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Number relationships on students with mild mental retardation

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Abstract

The purpose of this study is to investigate the number relationships of students about "The More-The Same-The Less" concepts. The students with mild mental retardation are handicapped children who need special education and their ability in number relationships have been recognized according to concrete-representational abstract (CRA) instructional approach.

Qualitative research approach have been used in the study Case study design have been carried out. The study is planned by studying with one participant and it has been multiple case study by including a few similar students with mild mental retardation in the study. Three students with mild mental retardation from a special education school were attended to the research. The participants of the study were selected among the students with mild mental retardation according to predetermined prerequisite skills. In the research to determine the ability of students with mild mental retardation, "The More", The Same" and "The Less" concepts were used in concrete-representational-abstract instructional abstract. For collection data assessment sets containing number relationships were prepared for each level of CRA and Interview, content analysis and think aloud methods were used to collect data. In the analysis of data, techniques of phenomenography were used in order to reach the concepts and relationships that can explain data related to sub-problems. According to the research's findings, students were recognized as inadequate in number relationships and also suggestions to teachers at the end.

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Key Words: Special Education, Mild Mental Reterdation, Number Relationships

1. Introduction

Mathematics skills, while very important prior condition for the students with intellectual disabilities to proceed in academic life, daily life, vocational field, is the leading skill which students with intellectual

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disabilities have difficulty to understand (Kroesbergen & Van Luit, 2003; Perie et al.,2005). This problem is multiplied by the factors. These factors are especially about mathematics skills which requires cognitive skills, difficulties in literacy, not allowing enough time teaching concepts, not providing students with enough opportunities and low motivation of the students (Vaughn et al., 2003).

Along with all these reasons, one of the reasons of not being able to gather mathematics skills for the students with intellectual disabilities is helix structure of mathematics. In other words in mathematics, acquisition of each skill depends on other skills that are prerequisite. From this perspective, especially the acquisition of the concept of number is one of the most important prerequisite skills for students to be successful in mathematics. National Council of Mathematics (2000) also proves that: "All the mathematics proposed for prekindergarten through grade 12 is strongly grounded in numbers". From research in literature, studying with students in numerical concept show that students gaining numerical concepts are recognized more successful in place value, numbers operation, computation, time telling and problem solving skills (Case & Griffin, 1990; Fischer, 1990; Griffin, Case, & Siegler, 1992; Kamii & Dominick, 1997; Resnick, Lesgold, & Bill, 1990).

Numerical concepts are very abstract and become more complex for students (Fuson, 1988) and conceptually understanding of numbers teachers based on three phase: Counting, Number Relationships and Numeral Writing & Recognition. (Van de Walle, 2007). Teachers should regard these three phase in the process of acquisition of numbers. In these phases students with mental retardation having counting and numeral writing skills; have difficulties in number relationships consists of cognitive process. Especially they have difficulties in acquisition the provision of the numbers containing multiplicity. So conceptually understanding of number relationships should teach to the students with evidence based strategies such as concrete to abstract models in the early years of life (Jung et al., 2013). However number relationships take part in early childhood academic skills in literature, should teach to the students with mild mental retardation regardless of their age. There are four types of number relationships children need to learn. These are (Van de Walle, 2007):

1. *Spatial Relationships:* Children need to recognize visual patterns, arrange the number of objects or organize objects into pairs visually without counting them. Children can develop a better understanding by looking at spatial relationships.
2. *One or Two More, One and Two Less:* Understanding that 6 is one more than 5 and two more than 7 leads to a better understanding of the basic facts students are required to memorize by 2nd grade.
3. *Benchmarks Of 5 and 10:* The numbers 5 and 10 are important to understand because they are so important in the base 10 system. Children need to understand how other numbers are related to 5 and 10, such as "8 is 2 less than 10, so 8 + 1 is less than 10."
4. *Part-Part-Whole Relationships:* Children need to recognize that numbers can be thought of as a whole which is made up of parts. For example, the number 7 can be made up of different parts, such as 3 and 4 or 5 and 2. Part-whole understanding leads to improved understanding of all mathematical operations.

