler hazırlıyor musunuz?)

7) Sınıfınızda özel gereksinimli öğrencilerinin olması matematik ders işleyişinizi nasıl etkiliyor? Örnekler verir misiniz?

8) Özel gereksinimli öğrenciler için sınıf içinde işlediğiniz konularda uyarlama yapıyor musunuz? Örnek verebilir misiniz?

9) Okulunuzda destek eğitim odası var mı? Siz destek eğitim odasında ders veriyor musunuz? Destek eğitim odasında özel gereksinimli öğrenciler ile ders işlemek bu öğrencilere matematik öğretim sürecinizi nasıl etkiliyor? Örnekler verebilir misiniz?

10) Özel gereksinimli öğrencilerinize matematik öğretim sürecinizde pekiştireç kullanıyor musunuz? Kullandığınız pekiştireçlere örnekler verebilir misiniz?

11) Özel gereksinimli öğrencilerinizin matematik dersine yönelik ölçme ve değerlendirmesini nasıl yapıyorsunuz?

2. GÖRÜŞME SORULARI

Aşağıdaki kazanımları özel gereksinimli öğrencilerinize öğretirken

1) Kullandığınız öğretim yöntem ve teknikler nelerdir? Örnek verebilir misiniz?
2) Varsa kullandığınız materyaller veya teknolojik uygulamalar nelerdir?
3) Bu konuları öğretirken hangi noktalarda sorun yaşıyorsunuz? Yaşadığınız zorlukları aşmak için neler yapıyorsunuz?

a) Toplama İşlemi (eldeli / eldesiz)
b) Çıkarma İşlemi (onluk bozmayı gerektirmeyen/ onluk bozmayı gerektiren)
c) Çarpma İşlemi (eldesiz çarpma/ eldeli çarpma)
d) Bölme İşlemi (Kalansız bölme işlemi / kalanlı bölme işlemi)
e) Dört işlem kullanarak problem çözme

3. GÖRÜŞME SORULARI

1) Destek eğitim dersinde kullandığınız Somut-Yarı Somut-Soyut (CRA)/ Sanal-Yarı Somut-Soyut (VRA)/ Nokta Belirleme Stratejileri hakkında neler düşünüyorsunuz?

2) Bu stratejilerin öğrencinin hedef kazanımı edinmesinde etkisi nasıl oldu? Dersinizden örnekler vererek açıklar mısınız?

3) Bu stratejileri kullanırken yararlandığınız materyalleri nasıl değerlendiriyorsunuz?

4) Bu stratejileri bir kez daha kullanmak isterseniz yapmak isteyeceğiniz değişiklikler neler olur?

5) Sizce bu stratejiler başka hangi matematik konularında kullanılabilir?

B. TURKISH SUMMARY/ TÜRKÇE ÖZET

ORTAOKUL MATEMATİK ÖĞRETMENLERİNİN KAYNAŞTIRMAYA YÖNELİK ALGILARI VE TEMEL ARİTMETİK İŞLEMLER VE PROBLEMLERİNİN ÖĞRETİMİNDE KULLANDIKLARI STRATEJİLER

Özel eğitim, Milli Eğitim Bakanlığı (2018) tarafından özel gereksinimli öğrencilerin eğitim ve sosyal ihtiyaçlarını karşılamak amacıyla uygun öğretim ortamlarında gerçekleştirilen öğretim programları olarak tanımlanmaktadır. Özel eğitime gereksinim duyan öğrenciler bireysel ve gelişimsel özellikleri bakımından akranlarından önemli derecede farklılık göstermektedirler (Özel Eğitim Hizmetleri Yönetmeliği, 2018). Türkiye İstatistik Kurumunun (2009) verilerine göre Türkiye'de yaşayan insanların %12.29'u özel gereksinimlidir. Özel eğitime ihtiyaç duyan bireyler fiziksel, zihinsel, öğrenme güçlüğü ve uyum özellikleri bakımından dört grupta sınıflandırılabilirler (TC. Başbakanlık Özürlüler İdaresi Başkanlığı, 1999). Zihinsel engel ve öğrenme güçlüğü birbirinden farklı kavramlardır çünkü öğrenme güçlüğü olan öğrenciler, hem akademik hem de sosyal ortamda gerekli becerileri elde etme konusunda zorluk yaşasalar da ortalama veya ortalamanın üzerinde zekâ seviyesine sahiptirler. Öğrenme güçlükleri disleksi, disgrafi, dispraksi ve discalculia olmak üzere dörde ayrılır (NCLD, 2014). Matematiksel öğrenme güçlüğü genel veya özel bilişsel eksiklikten dolayı matematikte başarı düzeyi düşük olan öğrencileri tanımlamak için kullanılır (Graham vd., 2007). Birçok araştırma matematiksel öğrenme güçlüğü yaşayan öğrencilere ek olarak zihinsel yetersizlik teşhisi konulan öğrencilerin de matematik öğretiminde oldukça zorluk yaşadıklarını ortaya koymuştur (Bouck vd., 2018; Kot vd., 2018). Ancak, NCTM (2000) her öğrencinin genel eğitim sınıflarında yüksek kalitede matematik eğitimi alma hakkına sahip olduğunu iddia eder. Bu fikir özel gereksinimli öğrencilerin ve normal gelişime sahip olan akranlarının gerekli desteğin sağlandığından emin olunması durumunda aynı okul öncesi, ilköğretim ve ortaöğretim okullarında ve yaygın eğitim kurumlarında eğitim almalarını ifade eden kaynaştırma uygulamasını ortaya çıkarmıştır (Milli Eğitim Bakanlığı Özel

