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Comparison of Cognitive Readiness Levels of the 4th Grade Students of Primary Education by Learning Domains

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Abstract

Previous acquisitions of students have a huge impact on students' learning new acquisitions faster and making the same more meaningful in their minds. Today, teachers often express that cognitive readiness levels of students are not at the desired level. This study aims to identify students' cognitive readiness levels and compare these levels by the learning domains. The study design is based on screening model and supported with qualitative data. The research is conducted in a state school located in one of the central districts of Ankara in the academic year 2014-2015. 4th grade students in the school constitute the research sample, and math achievement tests and interview forms constitute the data collection tools. T-test and one-way analysis of variance are conducted on the quantitative data and descriptive analysis is made on the qualitative data. Findings show that students' readiness levels in learning domain of numbers and geometry are higher than their levels in measuring domain.

Keywords: readiness; 4th grade; math education; learning domain; primary school teacher.

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1. Introduction

Today, knowledge is becoming more and more important every passing day and societies focus on educating their individuals at the highest level. This focus also improves ways and methods of knowledge acquisition. In order to adapt to this improvement, skills that individuals are expected to display also vary. New knowledge and skills are being added to the existing ones every passing day. Such knowledge and skills may be called as experiences in the next step. As in every field, experience is also at the forefront in math education.

Math is the science of numbers, figures, space, greatness and relationship between those. Math is also a universal language grounded on symbols and figures [1]. It is a fact that we use math at every moment of our life, probably not being aware of it most of the time. It is known that, in math, topics are somehow connected to each other through unique relationships; and the previous topic has a direct impact on learning the next topic.

1.1. Math education in primary school

Providing students with the chance to improve their competence in math at small ages has an important role in their success in learning in the subsequent periods. Children who are less acquainted with and less exposed to mathematical concepts and numbers will have a high risk of failing in math [2]. Researches emphasize that importance must be attached to math education in early period and show that most of the students fail to meet minimum math competency standards in the end of the ordinary course of education [3]. However, early interventions in math may eliminate deficiencies and prevent the possible deficiencies [2, 4, 5, 6].

It is known that success of students in the 4^{th} and 5^{th} grades have a considerable impact on their success in the 6^{th} and 7^{th} grades, and topics of the 4^{th} and 5^{th} grade and topics of the 6^{th} and 7^{th} grades are prerequisites for each other [7]. Researchers suggest that students' prelearning of math topics influence their comprehension in those topics, and express that math learning in 4^{th} and 5^{th} grades form the foundation for math topics to be learned in the 6^{th} and 7^{th} grades, and students who grasp this foundation better will continue their success in math lessons in the upper grades [1, 8, 9, 10, 11].

Students must be active participants in the learning process. Knowledge, skills and thoughts of students must be used to attribute a meaning to new experiences and situations [1]. Students are expected to associate the new information to the previous ones and interpret the same accordingly. Importance must be attached to students' ability to multiply two natural number and understand where multiplication will be suitable and what this multiplication means. Teachers must teach student math in a way to help them use math in their daily lives and aim to raise students' interest in the subject to be taught and reveal their prior knowledge [1].

Knowledge gained in primary school may contribute to solution of many problems to be encountered in life in the future. Through association of previous knowledge with new information, solution may be achieved in a shorter time. In acquiring new knowledge in the period from the school age to advanced ages, individuals frequently use their previous experiences. Previous acquisitions will light the way for new plannings, constitute a foundation for a task desired to be performed or a subject desired to be learned, and thus facilitate living conditions of the individuals. In cases where there is no previous experience or which are not experienced

before, things get harder or more complicated.

Dede and Argün [12] suggest that education of mathematical concepts lies behind math education. Mathematical concepts stand in a sequential and gradual line; therefore, if a concept is not learned or mislearned, it becomes more difficult to learn a concept to be learned in the next stage. Researches state that, for learning, it is required to present relationships of mathematical concepts with their sub-concepts and super-concepts, and their connection with each other.

1.2. Significance of cognitive readiness in math education

Argün, Arıkan, Bulut and Halıcıoğlu [13:3] express that mathematical concepts constitute one of the fundamental components of math education and, when a fundamental mathematical concept is learned, three points improve. The concept is learned firstly intuitively and them mathematically and, finally, the relationship with the intuitive version and mathematical version of the concept is learned. Briefly, it is emphasized that an individual must firstly improve the above-mentioned three points to claim that the individual has learned, understood or comprehended a concept. However, when cognitive readiness of students is not at a sufficient level, they cannot understand the association between intuitive and mathematical versions of concepts.

To achieve the aforementioned comprehension, curriculum of 4th grade math class in primary schools is divided into learning domains of numbers, geometry and measurement [1]. It is seen that numbers have a larger part in the curriculum when compared to other learning domains. The reason is the expectations create a rich and sound number concept for students and improve their skills in mathematical operations. Students already have counting skills when they come to school. Teachers make use of such prior knowledge of students and help them in developing knowledge of numbers at a more advanced level, doing math operations with numbers and understanding relations between numbers.

