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An Action Research on Teaching Natural Numbers to the First Grade Primary School Student with Low Readiness*

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Abstract: This study was designed as an action research with the aim of overcoming the deficiencies of a first-grade student with a lower level of readiness in mathematics. The participant of the study was a first grader studying in a public primary school in the district of Haymana, Ankara during the second semester of the 2018-2019 academic year. The teacher's in-class observations, examination of the students' homework notebooks, and familial interviews were taken into consideration in the selection of the participant. Observations and interviews were conducted as a preliminary study to determine the student's level of readiness for mathematics lessons. İt was seen that there were familial and educational reasons for the students to have difficulty in learning mathematics subjects. İn addition, an action plan was prepared because the student was behind his peers in terms of adaptation to school, literacy, and social development and it was aimed to obtain the first term gains. The study revealed that the student was successful in activities such as rhythmic counting, meaningful counting, one-to-one correspondence, quantity comparisons, addition, and subtraction while his confusion with number conservation remained. As a result of the obtained findings, it is predicted that raising the awareness of parents about the readiness of children of preschool age will positively affect their school success and hinder the problems described here.

Keywords: Primary school, readiness, natural numbers, action research

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Introduction

Given that education is a behavioral change process, it is paramount to identify and evaluate the difference between the starting and ending process. The difference is defined as "acquisition" (MoNE, 2018), "learning outcome" (Yakar, 2016; Yesilyurt, 2019), or "educational outcome" (Demircan, 2018), particularly in the field of curriculum and instruction. Behavioral change in an individual depends upon various factors such as the time allocated to the subject, the structure of the subject, active participation, feedback learning method (Bacanli, 2011). The student's motivation level, development level, age, and prelearning influence the learning process considering the factors related to the learner. The more advanced the student's pre-learning is, the more improved and meaningful their new learning becomes (Senemoglu, 2018).

The schools, where formal education is conducted in order to support an individual's behavioral change, expect learning proficiency to be ready for the related learning process. The ability of a student involved in any educational process to acquire the targeted acquisitions during the learning process depends largely on the prelearning activities. İn other words, students must acquire sufficient acquisitions at a school education level in order to have them gain the defined competencies at the education level. İt is a well-known fact that the cumulative progress of learning hinges on this situation. (Olkun & Toluk Ucar, 2007; Van de Walle, Karp, & Bay-Williams, 2012).

The Primary School Mathematics Curriculum covers a gradual and sequential structure that starts with natural numbers and then moves onto operation skills (MoNE, 2018). İncomplete learning in one subject may lead to a deficit understanding of the next subject. The development of the concept of natural numbers in primary school has a critical significance in terms of teaching all other subjects. The subject of natural numbers should be taught gradually and sequentially. Skipping any of the stages may cause numbers to be memorized without making any sense of them (Olkun & Toluk-Ucar, 2014). By adopting an approach from concrete to abstract in numbers teaching, actions can be done by first passing to the phase where real objects, object pictures, and then representations and finally numbers are used without using any objects or representations (May, 2001; Olkun & Ucar, 2007). Based on all the above-mentioned statements, it is wise to mention that mathematics instruction is a gradual process and the concept of readiness is one of the key concepts for further learning.

Conceptual Framework

Readiness is an extremely comprehensive concept that includes the student's previous learning, interests, attitudes, abilities, and health conditions, and it is defined as "reaching certain competence and behavior styles along with performance levels at the organism's cognitive, affective, and psychomotor level" (Topses, 2003, p. 25). The concept of readiness also means that the nervous system is ready to learn (Binbasioglu, 1995), that the individual acquires the necessary prerequisite behaviors in order to perform a learning activity (Ulgen, 1997; Yilmaz & Sunbul, 2003), and that the

individual reaches a level where he/she can perform a developmental task through maturation and learning (Basaran, 1998). Bloom (1995) considered the level of readiness, which is pivotal for the education process, as a notable part and input of the learning-teaching system. Basar (2001), on the other hand, indicated that the occurrence of a new behavioral change in an educational platform depends on the student's readiness level and that having cognitive, affective, and psychomotor behaviors is a prerequisite for this.

The national and international literature revealed that the studies conducted on readiness heavily focus on pre-school education (Bagceli-Kahraman, 2012; Ergul, et al., 2014; Hatfield, et al. 2016; Kutluca-Canbulat, & Yildizbas, 2014; Magnuson, Meyers, Ruhm, & Waldfogel, 2004; Yesil-Dagli, 2012; Ziv, 2013). Therefore, it is remarkable and necessary to carry out studies for all levels of education in this field (Harman & Celikler, 2012). Counting is one of the basic skills for primary school students' mathematical thinking development, and the accurate and meaningful activation of this skill is related to the proper implementation of some counting principles (Olkun, Fidan, & Ozer, 2013).

İn their study, Gelman and Gallistel (1986) proposed the following principles so that students can possess counting skills.

The stable-one principle means that the numbers are always in the same order,

The one-one principle involves the assigning of one or only one counting word to each of the items in a collection of items,

Cardinal principle means that the number allocated to the final counted object in a collection indicates the number of items in that collection,

The abstraction principle means that counting can be applied to any collection of objects,

The order-irrelevance refers to the fact that the order of the objects in counting is irrelevant.

Among those, the stable-one, one-one and cardinal principles significantly shape the development of children's counting skills (Gelman & Gallistel, 1986). Nye, Fluck, and Buckley (2001) stated that these principles describe both the procedural skills required for counting and the conceptual knowledge regarding counting. İn this vein, it is of utmost significance to evaluate each of these counting skills one by one in terms of the first-grade students' readiness to count.

Upon analyzing the related studies conducted in the field, Magnuson, et al., (2004) discussed the effect of participation in childcare and early education on children's school readiness as measured by early reading and math skills in kindergarten and first grade. Unutkan (2007) sought the primary school readiness levels of children with and without any pre-school education, based on their mathematical skills, in terms of their age, gender, and socio-economic levels. Yangin (2009) evaluated the students' school

readiness through the "Metropolitan Maturity Test" with sound awareness. Stephens, et al., (2017) examined the primary school students' readiness towards early algebra to represent and generalize operations. One of the common conclusions of these studies is that the first-grade students' readiness for primary school differs from one student to another and that some students lag far behind other students.