Eğitim Yönetmeliği, 2000). Pasha (2012), özel gereksinimli öğrencilerle normal gelişim gösteren öğrencilere eşit eğitim koşullarını sağlamanın oldukça zor olduğunu, çünkü çok sayıda eğitimcinin akademik olarak kaynaştırma uygulamasını yürütmeye hazır olmadığını belirtmiştir. Kırcaali-İftar (1992), başarılı bir kaynaştırma uygulamasına sahip olmak için gerekli olan en önemli unsurlardan birisinin, genel eğitim sınıflarında görev yapan öğretmenlerin özel gereksinimli öğrencileri sınıflarına kabul etmeye istekli ve kaynaştırma uygulamasının başarıya ulaşması konusunda kararlı olmaları olarak ifade etmiştir. Bu nedenle, özel gereksinimli öğrencilere etkili bir matematik eğitimi vermek için matematik öğretmenlerinin kaynaştırma uygulamalarına yönelik algılarını anlamak çok önemlidir (DeSimone & Parmar, 2006). Alan yazın incelendiğinde öğretmenlerin kaynaştırma uygulamasına yönelik algılarını etkileyen unsurların başında öğretmenlerin kaynaştırma eğitimi ile ilgili tecrübesi, bilgisi, kaynaştırmaya dönük aldığı eğitimler ve bulunduğu okul koşulları gelmektedir. Yapılan birçok araştırmada kaynaştırma hakkında daha fazla tecrübeye sahip olan öğretmenlerin bu uygulamaya karşı daha olumlu tutumlar sergileyip bu uygulama hakkında daha pozitif bir algıya sahip oldukları ortaya çıkmıştır. Buna ek olarak, bazı araştırmalarda öğretmenlerin kaynaştırma eğitimi ve özel gereksinimli öğrenciler hakkında sahip oldukları bilgi ve almış oldukları eğitimlerin de bu uygulamaya yönelik algılarını ve tutumlarını oldukça etkilediğini ortaya çıkarmıştır. (Avradimis & Kalyva, 2007; DeSimone & Parmar, 2006; Lamba & Bones, 2006). Öğretmenlerin kaynaştırmaya yönelik bilgi ve tecrübelerinin yanı sıra, Mukhopadhyay, Nety & Abosi (2012) çalışmalarında öğretmenlerin çalıştıkları okulların koşullarının bu öğretmenlerin kaynaştırma eğitimine dönük algılarını etkilediğini saptamıştır. Yaptıkları çalışmanın sonucuna göre özellikle sınıf mevcutlarının kalabalık olması ve kaynaştırma uygulamasını yürütmek için yeterli donanımın olmaması öğretmenlerin bu uygulamadan memnun olmamasına neden olmuştur.

Ayrıca, öğretmenlerin kaynaştırma uygulamaları ile ilgili algıları kullandıkları öğretim yöntem ve stratejilerini etkilemektedir (Shin, Ok, Kang & Bryant, 2018). Etkili öğretim yöntem ve tekniklerinin kullanımı özel gereksinimli öğrencilerin