Geometry must be taught carefully in primary schools, since it is constructed on abstract concepts and relations [1]. This is because students at these ages can understand concrete and finite objects. Measurement is another learning domain which contains concepts that students frequently encounter in their daily lives. Activities related to measurement help students improve their skills of estimation.

It is highly important in terms of math education that a student who reach to the 4th grade has cognitive readiness in the mentioned learning domains. Acquisitions, which are organized according to grades, are in a closer relationship with each other when compared to other lessons.

In the body of literature, there are many researches analyzing students' readiness levels for different lessons. [14, 15, 16, 17, 18, 19, 20, 21, 22]. However, there is no study that compares readiness levels of primary school students by learning domains. It is believed that, in order to improve quality of education, it is important to determine students' readiness levels in math and compare these levels by learning domains. Findings of this research will enable determination of the factors in question. In this study, cognitive readiness levels of 4th grade students in primary schools will be analyzed according to learning domains of math lesson. In this context, answers to the following questions are sought.

1.3. Problem sentence

How are cognitive readiness levels of 4th grade students in primary schools according to learning domains of math lesson?

1.3.1. Sub-problems

1) Does gender have a role in cognitive readiness levels of 4th grade students in primary school according to learning domains of numbers, geometry and measurement and to math lesson?

2) Is there any difference in cognitive readiness levels of 4th grade students in primary school according to learning domains of numbers and geometry in math lesson?

3) Is there any difference in cognitive readiness levels of 4th grade students in primary school according to learning domains of numbers and measurement in math lesson?

4) Is there any difference in cognitive readiness levels of 4th grade students in primary school according to learning domains of geometry and measurement in math lesson?

5) Is there any difference in cognitive readiness levels of 4th grade students in primary school according to learning domains of numbers and geometry in math lesson?

2. Method

This research is conducted through the method of general screening model. Screening model is a research model that aims to explain an existing situation as it is. In the screening model, it is aimed to identify the topic to be researched within its own conditions and as it is [23:77]. In the general screening model, the topic to be researched is screened within a sample to be taken from the population in order to obtain a general opinion [23:79, 24:58]. In the beginning of the academic year, a math achievement test (MAT) containing math topics taught in 1st, 2nd and 3rd grades and consisting of 40 open-ended question is done to identify cognitive readiness of 4th grade students of primary education for math lesson. In MAT, correct answers are scored 1 and all other cases are scored 0. Scores are summed and total scores are calculated for each learning domain. Furthermore, interviews are held with primary school teachers of students, who has taken MAT test, by means of semi-structured interview forms in relation to cognitive readiness of students for math lesson. The quantitative data obtained is examined through a t-test and one-way analysis of variance in SPSS 21 package software. Qualitative data obtained in interviews with teachers are interpreted through the method of descriptive analysis.

2.1. Population and sample

The research population consists of all 4th grade students studying in Yenimahalle district of Ankara province in the academic year 2014-2015. As the sample, a school from public primary schools in Yenimahalle district and all 4th grade students in this school are elected through the method of simple random sampling. The sample

consists of a total of 140 fourth grade students in five different branches. 71 (50.7%) of students are male and 69 (49.3) are female.

2.2. Data collection tools

Data collection tools used in this study are MATs and teacher interview forms.

2.2.1. Math achievement test (MAT)

4th grade MATs consist of three sections. MATs contain questions from learning domains of numbers, geometry and measurement containing acquisitions of 1st, 2nd and 3rd grades. Learning domain of numbers in MATs is developed by Fidan [25] according to acquisitions in learning domain of numbers in math curriculum for 1st, 2nd and 3rd grades [1]. There are 14 questions in the learning domain of numbers. It includes topics like counting, number patterns, questions and problems of four operations, fractions etc. KR-20 reliability coefficient of numbers test is calculated to be 0.93. Duration of the test is one lesson hour. Leaning domains of geometry and measurement are developed by Olkun, Akkurt Denizli, Kozan and Ayyıldız [26] on the basis of the learning domains of geometry and measurement in math curriculum for 1st, 2nd and 3rd grades [1]. MAT contains 16 questions from the learning domain of geometry and 20 questions from the learning domain of measurement. Two- and three-dimension geometric shapes, comparison-positioning, angles, square and perimeter measures of geometric shapes, time measures etc. KR-20 reliability coefficient of these tests is calculated to be 0.91. Duration of the test is recommended to be one lesson hour.

2.2.2. Teacher interview form

A semi-structured interview form for identification of teachers' opinion about students' cognitive readiness for math lesson (TIF) are prepared. While designing TIF, 10 rough questions related to cognitive readiness for math lesson are prepared. In the preparation of rough questions, opinions of two primary school teachers and two math teachers are taken. Subsequently, rough questions are sent two two experts with doctoral degree in math education and primary school teaching to take their opinions. According to feedbacks of experts, it is decided to remove six questions from the interview form, revise repetitions in other questions, and ask four questions. Teachers are also asked four questions of personal information to identify their demographic attributes. Thus, TIF is given its final form, which includes questions about personal information in the first section and questions about cognitive readiness levels of students in the second section.