Also according to Baroody (1987), for conceptually understanding of number relationships students need to develop three features. These are; Subitizing, Parts-Whole Relationships and More-and Less Relationships. Subitizing refers to the process of instantly seeing a number without counting like Walle (2007)'s spatial relationships. Teachers should make lots of concrete activities with students with mental retardation in subitizing process. But sometimes they aren't able to know the real sequence of counting words represents the total quantity of a collection (Fuson, 1988).So the only subitizing process isn't not enough for number relationships and teachers should organize Parts-Whole Relationships activities. In Parts-Whole Relationships students divides the whole into two parts by eyes and they add the part on the other. But they may have difficulties to understand explicitly the logical relationships. So teachers should organize an appropriate activity that connects missing addends and initial concepts of subtraction involves counting out items and then having a child hide some of them under a thing. And also they should encourage children to see all possible parts-whole compositions for a given number (Jung, 2011). The last feature of number relationships is More-and Less Relationships. It consists of more, less, and the same phases and it's accepted as successful way in helping children develop the overall

concept of number (Van de Walle, 2007). In this feature organizing a pair of collections with different quantities, students able to judge collections as “more”, “less” and “the same” for whether they understand the multiplicity and the symbol of numbers’ quantity.

From researches; Baroody (2000), determine that students aren’t be able to understand parts-whole relationships will have difficulty in addition, subtraction, and other mathematics problems (Jung, 2011). Also Fischer (1990) recognized that students have this feature are more successful in basic number concepts, addition and subtraction problem solving, and place value. While there are lots of findings to acquire the conceptual understanding of number relationships and many guidelines for students who need conceptual understanding of number relationships, number relationships aren’t cared about by teachers in special education. Usually teachers access numbers of operations after students begin to count and recognize the symbol of numbers. However teachers suppose that students who count and make operations are able to do these features (Jung, 2011), they should spend more time in these features before accessing the acquisition of numbers operation and they should place continuous assessment processes in sessions.

The aim of this research is to determine the ability of students with mild mental retardation in number relationships. For this reason questions below are seeked to be answered:

1. How is the ability of students with mild mental retardation in number relationships in concrete level?
2. How is the ability of students with mild mental retardation in number relationships in representational level?
3. How is the ability of students with mild mental retardation in number relationships in abstract level?

2. Method

In this research, qualitative research approach is used and the research is designed as a case study.

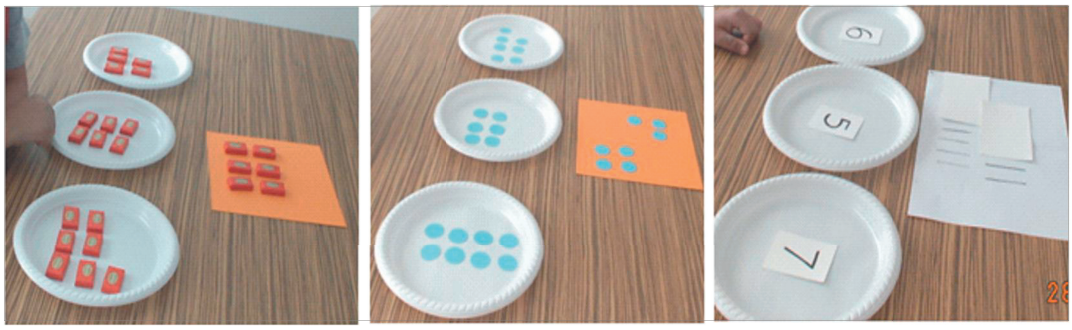
2.1. Participants

Three students, 2 boy and a girl, with mild mental retardation have attended the research who were selected according to their presequite skills. Presequite skills were reading & writing numbers and counting. Also they could do addition and substraction operations individually. They were also volunteers and have taken permission by parents. In the research participants called as their imaginary names Ali,zeynep and Mehmet.

2.2. Data collection

In this research assessment sessions were designed as parallel with the instructional guiddelines of Van De Walle (2007). To determine the ability of the students in number relationships, assessment sessions are designed according to “More”, “The Less” and “The Same” concepts of number relationships and also they were represented according to Concrete-Representational-Abstract (CRA) instructional approach. In assessment sessions 10 different number of sets were represented to each participant according to each level of CRA.

Figure 1. The materials used in assessment session



Concrete Level Representational Level Abstract Level

The assessment sets of number relationships concept were given in Fig. 1. In number of sets, a target number in the above and three different numbers in the below were took place and expected to answer the questions (Which one is the same?, Which one is the less? and Which one is more?) correctly by the participants. In the concrete level chocolate packets were used to represent the numbers; coloured circles were used in the representational level and also symbol of numbers were used in abstract level CRA. In abstract level strips drawn by pencil were used as semi abstract target number.