matematik başarısı üzerinde büyük etkiye sahiptir (Witzel, Riccomini & Schneider, 2008). Özel gereksinimli öğrencilerin matematikteki yetersizliklerinin, öğrencilerden ziyade bu bireylere uygulanan programların içeriğinden ve sunulmasından kaynaklandığı belirtilmektedir (Yıkmış, Öncül & Acar, 2013). Matematikte yeterli başarıya ulaşmak kavramsal ve işlemsel bilgiyi edinmeye bağlıdır (Rittle Johnson, Schneider & Star, 2011). Bazı araştırmalar, kavramsal anlamanın işlemsel anlama üzerinde daha güçlü bir etkisinin olduğunu ileri sürmektedir (Hecth & Vagi, 2010). Bu nedenle, kavramsal anlamanın geliştirilmesine öncelik vermek, etkili bir matematik eğitimi edinmeyi sağlayabilir. Araştırmalar, matematik öğrenme güçlüğü olan öğrencilerin özellikle dört temel aritmetik işlem ve problemlerini çözme konusunda sorunlar yaşadıklarını göstermektedir (Geary, Hamson & Hoard, 2000; Hanich vd., 2001). Ancak, özel gereksinimli öğrencilerin toplumda bağımsız birer birey olarak hayatta kalabilmeleri için gündelik yaşamlarında gereksinim duydukları temel becerilerden biri de dört temel aritmetik işlem ve problem çözmedir (Özkubat & Özmen, 2018). Alanyazın incelendiğinde matematik öğrenme güçlüğü olan öğrencilerin kavramsal ve işlemsel anlamalarının gelişmesine katkı sağlayan öğretim stratejileri ile ilgili çalışmalar bulunmaktadır. Özellikle temel aritmetik işlemlerin ve problemlerin öğretiminde kullanılan bazı stratejiler somut-yarı somut-soyut (CRA), sanal-yarı somut-soyut (VRA) ve nokta belirleme stratejileridir. Birçok çalışma bu stratejilerin özel gereksinimli öğrencilerin dört işlem ve problemlerinin öğretiminde öğrencilerin somuttan soyuta doğru öğrenmesine olanak sağlayıp bu konularda oldukça ilerleme kaydettiklerini ortaya çıkarmıştır (Bouck, Bassette, Shurr, Park & Kerr, 2017; Carmack, 2011; Genç, Issı & Yıldız, 2017; Milton, Flores, Moore, Taylor & Burton, 2018). Matematik öğretmenlerinin, özel geresinimli öğrenciler için matematik öğretiminde etkili öğretim yöntem ve tekniklerini belirlemesi gerekir (McLeskey & Billingsley, 2008). Ancak, öğretmenlerin kaynaştırma uygulamasına yönelik algıları tercih ettikleri öğretim stratejilerini etkilemektedir (Shin, Ok, Kang & Bryant, 2018). Bu nedenle, matematik öğretmenlerinin kaynaştırma uygulamasına yönelik algılarının incelenmesi başarılı bir kaynaştırma uygulamasının ortaya çıkması için oldukça önemlidir.

Bu çalışmanın amacı, ortaokul matematik öğretmenlerinin kaynaştırmaya dönük algılarını incelemek ve öğretmenlerin temel aritmetik işlemler ve problemlerin özel gereksinimli öğrencilere öğretiminde kullandıkları yöntemleri, teknikleri ve stratejileri hakkında bilgi edinmektir. Ayrıca, bu konularla ilgili karşılaştıkları zorlukları ve çözüm önerilerini öğrenmeleri de amaçlanmaktadır. Ek olarak, çalışma kapsamında araştırmacı tarafından katılımcılara dört temel aritmetik işlemin öğretilmesinde etkili olan somut-yarı somut-soyut, sanal-yarı somut-soyut ve nokta belirleme stratejileri hakkında bilgi sunulacağı için bu çalışma sayesinde katılımcılardan bu stratejiler hakkında yeterli bilgiye sahip olmayanların bilgilendirilmesi de amaçlanmaktadır. Ayrıca, katılımcılara bu stratejilerden öğrencilerinin seviyelerine uygun olan ve katılımcıların kullanmak istedikleri iki tanesini destek eğitim derslerinde kullanma imkânı sunulmuştur ve bu uygulamalardan sonra, katılımcıların stratejiler hakkındaki görüşlerini almak hedeflenmiştir.

Çalışmanın temel araştırma soruları ve alt sorusu aşağıdaki gibidir;

1) Ortaokul matematik öğretmenlerinin kaynaştırmaya dönük algılarında rol oynayan faktörler nelerdir?

2) Özel gereksinimli öğrencilere matematik öğretim süreci nasıldır?

a) Ortaokul matematik öğretmenleri, özel gereksinimli öğrencilere temel aritmetik işlem ve problemlerin öğretimi sürecinde hangi yöntemleri, teknikleri ve stratejileri kullanmaktadırlar?