Promoting the readiness of students whose readiness level is low for various reasons, especially in the first grade, will also be effective in making the further grade learning processes meaningful. Eliminating readiness at the first grade and earlier level may be more constructive in order not to have too much learning loss. The action research studies conducted in general terms have been mostly conducted on improving reading and writing skills (Akyol & Kayabasi, 2018; Akyol & Sever, 2018; Akyol & Kodan. 2016; Turkmenoglu & Bastug, 2017; Sidekli, 2010). No study was found within the scope of mathematics lessons in the primary school period except for the action research conducted by Koc and Korkmaz (2019) to teach addition and subtraction operations to an illiterate third-grade primary school student with dyscalculia. İn particular, it is necessary to pay attention to the deficient work done in the first class before coming to the bigger classes in order not to experience too much learning loss in the future. There is no such study specifically published on overcoming the deficiencies of the first-grade student regarding math. To overcome these deficiencies, this study used readiness skills such as rhythmic counting, meaningful counting, conservation of number, minority-multiplicity comparisons, one-to-one correspondence (Baykul, 2016); counting principles (Gelman & Gallistel, 1986), classification, sorting, grouping (Olkun & Toluk-Ucar, 2007), addition and subtraction together with natural numbers. Following the order of tangible materials, pictures, representations, and symbols (May, 2001), this research is critical in terms of directing teachers who are practitioners as well as academics who work in the area. Having an action research model, the study is grounded on such a question: "How can the deficiencies of the first-grade primary school pupil with low readiness level be overcome compared to his/her peers?".

Method

This section covers information regarding the study design, participant information, the environment and atmosphere where the study was conducted, data collection tools, the stages of the study, the process of identifying the readiness level, the preparation, and implementation of the action plan.

Study Design

This study is an applied action research conducted to overcome the deficiencies of the first-grade primary school student with low readiness level within the scope of mathematics course and to provide solutions. Action research refers to studies involving data collection and analysis processes in which a practitioner or a practitioner and researcher carry out the study together, the emerging problems are revealed or a

solution is sought to an existing problem. Action research is divided into two as applied and participatory action research. Applied action includes studies aiming at the development of both students and their performance in teachers' classroom environments (Creswell, 2017; Yildirim & Simsek, 2016).

Validity and Reliability

The terms credibility, transferability, dependability, and confirmability are used to ensure the validity and reliability of qualitative research (Creswell, 2016, cited in Lincoln and Guba). İn qualitative research, interviews and discussions with colleagues can be used to ensure the reliability of the study (Creswell, 2016; Merriam, 2018). A "Validity and Reliability Committee" was established to make an expert evaluation within the framework of this study.

Two field experts' views were sought about all processes of data collection, data analysis, preparation, and implementation of the action plan. Besides, various data collection methods were used for the validity and reliability of the study. This technique, called triangulation, employs multiple data collection sources and the participation of more than one researcher (Creswell, 2016; Merriam, 2018; Yildirim & Simsek, 2016). This study deployed different data collection tools such as readiness tests, mathematical activities, observation forms, and interviews.

Participant

The study was conducted with a student who had a low readiness level and difficulties in mathematics, and who was in the first grade of a public primary school in Ankara Haymana district. Prior to initiating the implementation, Demir and his family were met and their permission was obtained for his participation in the educational practices prepared within the framework of a special plan. Permission was obtained from the participant and his family in order to turn this process into research and publish it as an article. The family and the participant signed the consent and were informed in detail that some activity processes would be shared in the study. The student was selected by purposive sampling method, and he was designated as "Demir" by holding his name back in correspondence to ethical rules. Only Demir was included within the scope of the study since he was behind his peers in terms of all readiness skills according to the results of the readiness test administered to the whole class. Moreover, teachers' observations showed that Demir had no mathematical skills except for counting up to 10 in the class.

Demir's father was a laborer and his mother was a housewife. He was the eldest of three children. His family stated that Demir had difficulties in communicating with others except for his mother before he started school, that he did not receive pre-school education, and that he did not work hard at home for school preparation. Demir's family also indicated that he was reluctant to come to school, he had difficulty in communicating with his friends and in complying with the rules required

by the social environment in the first months of school. They also clarified that he made friends in the months to come, he came to school willingly, he adapted to social environments as a behavior, he was willing to learn, and he enjoyed the reading and writing process. The student terminated the literacy process behind his friends.

The primary school teacher mentioned that the student was cognitively behind his peers in the mathematics lesson. İn addition, his family and the teacher confirmed that the participant started to read and write at the beginning of the second semester of the academic year, and thus he had no mental retardation. Following the consolidation of the literacy process, Demir began to learn mathematics after his deficiencies were detected with this additional study in the last months of the second semester during the 2018-2019 academic year.

To determine the student's deficiencies in the mathematics lesson, he was observed during the lesson, an interview was performed with the student's parent, his notebooks were examined, and lastly, the readiness test developed by Paydar, Dogan, and Sahin (2019) was administered. The results revealed that the participant did not have any of the readiness skills such as rhythmic counting, one-to-one correspondence, meaningful counting, conservation of numbers, and minority-multiplicity comparisons (Baykul, 2016; Olkun & Toluk-Ucar, 2007). Therefore, Demir could not gain the learning outcomes of the mathematics course at the level predicted by the curriculum, and hence having difficulty in learning.

Working Environment and Atmosphere

All the activities were carried out in an empty classroom of the school. Since one of the researchers was Demir's teacher, an empty classroom was preferred so that they could always use it in the same school. Demir's teacher had a bachelor's and master's degree in the field of primary school teaching and was continuing a doctorate education in the related field. The other researcher was a faculty member who continued doctorate in mathematics education in primary school teaching. The status of the class was described according to the researcher's observations in the classroom and the achievement levels of the learning outcomes in the mathematics curriculum. There was no illiterate student in Demir's class. The majority of the students achieved the learning objectives required by the mathematics course. Others had the required readiness level for the mathematics course.