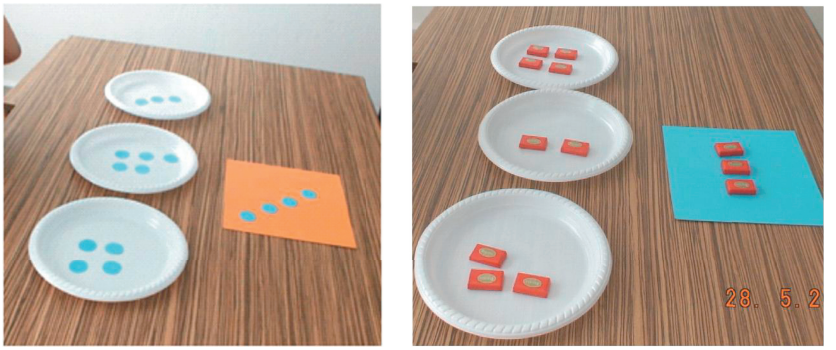
In the research 10 different directive sets were used to determine the ability of number relationships. In the sets five of them were prepared consecutively (like 4-5-6) and given randomly. The other five of them were prepared in twos (like 3-5-7) and given also randomly to each students in each level. 10 different assessment sets were used in each three level of CRA and each concept of "The More, The Same, The less". Assessment sets were given in Table 1.

Table 1. Assessment Sets

Level	Patterns	1	2	3	4	5	6	7	8	9	10
CRA	Target	3	4	5	6	7	4	8	5	6	7
	Given	2-4-3	4-5-3	6-4-5	6-5-7	7-6-8	6-4-2	9-6-8	3-7-5	6-4-8	7-5-9

In these sets consists of multiplicity, target number was represented with different patterns from given numbers to avoid memorization and determine how participants compare the sets.

Figure 2. Examples Of Different Patterns



In the assessment sessions reinforcements weren't used for the participants and also no feedbacks were used response to their answers but reinforcements were allowed by the researchers when the sessions completed before the beginning other level.

2.2. Data analysis

All assessment sessions were recorded by video camera and after completing the research, researchers watched records and redacted to the table. Also researchers observed the students how they do the number of sets. Finally datas were analysed by using content analysis method according to the research questions.

3.Findings

3.1. The ability of students with mild mental retardation in number relationships in concrete level

In the first sub-question it was sought to find an anwer to the question "How is the ability of students with mild mental retardation in number relationships in representational level?". When the results of the study were considered, the statement of the three of the participant students were found as follows.

Ali was able to count the concrete objects given to him correctly through recognizing by touching. When he was given multiplicity of objects around 2, 3 or 4, Ali can easily show the plate with the amount of the same, the less and the more multiplicity (even if they were given in successive order or not). However, when the amount of the multiplicity was increased, even if they were given in regular pattern, he sometimes counted the number of the multiplicity. That was, he could make mistakes like missing the order, recounting the ones that he already counted or miscounting the objects.

When the objects were given randomly without any pattern, he has difficulty in counting them correctly. Even more, he mostly fails to count correctly. Another interesting thing with Ali was that when he was required to show the plate with the less and the more amounts, he feels a need for recounting them each time even if he was able to recognize the one with the less visually. When he was asked to show the plate with the same one, even if he can primarily count the same one randomly, he cannot decide on the other plates before counting them. This was because Ali feels a need to recount the plate, forgetting all the time that he has already counted.

Zeynep can accomplish counting correctly by touching each of the given objects. However, she can sometimes make mistakes while subitizing without touching them. She was required to compare the target multiplicity provided by the researcher in the other plates. Zeynep was able to determine the multiplicity through counting one by one. She was able to show the correct plate with the same multiplicity. However, when she was asked "which one is more" or "which one is less", she showed the same plate again. This indicated that Zeynep knew the concept of "the same" but she couldn't know the concepts of "the same" and "the less".

It was seen that Mehmet cannot recognize the quantity of the chocolates by subitizing. He failed to subitizing, which was the first expectation of the researchers, but tried to decide the quantity of the chocolates by touching. During this process it was seen that he had a difficulty in continuing from where he stopped when he skipped a chocolates in the pattern. It was also seen that he had the same difficulty when he was comparing the target number with the plate he counted in the touching sessions. Generally, when analyzed, the results showed that he provided correct answered for the questions asked in the concrete level while he failed to provide correct answers for the questions about the concepts of the less and the more.

Tablo 2: The answers of students in number relationships in concrete level

Participant	Instructions	1	2	3	4	5	6	7	8	9	10
Ali	The Less	+	+	+	-	-	+	+	+	+	+
	The Same	+	+	+	+	+	+	+	+	+	+
	The More	+	+	+	-	+	+	+	+	+	+
Zeynep	The Less	-	-	-	-	-	-	-	-	-	-
	The Same	+	+	+	+	+	+	+	+	+	+
	The More	-	-	-	-	-	-	-	-	-	-
Mehmet	The Less	-	-	-	-	-	-	-	-	-	-
	The Same	+	+	+	+	+	+	+	+	+	+
	The More	-	-	-	-	-	-	-	-	-	-

The answers of the students at the concrete level is seen in the Table 2. In Table 2, the signs "+" and "–" show the students' answers to the questions in accordance with the instructions. As seen in table , concrete level, Ali, unlike his two other friends, gave correct answers almost in all instructions.