3) Ortaokul matematik öğretmenlerinin temel aritmetik işlemler ve problemlerinin öğretiminde özel gereksinimli öğrencilerine uyguladıkları stratejiler (somut-yarı somut-soyut, sanal-yarı somut-soyut ve nokta belirleme stratejileri) hakkındaki görüşleri nelerdir?

Araştırma modeli nitel olan bu çalışmanın verileri İstanbul'da bir devlet ortaokulunda 2018-2019 eğitim öğretim yılında toplanmıştır. Çalışmanın katılımcılarını bu okulda görev yapmakta olan 6 gönüllü matematik öğretmeni oluşturmaktadır. Ayrıca katılımcılar belirlenirken sınıflarında özel gereksinimli öğrencilere sahip olmaları ve sınıf dışında da destek eğitim odalarında bu

öğrencilere ders vermeleri şartı göz önünde bulundurulmuştur. Katılımcıların soruları çekinmeden cevaplandırmaları için isimleri belirtilmeyip kodlanarak araştırmacı tarafından saklı tutulmuştur. Çalışmada yer alan katılımcılar K1, K2, K3, K4, K5 ve K6 olarak isimlendirilmiştir. Bu araştırmada veri toplama aracı olarak nitel araştırma yöntemi için araştırmacı tarafından geliştirilen "Yarı Yapılandırılmış Görüşme Formu" geliştirilerek uygulanmıştır. Veri toplama aracındaki sorular oluşturulurken çalışmanın amacı olan matematik öğretmenlerinin kaynaştırma eğitimi hakkındaki algılarını ve dört işlem ve problemlerinin öğretimi sürecinde nasıl bir yol izlediklerini saptamak için bu konularla ilgili alan yazıları taranmıştır. Bu çalışma için 3 farklı veri toplama aracı bulunmaktadır. Her veri toplama aracı için öğretmenlerle ayrı ayrı görüşmeler yapılmıştır. Yapılan görüşmeler ses kayıt cihazı ile kaydedilmiştir. Birinci veri toplama aracında öğretmenlerin kaynaştırma uygulamaları açısından tanınıp kaynaştırma öğrencilerine matematik ders işleyiş süreçleri hakkında detaylı bilgi edinimi amaçlanmıştır. Birinci veri toplama aracında 11 soru bulunmaktadır. Bu sorulardan dört tanesi öğretmenlerin demografik bilgilerini içeren ve kaynaştırma eğitimi hakkında öğretmenleri tanımaya yönelik sorulardan oluşmaktadır. Bu sorular içerik olarak öğretmenlerin kaynaştırma eğitimi hakkındaki deneyimleri, öğretmenlik hayatları boyunca karşılaştıkları kaynaştırma öğrencilerinin özellikleri, kaynaştırma eğitimi hakkındaki aldıkları ve almak istedikleri eğitimleri, öğretmenlik süresince kaynaştırma eğitimi hakkındaki algı değişimleri ve nedenlerini kapsamaktadır. Diğer 7 soru ise öğretmenlerin kaynaştırma eğitimi sürecini incelemeye yönelik sorulardır. Eğitim süreci ile ilgili sorular kurum koşulları, kaynaştırma öğrencilerine yönelik yapılan ek işler, sınıf-içi ve destek eğitim odalarında matematik ders işleyiş süreci, bu süreçteki pekiştireç kullanımları, son olarak da süreç sonunda yapılan ölçme ve değerlendirme ile ilgilidir. İkinci veri toplama aracı öğretmenlerin kaynaştırma öğrencilerine dört işlem ve problem çözme becerilerini nasıl aktardıkları ve hangi noktalarda sorun yaşayıp bu sorunları nasıl giderdiklerine yönelik sorulardan oluşmaktadır. Bu veri toplama aracında öğretmenlerden kaynaştırma öğrencilerine toplama, çıkarma, çarpma, bölme ve problem çözme öğretimlerinde ayrı ayrı kullandıkları öğretim yöntem, teknik ve stratejilerden bahsederek bu konuları nasıl anlattıklarını detaylı