They could do almost all of the activities within the scope of the mathematics teaching course and achieved the learning outcomes within the mathematics course curriculum. The researchers' observations suggested that students in this class were interested in school and learning, notably mathematics. The students had generally low and middle socioeconomic levels. Students differed across their academic achievements. They were evaluated and raised by taking individual differences into account. Teachers' and parents' observations were noted regularly for each student. The teacher routinely met parents to improve student status, to evaluate the functionality of the activities, to plan

the next stage, and to ensure the continuity of similar reinforcing activities and games that help teach the lesson at home. Communication with parents made a major contribution to learning. The communication process established with Demir's mother contributed greatly to his development. The parent's interest and support made the process more effective and easier.

Data Collection Tools

Readiness identification test: İn order to determine which skills such as rhythmic counting, meaningful counting, one-to-one correspondence, minority-multiplicity comparisons, and conservation of numbers, which are the required skills for the readiness level related to natural numbers in mathematics teaching Demir had, this study employed the readiness test used by Paydar, Dogan and Sahin (2019) in their studies. The test was used to diagnose problems before implementation and to test the functionality of the application after implementation. Since the test was prepared for the first-grade students who were just learning the literacy process, the questions were asked by the teacher and responded by the student.

Mathematics activities: Activities to be used in the student's learning process and those performed through using representations in the process. The written activities were taken from the math activities book prepared by Toptas and Karaca (2019). The activities suitable for the level were selected after asking the opinions of a field expert lecturer and primary school teacher. The following criteria were adopted to determine the eligibility of the activities:

1. Having visual content suitable for the student's age range.

2. Objects that were familiar in daily life and that were frequently used in the class were selected in the activities performed with tangible objects for all skills.

3. Attention was paid to ensure that the paper activities included the relevant skill.

Observation form: The parent and the teacher filled out the form independently of each other to get to know the student better and to determine the difficulties of the student. İn this regard, a semi-structured observation form was used. The form secures more systematic data collection. Participant observation type was used while making the observations (Buyukozturk, 2011). The researchers sensed that it would be necessary to have information about the academic and social development of the student in the pre-school and school period in order to determine the underlying reasons behind the deficiencies in math, and thus the observation form consisted of these dimensions. Another dimension to overcome the student's deficiencies was to examine the independent observations of both the parent and the teacher. The form got its final version by adding some dimensions in line with expert opinions. The observation form filled by the parent included the student's social and academic development before starting school and throughout the school process. The form illuminated that the student did not communicate with anyone except for his mother during the pre-school period

even though he grew up in a large family. Besides, the student did not develop a line of friendship during this period. İn the school period, however, he was found to have difficulty in communicating at the beginning, he could not manage friendships, and that the process was relieved later on. İt was also highlighted that he did not receive academic support from family or any institution in the pre-school period.

The observation form filled up by the teacher involved the student's social and academic development from the first day of school. The student was unwilling to come to school when he came to school for the first time. He always wanted to be with his mother. He had some difficulties in communicating with his friends in the classroom environment and in obeying the classroom rules for a while. He mentioned his unwillingness to come to school during the first semester; instead, he wanted to spend time with his mother at home. İn the academic sense, some statements implied that the student with a low readiness level had no counting skills. The researchers prepared the form.

İnterview: Negotiations were made with Demir and Demir's mother from time to time. The unstructured interviews were preferred in the present study. An Unstructured interview provides freedom and aims to obtain rich and sufficient information with open-ended questions (Buyukozturk, 2011). The purpose of the interview is to design an action plan for the student's development before the research. The objective of the interviews that continued from time to time was to obtain information regarding Demir's development process. Conversations were treated about Demir's academic and social development. Here are some examples of these conversations: "Demir, how do you think it feels to come to school?" Demir responded, "Actually, the school seems to be getting better now. Ercan and Faruk start to play with me. We start to hold a match. We also share our food. İ will teach my brother what İ have learned." He was asked, "What kind of lesson do you think math is?". He said, "Actually it is fun. There was a question with an elephant in the lesson yesterday. İ got a star for that question too. İ counted my toys yesterday at home. Will you study with me again in Ahmet teacher's class after school?". The conversations showed how the student went through this process. Likewise, those with the parent suggested the positive aspects of the student's development.

Data Analysis

Data analysis proceeded concurrently with data collection. The descriptive analysis method was used during data analysis. The interviews and observations that would be used to design the action plan were initially analyzed and the action plan was prepared within this framework. İnterviews with the parent and student lasted throughout the process. These conversations were chatty. Essential information about the student's development was noted after the interviews. Particularly, the interviews held before the action research contributed to the development of the action plan. The evaluation of the interview notes confirmed that the student did not have any other skill apart from counting up to 10. The independent observation forms filled by the parent and teacher provided detailed information about the student's status and contributed to the creation of the action plan. The observation form, which was analyzed through the use of the

descriptive analysis method, was evaluated in terms of the student's academic, social, pre-school, and school development. The student was evaluated based on these dimensions, and it was concluded that his current situation was suitable for learning mathematics, considering the progress he made in coming to school and the learning process. The proficiency level in mathematics was evaluated and the action plan was shaped in terms of the student's academic development.

The portrayal of the data boosts us to make some interpretations, evaluations, and conclusions. Descriptive analysis includes summarizing and interpreting the obtained data according to predetermined themes. The qualitative data acquired for descriptive analysis is organized into a framework, and the themes under which it will be presented are determined. Data are presented under these themes (Yildirim & Simsek, 2016). The findings were analyzed under the themes of rhythmic counting, meaningful counting, one-to-one correspondence, minority-multiplicity comparisons, and conservation of number, which are the required skills for preparation for natural numbers, as asserted by Baykul (2016), in line with showing with symbols and addition-subtraction operations added by the researchers. İn addition to these 5 themes, 2 more themes were added to the data analyzed by the field experts, namely, showing with symbols and addition-subtraction activities. Necessary arrangements were made by discussing the issue of agreement and disagreement.

A total score was obtained by giving 1 point for each correct answer and 0 for the wrong one in the analysis of the readiness test. Each item of the test included one of the natural numbers readiness skills. The student's responses to the prestudy test contributed to the formation of the action plan. The results of the test administered at the end of the research revealed the student's proficiency level by identifying which of the readiness skills the student responded to and which he did not.