3.2. The ability of students with mild mental retardation in number relationships in representational level

The second sub-question sought an answer for the question "How is the ability of students with mild mental retardation in number relationships in representational level?". When the findings of the participants are considered, three of the participants' situations were found to be as follows:

It was seen that Ali repeated the same mistakes that he did at the concrete level. As he corrected his miscounts at representational level, he was found to be more successful in showing the less, the same and the more multiplicities.

Zeynep has difficulties in distinguishing the concepts 'the same", "the less" and "the more". She counted the target multiplicity and stated that they were the same, pointing out one of the other three plates. It was seen that Zeynep failed to provide correct answer for any of the instructions at the concrete level. Generally speaking, although Zeynep has prerequisite skills, she couldn't have a precise understanding of the concepts of "the less" and the more". As for the term "the same", it might be inferred that although she had an idea about what "the same" was, her correct answers did not necessarily mean that she knew the quantity of it but probably because they were represented with the same numbers. The fact that she showed the one with what she shoed for "the same", when she was asked to show "which one is more?", indicated that she did not quite perceive the term "the same" clearly.

Mehmet was also asked to compare the number of counting circles in the tables with the target number. However, he could not distinguish the counting circles at this level either and he pursued the activity feeling the need for touching. At the concrete level, although he provided correct answers to the term "the same", it was seen that he provided wrong answers to some questions about the term" the same". The main reason for this was found that he felt the need for recounting the target multiplicity in order to relate the counting circles and target multiplicity.

Tablo 3: The answers of students in number relationships in Representational level

Participant	Instructions	1	2	3	4	5	6	7	8	9	10
Ali	The Less	+	+	-	+	+	+	+	+	+	+
	The Same	+	+	-	+	+	+	+	+	+	+
	The More	+	+	+	+	+	+	+	+	+	+
Zeynep	The Less	-	-	-	-	-	-	-	-	-	-
	The Same	-	-	+	-	+	+	-	+	-	-
	The More	-	-	-	-	-	-	-	-	-	-
Mehmet	The Less	+	-	-	-	-	-	-	-	-	-
	The Same	+	+	+	+	-	-	+	+	+	+
	The More	-	-	-	-	-	-	-	-	-	-

The answers of the students' at the representational level were given in Table 3. As seen in Table 3, at the representational level, Ali again unlike his other two friends, provided correct answers to all instructions.

3.3. The ability of students with mild mental retardation in number relationships in abstract level

In the third sub-question, it was sought to find an answer for the question "How is the ability of students with mild mental retardation in number relationships in abstract level?" The results of the findings about the three students were found to be as follows:

It was seen that Ali experienced almost similar experiences as he had at the concrete and representational levels. On his confusing "the less" and "the more" for the questions 4 and 6, to the researcher's question "which one is bigger 9 or 7?". He replied as 7. This might be resulted from the fact that confusing the quantity of numbers as a symbol.

Zeynep had difficulties in gathering her attention. Although she was able to define the number of sticks correctly, when she was asked to show which one of the number of counting cards placed on the plates was the same with the number of the sticks, "which is less" and "which is more", she pointed out all of the plates. Therefore, she failed to provide appropriate answers. That she answered as 8 for the question "which is bigger 8 or 6" and answered as "6" for the question "which is bigger 6 or 8" and same inconsistencies for such kind of questions indicate that Zeynep had difficulties in understanding abstract expressions.

Since Mehmet recognized the numbers during the evaluation of the abstract stage, he was able to provide correct answer for the question "which is the same?" However, it was seen that he failed to provide inconsistent answers for the questions "which is more" and "which is less?" particularly, changing the places of the patterns and his tendency of doing the exercise by rote contributed negatively to his answers. Following the answer for "the same", when the plate was distanced from the environment, he felt it necessary to recount the lines again.