bir şekilde örnekler vererek açıklamaları istenmiştir. Ayrıca bu süreçte kullandıkları materyal veya teknolojik uygulamaları da belirtmeleri istenmiştir. Son olarak ise her bir konunun öğretiminde yaşadıkları sorunlar ve çözüm için kullandıkları yöntem ve önerileri belirtmeleri istenmiştir. Üçüncü veri toplama aracı ise öğretmenlerin CRA, VRA ve nokta belirleme stratejilerinden destek eğitim derslerinde kaynaştırma öğrencilerine uyguladıkları derslerle ilgili görüşlerini almak için oluşturulan 5 soruyu içermektedir. Öğretmenler kaynaştırma öğrencilerinin bulunduğu seviyeyi dikkate alarak dört işlem veya problem çözme öğretimiyle ilgili bu stratejilerden uygun bulduklarını kullanmışlardır. Ders sonunda ise bu stratejilerle ilgili 5 soruyu cevaplandırmışlardır. Bu sorular öğretmenlerin strateji hakkındaki görüşlerini, kullandıkları materyal hakkındaki görüşlerini, bu stratejinin öğrencinin anlamasına etkisi hakkındaki görüşlerini, stratejiyi tekrar kullanmak isterlerse ekleyip çıkarmak istedikleri noktaları ve son olarak bu stratejiyi hangi matematik konularında uygulamak istediklerini içermektedir. Bu stratejilerin seçilmesinin nedeni öğrenme güçlüğü yaşayan öğrencilerin eğitiminde daha önceki çalışmalarda kullanılıp öğrencilerin konuyu anlamalarına olumlu yönde katkı sağladığı ortaya çıkarılmış olmasıdır.

Katılımcılarla 3 veri toplama aracının her biri için ayrı ayrı görüşmeler yapılmıştır. Katılımcıların uygun oldukları zaman dilimlerinde gerçekleştirilen görüşmeler en az 10 dakika en fazla 35 dakika sürmüştür. Hazırlanan görüşme sorularının anlaşılması ile ilgili herhangi bir sorun yaşanmamıştır. Katılımcılara birinci ve ikinci görüşme için herhangi bir ön bilgilendirme yapılmamıştır ancak üçüncü görüşme için önce belirlenen stratejileri kullanıp kullanmadıkları sorulmuş ve CRA stratejisini K1 ve K5 in daha önce kullandığı, VRA ve nokta belirleme stratejisinin ise daha önce hiçbir katılımcı tarafından kullanılmadığı sonuçlarına ulaşılmıştır. Katılımcılara stratejiler hakkında detaylı bilgi verilmiştir. Daha sonra öğretmenler kaynaştırma öğrencilerinin bulunduğu seviyeyi dikkate alarak dört işlem veya problem çözme öğretimiyle ilgili bu stratejilerden uygun buldukları 2 stratejiyi kullanmışlardır. Katılımcılara somut ve sanal materyal sağlama konusunda destek sağlanmıştır. Uygulamalar yaklaşık 3 ders saati sürmüştür. Daha sonra katılımcılarla kullandıkları stratejilere dönük görüşme yapılmıştır. Elde edilen

veriler içerik analizi kullanılarak analiz edilmiştir. Veri analizi her bir veri toplama aracı için ayrı ayrı yapılmıştır. Katılımcıların her bir soruya verdikleri cevaplar kendi içlerinde kodlanmış ve kodlar arasındaki ilişkilerden alt temalar ve temalar belirlenmiştir. Katılımcıların kendi cümlelerine de yer verilerek bulgular yorumlanmıştır. Görüşmelere ek olarak, araştırmanın geçerliliğini artırmak için araştırmacı tarafından 2 ders saati boyunca öğretmenlerin destek eğitim dersleri gözlemlenmiştir. Ayrıca, gözlemlerden elde edilen veriler ve ders sırasında yapılan etkinlikler ilgili fotoğraflara bulgularda yer verilmiştir.

Çalışmanın sonucunda katılımcıların kaynaştırmaya yönelik algılarındaki değişime neden olan etmenlerin başında kaynaştırma uygulamaları ile ilgili deneyimlerinin geldiği ortaya çıkmıştır. Katılımcılar özel gereksinimli öğrencilerle geçirdikleri vakit arttıkça onlara karşı algılarında olumlu yönde değişim olduğunu vurgulamışlardır. Araştırmanın bu sonucu daha önce yapılan çalışmalarla tutarlıdır (Avradimis & Kalyva, 2007; Lamba & Bones, 2006). Ayrıca, Ünal'ın (2012) çalışmasına benzer olarak destek eğitim hizmeti sayesinde bu öğrencilere bire bir ders verme olanağına sahip olan katılımcılar bu derslerin özel gereksinimli çocukları daha iyi tanıyıp onlara karşı olan önyargılarını da azalttığını vurgulamaktadırlar. Özellikle bu öğrencilere bire bir matematik dersi vermelerinin onlara yönelik hazırladıkları bireyselleştirilmiş eğitim planlarını daha etkin bir şekilde uygulamalarına ve bunun sonucunda da bu öğrencilerin başarılarının ve kendilerine olan güvenlerinin arttığını görmelerine neden olmuştur. Destek eğitim derslerinin katılımcıların özel gereksinimli öğrencileri tanımaları konusunda daha fazla tecrübe edinip kaynaştırma uygulamalarına karşı daha olumlu bir algıya sahip olabilecekleri düşünülmektedir. Bu bulgular aynı zamanda Vlachau, Didascalou ve Argyrakaouli'nin (2006) yapmış olduğu araştırma sonuçlarıyla da paralellik göstermektedir.