Stages of the Study

This section includes some actions carried out to identify Demir's readiness level.

A- İdentification of readiness level

İn an attempt to identify Demir's readiness level, he was first asked to count rhythmically to measure the skills of rhythmic counting, meaningful counting, one-to-one correspondence, minority-multiplicity comparisons, and conservation of numbers.

Rhythmic Counting: The student was determined to count from 1 to 10 and make jumps while counting from 10 to 20. Demir could not count more than 20.

Meaningful counting: A group of items was given to the student and he was asked to count these objects one by one. The student could not comprehend that each object corresponded to a number symbol while counting the items. He was observed to put more than one object while saying a number at first. After the teacher's warning that he

put an object for each number, the student could count the objects up to 10 one by one, yet the student failed as he could not rhythmically count more than 10 items.

One-to-One Correspondence: İn one-to-one correspondence, the student was asked to match the beans of two different colors and express their amounts. The student was unable to complete this stage successfully. He could not comprehend that each object corresponded to per object.

Minority-Multiplicity comparisons: The student was asked to identify the groups with fewer and more than two objects. At this stage, the student failed to determine which group had more or fewer objects. The student could not determine which group had the most, either by matching the objects one-to-one or by counting the number of objects in both groups.

Conservation of number: The student was given the same number of objects in two groups, in bulk and scattered, and he was asked which group had the greater number. The student said that the scattered object group had more.

Expression of numbers with symbols: The student was asked to count a group of objects fewer than 10 and to write the symbol of the number corresponding to the number of objects he counted in his notebook. Although the student counted the objects correctly, he could not write the equivalent of the amount as a symbol. All numbers were told to the student verbally and he was asked to write down the numbers. Still, the student could not write the numbers that were said. Based on the observations made during the lesson, the student copied the figures to a large extent by looking at them. Some errors occurred in the writing of the numbers. The student also failed when asked to set aside as many object groups as the written numbers represent. Even if he could set aside a group of objects up to 10 when verbally expressed in numbers, he was unable to separate the amount expressed in numbers in written form. The student could not match the quantities expressed by the objects with the number symbols.

The situation of increasing and decreasing the number: Demir was able to express that the objects increased over time when additions were made to the given object. Having realized a decrease with the decrease of the objects, Demir could not make sense of this in terms of quantity. İt may be wise to mention that Demir's knowledge about increasing and decreasing numbers is visually nothing beyond a lot or a little.

B- Preparation and implementation of the action plan

Demir and his mother were interviewed during the preparation of the action plan. His willingness was interrogated while chatting. Demir stated that he was happy as he learned to read and write, that he played more comfortably with his friends now, and that he wanted to teach his brother what he learned. Meanwhile, Demir was determined to communicate easily with his teacher compared to the beginning of the year, explain the subjects he had difficulty with, and was able to ask his teacher's support. Demir was asked whether he wanted to count numbers, to do math activities as easily as his friends,

and whether he wanted to play games in math class with ease. Demir, on the other hand, concluded that he wanted to learn, to enjoy doing the activities and games in the mathematics lesson, and to teach these activities and games to his brother. Demir's mother emphasized that Demir came to school willingly; moreover, succeeding in the reading and writing process increased Demir's self-confidence, yet the student had many deficiencies in mathematics lessons and had difficulties in this regard.

Preliminary studies, observations, and interviews were conducted to determine Demir's readiness level for the mathematics lesson. The reason why Demir had difficulty in learning mathematics was that he did not receive any education before starting school and had no knowledge of mathematics except for being able to count to 10. Demir could not learn the skills of rhythmic counting, meaningful counting, one-to-one correspondence, minority-multiplicity comparisons, and conservation of numbers, which are the readiness skills for mathematics, and other skills within the scope of the mathematics lesson together with his peers. The acquisition of these skills was emphasized in the first period since he was behind his peers in terms of adaptation to school, literacy, and social development.

Afterward, the national and international literature was examined on this subject, and the most appropriate approach for the student was adopted by taking a field expert's opinions. Grouping classification and sequencing skills are significant elements in teaching natural numbers. The student was provided with the development of grouping, sorting, and classification skills, which is essential for teaching numbers, in number teaching; furthermore, the skills of rhythmic counting, meaningful counting, one-to-one correspondence, conservation of numbers, minority-multiplicity comparisons, which are needed for readiness for natural numbers, were taught and the teaching process ended with activities that required simple addition and subtraction in natural numbers.

The study took place in the second semester of the 2018-2019 academic year. The acquisitions, tangible activities, and paper activities were determined and daily plans were prepared. Toptas and Karaca's (2019) math activities book was used as paper activities. Thus, the teaching process was planned and implemented as 25 lesson hours. This process took place in the classroom where the participant was studying and on the predetermined days and times. Necessary precautions were taken against the stimuli that would distract the student (noise, removal of material from which the student would cheat, etc.). Table 1 depicts the action plan implemented in the process:

Table 1.

Applied Action Plan

Lesson	Activity	Time
1st lesson	Activities related to rhythmic counting by 10s and 5s were performed.	25 min.
2nd lesson	Activities related to rhythmic counting by 10s and 5s were performed with rhythm accompaniment.	25 min.
3rd lesson	Rhythmic counting from 1 to 50 was done accompanied by rhythms.	25 min.