Tablo 4: The answers of students in number relationships in Abstract level

Participant	Instructions	1	2	3	4	5	6	7	8	9	10
Ali	The Less	+	+	+	-	+	-	+	+	+	+
	The Same	+	+	+	+	+	+	+	+	+	+
	The More	+	+	+	-	+	-	+	+	+	+
Zeynep	The Less	+	-	-	-	-	-	-	-	-	-
	The Same	+	-	-	-	-	-	-	-	-	-
	The More	+	-	-	-	-	-	-	-	-	-
Mehmet	The Less	+	-	+	-	-	+	-	-	-	-
	The Same	+	+	+	+	+	+	+	+	-	+
	The More	+	-	-	-	-	-	+	+	-	+

Status of the students' responded to the instructions are seen in the table 4. As can be seen in the table 4, at the representational stage, Ali, unlike his two friends, was seen to provide correct answers for almost all of the questions in the instructions. Mehmet, on the other hand, was seen to be successful in showing the reference multiplicity and the same multiplicity as he was in other two levels.

In general, the symptoms of students with mild mental retardation of showed itself also in the study. Every student had knowing numbers and counting prerequisite skills. All of the students participated in the study had no problems while finding "the same" in the other multiplicities with the given target multiplicity after they counted them. This situation was available for all of the three levels of CRA. However, except for Ali, it would be a mistake to state that the other two students had a clear understanding of the concept "the same". At the concrete stage, although there were some certain individual differences, in general it was seen that they had similarities in their making mistakes and calculating processes. Among the most common mistakes in calculating process were found to be recounting the objects and miscounts. This was also the same for the situations given in patterns. It was also seen that the counting level of the students were at the initial stage (counting by touching the objects one by one).

At the representational and abstract levels, it was found that two of the participants (Mehmet & Zeynep) had problems because of the fact that they failed to gather to do by subitizing. In general, although Mehmet has prerequisite skills, he was found not to have precise information about "less" and "more". Although he was aware of the term "the same", it has been thought that he answered correctly not because he knew the multiplicity

of it but probably because they were pronounced same. Therefore, it was possible to conclude that he cannot use the term quite consistently.Particularly, one of the participants, (Zeynep) was found to be not aware of the fact that she needed to consider the target multiplicity in order to choose the plate with the less or the more multiplicity while deciding the same multiplicity based on the target multiplicity. It would be quite possible to conclude that she caught the right answer during the pronunciation of the number while counting the multiplicities in the plates when she was asked to choose "the same" one. Ali, on the other hand, was aware of three of the concepts "the less, the same and the more".

At the abstract stage, while Mehmet showed the plate with the same multiplicity, he could not show the others. Zeynep, was able to show the plate with the same multiplicity for only one instruction. Both the participants were found to be insufficient in showing the "the more" and "the less". Ali on the other hand showed a good performance in this stage as he did in the other two levels.

4. Results and Discussion

A general assessment of findings showed that participants failure in subitizing and counting the objects caused negative impact in ability of comparing the multiciplicity. Although they could do addition and substraction skills in assessment of prerequisite skills in the class, they were recognized as in the begining of couting skills. Also despite of being given to participants in the form of clusters of patterned sets of multiplicities are strangers. The numbers of these children with mild mental disability appeared to be very inefficient at seeing relationships.

In the research the ability of number concepts until fifth patterns were expected to determine and after fifth pattern subitizing were expected by looking the multicipty of patterns. But participants prefer to count all items in the patterns than subitizing in each level of CRA. Just Zeynep tended to show "the same" but she also counted after this attempt. This findings showed consistency with Muldoon, Lewis & Towse (2005) research found participants refer to count the items if they are visible.

Among participants just Ali showed expected performance and he answered the instructions with less mistakes owing to better counting skills. Also the participants showed expected performance in the concept of "the same". But during the sessions it was recognized that it was caused by telling the same number verbally rather than understanding the multiciplicity, According to Van De Walle (2007), concepts of "The more" is easier to use than the concept of "The Less". But in the results there weren't any result to support this idea (see Tables 2-3-4). An assesment of CRA levels, in concrete level researchers were expected more success. But in concrete level, just Zeynep had more correct answers in the concept of "The same" and there weren't any difference among the others.

In this research, researchers expected the idea of acquiring how the teaching of mathematics in special education schools with students with mild mental retardation and defining what educators may do in the future in the classrom. However studying with the participants who had the same prerequisite skills, each participant showed different characteristics in need of special education. During sessions each participants were different mistakes depend on different sources. But their results and their attempts to answer the instructions may generalize to the literature and their abilities in number relationships recognized as not enough to gain more complex mathematics skills. This finding also showed that activities in the classroom to develop childrens' ability in number relationships aren't enough. So teachers should give place to appropriate activities based on literature to develop number relationships and shouln't begin another skills without assessing students performance. This research also should do in the preschool and in the first grade of elementary school with students.

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