Ek olarak, bu çalışmanın sonucunda katılımcıların kaynaştırmaya dönük aldıkları eğitimlerin de algılarını belirlemede rol oynadığı ortaya çıkmıştır. Katılımcıların hepsinin rehber öğretmen tarafından yapılan sunumlara katıldıkları ve özellikle bu sunumlarda bireyselleştirilmiş eğitim planlarının nasıl hazırlanacağı konusunda

bilgi edindikleri belirlenmiştir. Ancak katılımcıların çoğunun özel gereksinimli öğrencilere matematik öğretimi konusunda lisans döneminde herhangi bir ders almadıkları ve öğretmenlik yaptıkları süreçte de herhangi bir hizmet içi eğitim veya seminer almadıkları ortaya çıkmıştır. Bu yüzden katılımcıların kendilerini matematik öğretimi noktasında yetersiz hissettikleri ve bu konuda eğitimler almak istedikleri sonucuna ulaşılmıştır. Sonuç olarak, katılımcıların rehber öğretmen tarafından verilen bireyselleştirilmiş eğitim planı hazırlama konusundaki aldıkları eğitimlerin katılımcılara bu planların hazırlanması ve uygulanması konusunda katkı sağladığı anlaşılmıştır. Ancak katılımcıların özel gereksinimli öğrencilere yönelik matematik öğretim yöntem ve teknikleri konusunda hem üniversite eğitimlerinde hem de öğretmenlik yaptıkları süre boyunca gerekli eğitimleri almadıkları için bu öğrencilere matematik öğretirken zorlandıkları ortaya çıkmıştır. DeSimone ve Parmar'ın (2006) çalışmasında ortaya çıkan bulgulara paralel olarak bu çalışmada da katılımcıların kendilerini özel gereksinimli öğrencilere matematik öğretimi konusunda yetersiz görmeleri onların kaynaştırma uygulamalarına karşı olumsuz algı geliştirmelerine neden olabilir.

Ayrıca okul koşullarının katılımcıların kaynaştırmaya dönük algılarında etkiye sahip olduğu belirlenmiştir. Katılımcılar okul koşullarını değerlendirirken hem sınıf içindeki olanaklardan hem de destek eğitim odasındaki imkânlardan bahsetmişlerdir. Bazı katılımcıların sınıf içi koşulları ile ilgili yorumları incelendiğinde bulundukları okuldaki sınıf mevcutlarının 5. Sınıflarda yaklaşık 50 kişi, diğer seviye gruplarında ise yaklaşık ise 40 kişi olduğunu ve bu durumun sınıf içinde özel gereksinimli öğrenciler ile yeterince ilgilenememelerine neden olduğunu vurgulamışlardır. Ayrıca destek eğitim odasının sadece 1 tane olması katılımcıların bu oda dışındaki okul müdür yardımcısı odası ve öğretmenler odası gibi başka odalarda destek eğitim hizmeti vermelerine neden olmaktadır. Ayrıca katılımcılar hem sınıf içi hem de destek eğitim odasının matematik öğretimi için gerekli olan materyal ve teknolojik desteği barındırmadığını belirtmişler. Mukhopadhyay, Nety ve Abosi 'nin (2012) araştırma sonucuna benzer olarak, bu araştırmada da çalıştıkları okuldaki yetersiz koşullar katılımcıların özel gereksinimli öğrencilere matematik öğretimlerinde etkili materyalleri ve öğretim

yöntem-tekniklerini kullanamamalarına ve kaynaştırma uygulamasına karşı olumsuz bir algı geliştirmelerinde rol oynamış olabileceği düşünülmektir.