4th lesson	Meaningful rhythmic counting was performed with 1, 5, and 10 real items up to 100.	25 min.
5th lesson	Meaningful counting backward from 20 was performed with real items.	25 min.
6th lesson	Activities were done on the principle of separating the specified entity amount and order independence.	25 min.
7th lesson	The activity was conducted to find the number of a given set of objects	25 min.
8th lesson	One-to-one correspondence activities were carried out with tangible objects.	25 min.
9th lesson	A comparison of minority and multiplicity tangible objects was made.	25 min.
10th lesson	A comparison of minority and multiplicity was made based on intuition.	25 min.
11th lesson	Conservation of number activity was performed according to scattered and aggregated objects information.	25 min.
12th lesson	Conservation of number activity was performed according to scattered and aggregated object information.	25 min.
13th lesson	The student was taught to write the symbols corresponding to the numbers (0-9) (by counting objects).	25 min.
14th lesson	The meaning of zero, decimal, and one were taught as a unit.	25 min.
15th lesson	Exercises about decimals and units in numbers up to 20 were done.	25 min.
16th lesson	The student was taught to write number symbols. (Spoken verbally from 1 to 20)	25 min.
17th lesson	Minority-multiplicity comparisons, one-to-one correspondence, and conservation of number principles were revised.	25 min.
18th lesson	Activities were performed for reading the numbers given with the symbols between 0-20 and writing the numbers spoken verbally with symbols without any clue.	25 min.
19th lesson	İncreasing and decreasing operations were performed with a group of tangible objects and examples from daily life (İ bought it from the market, gave it to a friend, etc.). The formation of the increase and decrease process was taught.	25 min.
20th lesson	Addition activities were carried out with representations. The meaning of the "+" symbol was taught.	25 min.
21st lesson	Activities were done related to number symbols addition up to 20.	25 min.
22nd lesson	Subtraction activities were carried out with representations. The meaning of the "-" symbol was practiced.	25 min.
23rd lesson	Number symbols addition activities up to 20 were held.	25 min.
24th lesson	Both addition and subtraction operations were performed with number symbols in writing.	25 min.
25th lesson	All learned information was revised.	25 min.

Table 1 displays the activities and the duration of the activity in the action research process. The implementation lasted 25 lesson hours in total. Each lesson was planned and retained for 25 minutes.

In order to carry out this study, the ethics committee permission was granted by the Social and Human Sciences Ethics Committee of Kahramanmaraş Sütçü İmam University with the decision dated 22.04.2020 and numbered 2020-11.

Findings

The results of the readiness test, the observations, and the interviews suggested that the student did not possess any skills except for counting from 1 to 10 within the scope of the mathematics course. İn this line, the activities related to rhythmic counting, meaningful counting, representation with symbols, one-to-one correspondence, minority-multiplicity comparisons, conservation of number, addition-subtraction were implemented and the findings were depicted under these themes. Besides, the results of the readiness test were depicted as findings.

1. The stage of rhythmic counting: At first, a verbal counting activity up to 10 was performed with the student. Afterward, an activity regarding rhythmic counting by 10s was done. The activity was reinforced by making use of counting 10s song while making rhythmic counting by 10s. Then, counting activities by 5s up to 100 were carried out. Verbal counting activities were conducted by keeping the rhythm up to 20, 30, 40, 50, 60, 70, 80, 90, and 100, 1 by 1 respectively (rhythm was kept by clapping hands and hitting the table). The student said the numbers by skipping and in mixed order (11,13,18…etc.). Counting activities were practiced by starting from any number in order for the student to reinforce what he learned. All these activities were consolidated with the use of symbols. Activities related to rhythmic counting were performed on paper.

2. The stage of meaningful counting: Counting activities were carried out with desks, boards, pencils, sugar cubes at school. By making counting with different object groups, the student was taught that all entity groups could be counted (principle of abstraction). T: "Can we count the tables?". D: "İ guess so" T: "Can we count the small balloons on the board? D: "Yes, teacher" T: "But can we count everything?". D: "Ummmm (thinks about 1 minute). Yes, teacher." The student was introduced that the number increases when every object from 1 to 20 is added. The student was taught that each number word corresponds to an object (the one-to-one correspondence principle). T: "One, two, three…etc. When we put each bean in, we say the numbers in order." D: "Yes, teacher, because we are adding new beans." The student was taught that the order of numbers was stable while counting with objects (stable-one principle). Counting is done by counting different objects, emphasizing that the numbers were stable while counting each object. Later on, the student was trained to count backward by decreasing 20 objects by 1. While taking the bulk beans one by one, the student was posed a question. T: "What's going on with the beans, Demir?" D: "Teacher, we take the beans in hand, there are fewer beans on the table." The student learned that the number decreases in countdowns. At this stage, the student understood that the last counted object represented the total number of objects (the principle of cardinal number) after he was taught that each object corresponds to a number. T: "How many beans are on the table?". D: "12". T: "How did you know?". D: "İ counted them". T: "What did you say last time?". D: "12". T: "Then the last number said …". D: "İt shows us how many beans are there". The acquisition of rhythmic counting by 10s was reinforced at this stage with counting activities by grouping the sugar cubes by 10s. Thenceafter, meaningful counting activities from 1 to 30, 1 to 40, 1 to 50, 1 to 60, 1 to 70, 1 to 80, 1 to 90, 1

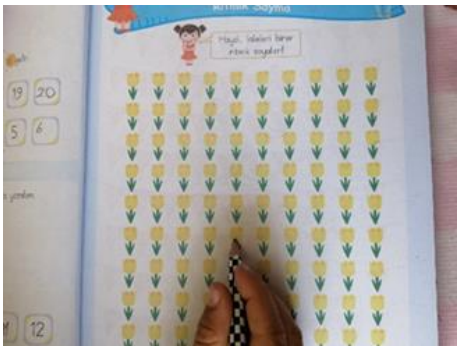
to 100, respectively, were made step by step. Plastic beans (representations) were used at this stage of meaningful counting activities. Since the student learned to count by 10s, he smoothly understood counting up to 100. The student was asked to count a group of objects in different colors and to say how many objects there are. He was able to predict the total number. When the student was asked how many objects there would be while the counting process started with an object of a different color, he could not express that the total would not change. T: "Demir, how many beans are there on the table?". D: "12" T: "Alright, if you started counting from orange-colored beans, how many beans would there be?". D: "Ummmmmm, İ don't know." The student was requested to say what the number of objects was, starting with a different color each time until he used all the colors. He realized that the number of objects in the group would not change no matter the object one started with (principle of order-irrelevance). Tangible activities were strengthened with exercises on paper.

Figure 1.

Meaningful Counting Activity with Tangible Objects

Figure 2.

Meaningful Counting Activity with Objects.



3. Representation with symbols: At this stage, the student was taught the mathematical symbol corresponding to each object. The student was instructed to write the numbers from 1 to 9. The shape of the symbol was initially displayed by counting a group of objects in order. Thence, he was asked to write them following the spelling rules. Then, the student revised the number of counted objects and symbol matching using visuals (pictures). The student was enlightened about the meaning of zero with the help of various case studies from daily life. T: "How many apples are on the table?". D: "Not at all, teacher." T: "How many animals do we have in our class?". D: "There is none." T: "There is a symbol showing nonexistence". These examples enable us to teach the meaning of the non-existence of zero with the countdowns practiced before, its correct production as a symbol was taught. The difference between the number zero (0) and the letter "o" and the production method was emphasized so that the student did not expose to ambiguity. After that, the formation of the number 10 was taught to the student through activities and the instruction of two-digit numbers was realized. Two pots were placed. The student was requested to put 9 sugar cubes in one of them. When asked to

add 1 more, the student could count 10 sugar cubes. When there were 10 sugar cubes, they were transferred to the other pot. This activity lightened the student about the idea of how the second digit of a two-digit number was formed. The student grasped the formation of a single unit by sticking 10 sugar cubes. İn favor of this activity, the formation of decimals and units in numbers was tangibly taught to the student. Numbers up to 20 were expressed in representations (base ten blocks). Then, the writing of numbers up to 20 was presented. The numbers whose spelling was learned up to 20 were expressed with symbols and divided into decimals and units. (The instruction of zero, decimal, and unity concepts were all taught after one-to-one correspondence, minority-multiplicity comparisons, and conservation of number principles.)

Figure 3.

Displaying Numbers with Symbols.

Figure 4.

Matching Object Quantity and Symbol.

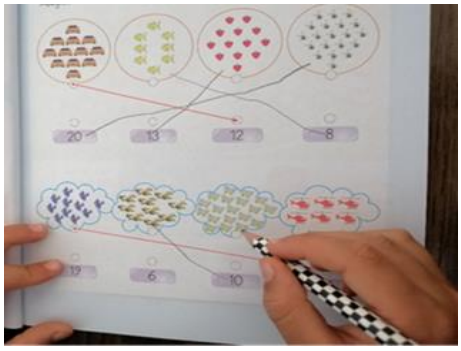


Figure 5.

Writing Abstract Symbols by Heart.

Figure 6.

Development of the Concept of Decimals.

4. One-to-one correspondence: At this stage, the student was asked how to find out which of the objects was less and which was more. The student gave wrong answers by

making wrong guesses. D: “Because it looks more.” The student was asked to match the given pencils and erasers with each other. The teacher and the student discussed how this situation emerged using a large number of unpaired pens and erasers and the small number of pens and erasers. Because it will be the basis for the student to gain the concepts of less, more, and equality in the comparison of numbers. The correspondence activity was performed repetitively by increasing or decreasing the number of pencils and erasers, and that the student was taught which object group was larger and which group was less.

Figure 7.

One-To-One Correspondence Activity with Tangible Objects.

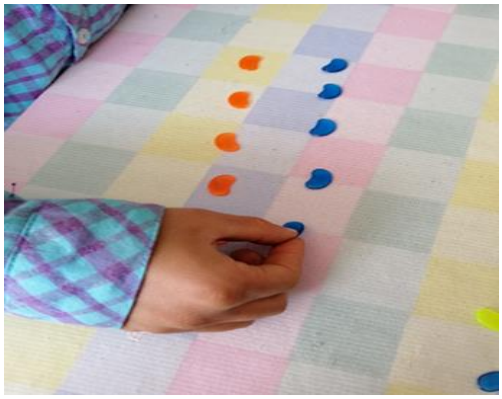
Figure 8.

One-To-One Correspondence Activity with Representations.

5. Minority-multiplicity comparisons: Minority-multiplicity comparisons can be divided into two stages: intuitive comparison, which is the stage before one-to-one correspondence, and one-to-one comparisons (Baykul, 2016). Prior to the concept of conservation of numbers, two stacks of pencils with different numbers were placed on the table and the student was asked to guess which one was more. The student could readily make this prediction. Then, he was asked to guess which one was more by giving a close number of pencil stacks. The student had difficulty estimating at this stage. D: “Teacher, İ think they are the same.” The student was asked how to get an answer to this question, and no answer was received. The students were reminded of the one-to-one correspondence activities. Then, some activities were carried out to have the student understand one-to-one correspondence or counting less, more, or equal number of objects. At this stage, when the student was asked which of the collection of two objects was more, he made an intuitive prediction and could not count or correspond one-to-one. When the teacher gave small hints, (T: "We matched each pencil with an eraser. There were some leftovers..." D: "İt was more because there were pencils that could not be siblings with an eraser."), the student achieved the correct results by counting and one-to-one correspondence. Tangible activities were reinforced with those on paper.

Figure 9.

The Activity of İdentifying the Group with Less and More.



6. *Conservation of number*: The student was given two groups of beans with different colors in equal numbers. A group of these beans was given collectively and another group dispersedly. The student was asked which group of objects had more. The student stated that the object group that was given dispersedly without counting and one-to-one correspondence of the object groups was more. D: "As if there were more of these. They occupy more space." The student was asked to correspond the bean groups one-to-one. After the teacher's warnings, the student matched the beans one to one and stated that they were equal. Then, the student counted the objects in both groups. Demir replied that "Both beans are 12, so they are both equal". The student was informed that he could match or count one-to-one in order to make him understand which of the object groups was more, less, or equal. However, the student insisted that more objects were scattered when the teacher did not remind the activities carried out during the evaluation phase. Tangible activities were stiffened by revising them on paper.

Figure 10.

The Activity of Understanding the Conservation of Numbers with Representations.