Bu çalışmada katılımcıların özel gereksinimli öğrencilere uyguladıkları matematik öğretim süreçleri de incelenmiştir. Bu süreç kapsamında özel gereksinimli öğrenciler için yapmış oldukları ek işlerden, bu öğrencilere uyguladıkları matematik öğretim süreçlerinden, dört işlem ve problemlerinin öğretiminde hangi öğretim yöntem teknik ve stratejileri kullandıklarından, özel gereksinimli öğrencilere matematik öğretim sürecinde pekiştireç kullanma durumlarından ve bu öğrencilere yönelik ölçme ve değerlendirme sürecini nasıl yürüttüklerinden bahsedilmiştir. Araştırmanın sonuçlarına göre katılımcıların tamamının yaptıkları ek işler bireyselleştirilmiş eğitim planı hazırlamak, bu plana uygun özel gereksinimli öğrenciye dönemde iki kez sınav uygulamak ve bu öğrencilere müfredatlarındaki kazanımla ilgili sorular içeren çalışma kâğıdı hazırlamaktır. Ayrıca bazı katılımcıların bu öğrenciler için somut materyal de hazırladığı ortaya çıkmıştır. Katılımcıların özel gereksinimli öğrenciler için yaptıkları bu ek uygulamaları iş yükü olarak görmedikleri ortaya çıkmıştır. Bu yüzden Battiga (2008) tarafından yapılan çalışmanın aksine bu çalışmadaki katılımcıların kaynaştırma uygulamasına yönelik algısının bu uygulama kapsamında yapmaları gereken ek iş yükünden olumsuz etkilenmediği söylenilebilir.

Ek olarak katılımcıların sınıf içindeki öğretim sürecinde bu öğrencilere hem bireysel hem de sınıfta yaptıkları uyarlamalar incelenmiştir. Katılımcıların bazılarının sınıf içi uyarlama yaparken bu öğrenciler için sınıfta çözdükleri soruları değiştirmeden sadece sorunun bu öğrencilerin çözebileceği kısımlarında öğrencilerin derse katılımını sağladıkları ortaya çıkmıştır. Ayrıca, bazı katılımcıların da sınıfta anlatılan konu ile ilgili ancak konunun en basit kısmını içeren sorularla bu öğrencilerin derse katılımını sağladıkları belirlenmiştir. Sınıf içinde katılımcılarının çoğunun özel gereksinimli öğrencilere bireysel olarak çalışma kâğıdı verip ders içinde bu öğrencilere belirli miktarda zaman ayırarak öğrenicilerin bu çalışma kâğıdını çözmesini sağladıkları saptanmıştır. Katılımcılar özel gereksinimli öğrencilere sınıf içinde uyguladıkları matematik öğretim süreci

dışında destek eğitim odasında uyguladıkları matematik öğretim sürecinden de bahsetmişlerdir. Katılımcıların tamamı destek eğitim dersinde yapılan derslerin özel gereksinimli öğrencilerin matematik öğrenimine olumlu etkilediğini belirtmişlerdir. Katılımcıların çoğu sınıf içinde bu öğrencilere zaman ayrılsa da bunun yeterli olmadığını destek eğitim dersleri sayesinde bu öğrencilerle bire bir çalışma imkânı bulunduğu için öğrencilerin bireyselleştirilmiş eğitim planlarını çok daha etkili bir şekilde uyarladıklarını belirtmişlerdir. Bu sonuçlar daha önce yapılan Ünal (2012) ve Vlachau, Didascalou ve Argyrakaouli' nin (2006) araştırmalarının sonuçlarıyla benzerlik göstermektedir.

Katılımcıların özel gereksinimli öğrencilere dört temel aritmetik işlem ve problemlerinde uyguladıkları metot, yöntem ve teknikler incelendiğinde bütün katılımcıların doğrudan öğretim yöntemi ve soru cevap tekniğini kullandıkları ortaya çıkmıştır. Yapılmış çalışmalar incelendiğinde doğrudan öğretim yönteminin özel gereksinimli öğrenciler için kullanılması gereken en etkili öğretim yöntemlerinden biri olduğu görülmektedir bu yüzden katılımcıların bu yöntemi kullanılmalarının özel gereksinimli öğrencilerin matematik öğretimini olumlu yönde etkilemiş olabileceği söylenebilir (Heasty vd., 2012; Wilson & Sindeler, 1991). Ancak araştırmanın sonuçlarına bakıldığında katılımcıların özel eğitimde kullanılan diğer yöntem ve stratejileri yeterince kullanmadıkları ortaya çıkmıştır. Katılımcılar tarafından kullanımının yetersiz olduğu bu yöntem ve stratejilerin birçok araştırmada özel gereksinimli öğrencilerin matematik öğretim süreçlerine katkı sağladığı ortaya çıkmıştır. Bu yöntem ve stratejiler yanlışsız öğretim yöntemleri, oyun tabanlı öğrenme, drama ve rol oynama, nokta belirleme stratejisi, somut-yarı somut-soyut, soyut-yarı somut-soyut stratejileridir (Erdoğan, 2008; Türkmen & Soybaş, 2019; Carmacs, 2011; Bouck & Flanagan, 2010; Tekin İftar & Kırcaali İftar, 2012; Scott, 1993). Öğretmenlerin bu yöntem ve stratejileri yeterince kullanmama nedeninin özel gereksinimli öğrencilere matematik öğretimi için yeterli eğitime sahip olmamaları olabileceği düşünülmektedir. Ayrıca bu yöntem ve stratejilerin özel gereksinimli öğrencilerin kavramsal öğrenmelerine katkı sağladığı için yeterince kullanılmamaları dört işlem ve problemlerinin öğreniminde bu öğrencilerin çeşitli sorunlar yaşamalarına neden olmuş olabilir. Ek olarak