7. Addition and subtraction activities: The student learned the concept that the number increases when counting forward and decreases when counting backward during this process. The student was asked to identify the number of objects. The student counted the objects and said the total number. Later, when the student was asked to add 2 more objects, he added starting from the amount in the total object group instead of adding on it. (For instance; the student counted 5 pencils and said there were 5 pencils, yet he continued to add on 5 since the last number was 5, and he concluded that the result was 6 instead of saying 7 when he added 2 more pencils). The student was encouraged to count the objects without any intervention. The student, who did not face any problems at this phase, was reminded of the concept that each object corresponded to a number and had two numbers added to each other at every turn. The student was finally able to add the numbers. After this process was consolidated with the objects, two groups of object pictures were presented and he was asked to add them to each other. The student counted the number of objects, wrote the counts under them, and added them up. Afterward, the "+" symbol was practiced with the student. The concept of the symbol was presented to the learner, and he was taught that this symbol raises the number in counting and necessitates more counting. At first, the additional activities were conducted with object pictures, and then with the symbols without the object pictures. The operations were carried out successfully by counting first between the numbers 0-9 and then between the first 20 numbers. Later, the concept that the number is reduced in counting down processes was learned by the student. When asked to separate the desired amount from a group of objects, the student first separated the object and counted the remaining one by one. The student was asked a question "How can we do this easily?", and the student repeated the same method. Afterward, activities for counting the objects as a whole (that is, without making two groups) were carried out. Besides, a countdown activity was performed as much as the desired object group. The student was taught that the last-mentioned amount expressed the number of objects in the group by reminding the cardinal principle of number. İn this way, the student was able to separate the desired amount from a group of objects and said the result. Then, the teacher asked the student to reduce as much as the other picture from a group of objects with pictures. He was able to achieve the correct result. The student was taught that "-" means subtracting and counting down. The number of objects was determined and subtraction was performed on the activity sheet, which did not contain pictures but only symbols. Afterward, operations with no objects but symbols were carried out. The subtraction was performed in the range of 0-10 numbers and then in the range of 0-20 countdowns. While the student was able to add and subtract one-digit numbers with one-digit numbers, as well as two-digit and one-digit numbers, he struggled to add and subtract two-digit numbers with two-digits numbers. This may be because the student performed operations using his fingers. All these tangible stage activities were reinforced with activities using the symbols of numbers.

Figure 11.

Addition Activity Through Pictures.

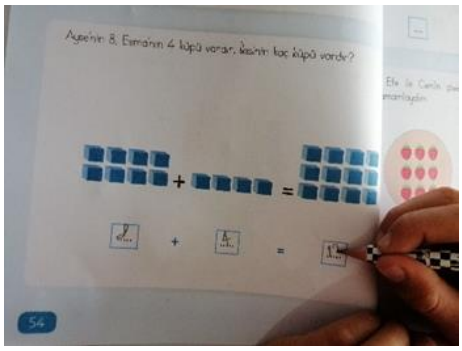


Figure 12.

Counting Activity Through Pictures.

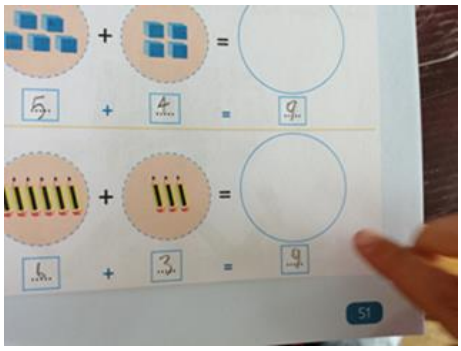


Figure 13.

Reduction Activity Through Pictures.

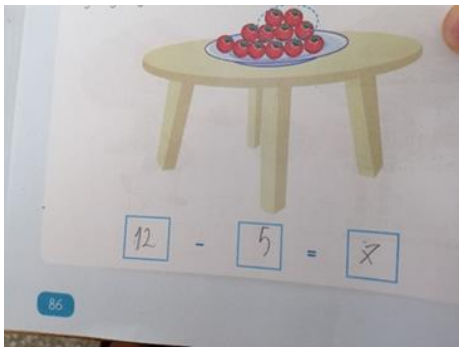
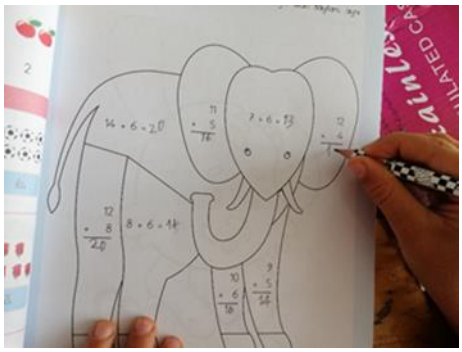


Figure 14.

Operations with Symbols.



Results of the Readiness Test Performed After the İmplementation: This test was prepared for the first-grade students who were still at the literacy stage. The questions of the test were suitable for the teacher to ask the student and note the answer. The results of Demir, who could not respond to any of the pre-application questions of the readiness test, are as follows: The first question of the test, "To what number can the student count by 1?" He was able to count up to 100 in order. The second question, "Can the student count up to 100 by 5s?" The student was able to count by 5s at a time. The third question of the test, "Can the student count up to 100 by 10s?" He was able to answer the question. The fifth question of the test, "Did the student know that 7 scattered and collective objects were equal?". He did not exactly answer the question. He could guess the correct answer with the teacher's hint. The sixth question was related to the pictures of animals and fruits, and the student was asked which one was more. The student answered correctly by saying that the number of animals was more. İn the seventh question of the test, the student was asked to correspond the number of objects with the number symbols. The student counted each of the objects and correctly matched them with the numbers. İn

the eighth question of the test, the pictures of 10 mice and 7 cheese were given. The question was that "A mouse will eat each slice of cheese. Accordingly, how many mice went hungry?". The student paired the mice with the cheese without thinking and answered that 3 rats would go hungry. İn the ninth question of the test, 10 numbers were given up to 100. He was asked which number comes in the blank space. The student was able to write the correct answer. The 10th question included 2 groups of mice. There were 10 mice in group 1 and 6 in group 2. "How many mice should be drawn in group 2 so that the number of mice can be equal?". The student responded "6". İn the 11th question, 6 soccer balls were given disorganizedly and 6 stars were given in a body. (Stars and balls are equal in size) He was asked which one had more. The student could not reach the desired skill in the conservation of numbers by answering "balls are more". İn question 12, a red bar that did not consist of units was placed on a blue rectangle consisting of 12 unit squares. He was asked, "The red bar is how many blue boxes long?". Counting the boxes, he found that the length of the red bar was "10 units".