katılımcılardan sadece ikisinin genellikle özel gereksinimli öğrenciye matematik öğretimi sürecinde somut materyal kullandığını ancak bu materyallerin kullanımının konunun sadece belli kısımlarıyla sınırlı kaldığı anlaşılmıştır. Örneğin toplama işleminde eldesiz toplama işlemi öğretiminde, çıkarma işleminde ise onluk bozmayı gerektirmeyen çıkarma işlemi öğretiminde somut materyal kullanılmadığı belirlenmiştir. Katılımcılara dört işlem ve öğretiminde öğrencilerin yaşadıkları zorluklar sorulduğunda ise genellikle konunun öğretiminde somut materyal kullanımının yetersiz olduğu kısımlarda öğrencilerin anlamada zorluklar yaşadıkları ortaya çıkmıştır. Bu durumun nedeni olarak öğrencilerin kavramsal anlamalarının somut materyal ve teknoloji kullanımı ile desteklenmemesi söylenebilir. Ayrıca kullanılan somut materyallerin de özellikle dört işlem ve problemlerinin öğretiminde kullanılan onluk taban blokları gibi materyaller olmadığı daha çok günlük hayattan kullanılan kalem, silgi, bilye, fasulye gibi materyaller olduğu görülmüştür. Bu durumda öğretmenler somut materyal kullansa bile bu materyallerin dört işlem ve problemlerinin öğretiminde yetersiz kaldığı söylenebilir. Ayrıca, katılımcıların tümü öğrencilerin bol miktarda soru çözmelerini sağlamayı hedefledikleri için çalışma kâğıtlarını kullanmaktadır. Bu şekilde özel gereksinimli öğrencilere dört işlem ve problemlerinin çözümünde kullanılan kuralları vurgulayarak öğrencilerin karşılaştıkları zorlukların üstesinden gelmeye çalıştıkları belirlenmiştir. Bu durum, katılımcıların özel gereksinimli öğrencilere işlemsel bilgi edinmelerine önem verdiklerini ortaya koymaktadır.

Katılımcıların destek eğitim derslerinde öğrencilerine CRA, VRA ve nokta belirleme stratejilerini kullandıklarında ise öğrencilerin dört işlem ve problemlerinin öğreniminde yaşadıkları sorunların önemli ölçüde giderildiği ortaya çıkmıştır. Bunun nedeni ise bu stratejilerin öğrencilerin kavramsal anlamalarını destekleyip dört işlem ve problemlerinin anlaşılmasını kolaylaştırması olabilir. Çalışmada elde edilen bu sonuçlar ile Carmack (2011), Simon (2004), Mancl, Miller ve Kennedy (2012) ve Özlü' nün (2016) yapmış oldukları araştırmaların bulguları tutarlılık göstermektedir.

Bu çalışmanın sonuçlarına göre ortaokul matematik öğretmenlerinin kaynaştırma uygulaması ve özel gereksinimli öğrencilere uygulanabilecek etkili matematik öğretim yöntem, teknik ve stratejileri ile ilgili seminerler veya hizmet içi eğitimlerin düzenlenmesi tavsiye edilebilir. Ayrıca öğretmenlerin somut materyal ve teknolojik uygulamaları kullanabilmeleri için okullara gerekli desteğin sağlanmasının gerekli olduğu düşünülmektedir. Ek olarak bu çalışma destek eğitim hizmetinin öğretmenlerin kaynaştırma uygulamasına karşı algılarını olumlu yönde etkilediğini ortaya çıkarmıştır. Özel gereksinimli öğrencilerin matematik öğretimlerini destekleyen ve onların hem kendilerine güvenlerini hem de matematik öğrenmeye karşı olan motivasyonlarının artmasını sağlayan destek eğitim hizmetinin diğer okullarda da yaygınlaştırılmasını ve geliştirilmesi önerilebilir.

C. PERMISSION FROM METU HUMAN SUBJECTS ETHICS COMMITTE

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Bilgilerinize saygılarımla sunarım.

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