Discussion, Result, and Recommendations

This study was conducted with the first-grade primary school student who was behind his peers academically and socially. Demir, who had a low level of social and academic readiness, did not possess any skills in the mathematics course except for counting up to 10. At the end of the 25-hour study, he was observed to gain the skills such as rhythmic counting, meaningful counting, one-to-one correspondence, minority-multiplicity comparisons, which are the necessary skills for mathematics readiness, and adding and subtracting numbers up to 20 as well as expressing numbers up to 20 with symbols; whereas, he gave incorrect answers regarding the conservation of number without taking any hint.

Under the strength of the observations made during and before the study, as well as the readiness test applications, it is thought that the level of readiness must be one of the most significant aspects determining the student's learning. One of the most crucial reasons why Demir was behind his peers was determined as his low readiness. Kocyigit (2009) grouped readiness under five categories within the framework of teachers' and parents' views. These are; physical skills and general health status, social-emotional skills, mental skills, self-care skills, and biological age. İn their study, Sahin and Guzel (2018) compared the average scores of the older and younger age group students in terms of numbers compared to the 69 months age group, and they found a significant difference in favor of the older age group with high readiness. Avci (2015) concluded that those receiving pre-school education had higher mathematics skill scores. Having analyzed the first-grade primary school students' knowledge about numbers, Olkun, Yesilpinar, and Kisla (2014) noted that knowledge and skills with counting develop depending on age and pre-school education status. Keeping all these results in reserve, the biggest reason for Demir's readiness to fall behind all his peers' was that he was not in an educational process through family or school during the pre-school period.

Demir did not receive pre-school education from family or school in the cognitive and social sense of being ready for school before starting school. Various results outlined that students who did not receive preschool education compared to their peers experienced more cognitive, social, and emotional difficulties (Uzun & Alat, 2014). According to Alptekin (2015), math teaching is a lesson in which previous information is a prerequisite for the next during the learning process, which ranges from easy to challenging. Therefore, being disciplined and systematic are remarkable for ensuring permanence. İt is argued that the acquisitions of the previous class should be achieved in order to move on to the next education level (Olkun & Toluk- Ucar, 2007; Van de Walle, Karp, & Bay-Williams, 2012). This process was treated from concrete to abstract, firstly rhythmic counting, then meaningful counting, one-to-one correspondence, conservation of number, and minority-multiplicity comparisons were made and the learning objective of the previous principle was used. The instruction included the order of objects, pictures, representations, and abstract symbols.

The level of readiness and the cumulative progress of mathematics are considered key steps for further learning. Grouping, classification, and sequencing skills, a basis for learning numbers in mathematics lessons along with math readiness skills such as rhythmic counting, meaningful counting, one-to-one correspondence, minority-multiplicity comparisons and conservation of number and one-to-one counting, stable-one order, cardinal principle, abstraction, and order-irrelevance principles known as counting principles are significant for readiness and teaching more complex skills in mathematics lesson (Olkun & Toluk-Ucar, 2007; Baykul, 2016; Gelman & Gallistel, 1986). İn order for the student to be ready for the concept of numbers, rhythmic counting, meaningful counting, one-to-one correspondence, minority-multiplicity comparisons, and conservation of number skills should be considered both among each other and as a whole with the counting principles for natural numbers readiness, and teaching them in an integrated way may contribute more to the learning process. Alptekin (2015) emphasized that great importance should be attached to counting skills in order to ensure number acquisition. Just as in this study, the student can achieve some of the readiness stages or he or she may have difficulties in others. Olkun, Celik, and Sonmez (2017) implied that students had difficulty in meaningful counting even though they knew the counting skill by rote and that some of the children had difficulty in acquiring the cardinal principle of counting even though they gained the order-irrelevance principle of counting, which is parallel to the results of this study.

Referencing the classification, sorting, and comparison stages, the significant skills for numbers, and one-to-one correspondence in this study, İnan and Erkus (2019) put forward that the concept of one-to-one correspondence for 3 years old and over greatly improved, 5- 6-year-old group improved 100% in terms of one-to-one correspondence skills, the classification skill used in the study develops from the age of 4, the concept of comparison develops to a large extent from the age of 3, the concept of sorting develops with the age of 5-6. These results show the acquisition of these concepts in pre-school and the significance of the education received in the pre-school period in terms of readiness for numbers. As is seen in the plan prepared for Demir in our study, it may be

wise to mention that teaching mathematics courses as a whole in a complementary way will make a major contribution to the child's holistic mathematics development in the following processes.

During the counting procedure, numerous things were counted in order to keep Demir alert during the instructional process. Demir was observed to show more interest in the process and learned by having fun with the addition of songs to the enriched activities. İn particular, the teaching process was carried out in an empty classroom, which prevented the student's distraction. Likewise, Koc and Korkmaz (2019) taught mathematics to an illiterate third-grade student with dyscalculia and concluded that students with dyscalculia caught up with normal students thanks to sufficient time, individual instruction, and enriched instruction. The student was given feedback while producing each number, especially at the point of the production of symbols, and he was provided to rewrite the number. This contributed to the correction of the student's erroneous learning. Similarly, in the action research conducted by Akyol and Ozdemir (2018), correcting the writing disorder by following the student gradually, and the individual practices and interest shown by the teacher contributed greatly to overcome the student's deficiencies.

This study includes some limitations, the biggest of which was to conduct the study with a single student. The instruction was carried out by developing an action plan in line with the needs of the student. The effects of this application carried out with larger groups are shadowy. The study took place in a region with a low socioeconomic status. İt is ambiguous what the effects of the study will be when conducted in a different region and environment.

❖ Readiness level is of utmost importance for students to learn many subjects before starting primary school and during the educational process. Parents who are aware of and accept this circumstance can make the appropriate arrangements. As a result, parents might be made aware of their responsibilities.

❖ The students' readiness should be endorsed in the pre-school period by exposing them to as many stimuli as possible for their mathematical development.

❖ Action research may be conducted to develop students' four operation skills, which are the basis of mathematics, in order to avoid learning loss, especially in larger classes. These studies may be carried out specifically for teaching 4 operations with different methods and techniques.

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