2.3. Data analysis

In this research, SPSS 21 package program is used for the analysis of qualitative data. Total scores of learning domains in cognitive readiness test for 4th grade math lesson (MAT) are interpreted at a significance level of $p<0.05$, which is accepted in educational sciences. Paired sample t-test is used in paired comparisons of learning domains, and one-way analysis of variance (one-way ANOVA) is used in triple comparisons. Number of questions in learning domains of numbers (14 questions), geometry (16 questions), measurement (20 questions) and general total (50 questions) are different. Therefore, all learning domain and general total scores are adapted

to the scale of 100 in order to eliminate any average differences that may occur in comparisons. Besides, TIF is used in interviews with teachers of students who have taken MAT tests. Qualitative data obtained from teachers are interpreted through the method of descriptive analysis.

3. Findings

This section consists of quantitative findings, where learning domains are compared to each other in relation to cognitive readiness levels of students for math lesson, and qualitative data obtained from primary school teachers.

3.1. Quantitative findings

3.1.1. Analysis of learning domains of math lesson and general total scores by gender

Independent sample t-test is performed to determine whether gender has a significant difference in cognitive readiness of 4th grade students for math lesson according to learning domains. Results of t-test, which is performed on the basis of the gender variable between learning domains of numbers, geometry, measurement and general total scores, are given in the Table 1.

Table 1: T-test analysis of learning domains and general total scores by gender

Learning Domains	Gender	N	Average	SS	t	df	p
Numbers total score	Female	69	48	27.6095	0.938	140	0.350*
	Male	73	43.75	26.4756			
Geometry total score	Female	69	40.31	29.5602	0.801	140	0.425*
	Male	73	40.99	30.3986			
Measurement total score	Female	69	24.42	21.083	-0.718	138.456	0.476*
	Male	73	27.19	24.819			
General total score	Female	69	37.74	23.095	0.349	140	0.727*
	Male	73	36.36	24.045			

*p>0.05

Table 1 shows that total scores of 4th grade students in the learning domain of numbers in math lesson do not have a significant difference according to the gender variable (t(140)=0.938, p=0.350, p>0.05) It is also seen that averages of total scores of female and male students in the learning domain of numbers have values close to each other. It is seen that total scores in the learning domain of geometry do not have a significant difference according to the gender variable (t(140)=0.801; p=0.425; p>0.05). It is also seen in the Table 1 that averages of total scores of female and male students in the learning domain of geometry have values close to each other. It is seen that total scores in the learning domain of measurement do not have a significant difference according to the gender variable (t(138.456)=–0.718; p=0.476; p>0.05) It is also seen that averages of total scores of female and male students in the learning domain of measurement have values close to each other. Table 1 also shows that general total scores obtained from the total of all learning domains do not have a significant difference

according to the gender variable (t(140)=0.349; p=0.727; p>0.05). Averages of general total scores of female and male students have close values. Consequently, scores of 4th grade students in the learning domains of numbers, geometry and measurement and general total scores do not have a significant difference according to the gender variable.

3.1.2. Analysis of total scores in learning domains of numbers and geometry

Paired sample t-test is performed to determine whether there is a significant difference between total scores of numbers and geometry in terms of cognitive readiness of 4th grade students according to learning domains of numbers and geometry in math lesson. Table 2 contains comparison results and t-test results in relation to the relationship between total scores of numbers and geometry.

Table 2: Paired sample t-test analysis of total scores in learning domains of numbers and geometry

Learning Domains	N	Average	SS	Correlation	t	df	p
Numbers and Geometry	142	45.81	12.3461	0.750	1.677	141	0.096*
total scores	142	42.95	12.2572				

*p>0.05

Table 2 shows that correlation coefficient between total scores of the learning domains of numbers and geometry is 0.750, and there is no significant difference in terms of cognitive readiness of students in learning domains of numbers and geometry (t(141)=1.677; p=0.096; p>0.05). In other words, no statistically significant difference is found between total scores of students in the learning domain of numbers and total scores in the learning domain of geometry. It is also seen that averages of total scores of students in numbers and geometry have values close to each other.

3.1.3. Analysis of total scores in learning domains of numbers and measurement

Paired sample t-test is performed to determine whether there is a significant difference between total scores of numbers and measurement in terms of cognitive readiness of 4th grade students according to learning domains of numbers and measurement in math lesson. Table 3 contains comparison results and t-test results in relation to the relationship between total scores of numbers and measurement.

Table 3: Paired sample t-test analysis of total scores in learning domains of numbers and measurement

Learning Domains	N	Average	SS	Correlation	t	df	p
Numbers and Measurement	142	45.81	27.0207	0.700	12.060	141	0.000*
total scores	142	25.85	23.040				

*p>0.05

Table 3 shows that correlation coefficient between total scores of the learning domains of numbers and geometry is 0.700, and there is no significant difference in terms of cognitive readiness of students in learning domains of numbers and measurement ($t(141)=12.060$; $p=0.000$; $p<0.05$). In other words, no statistically significant difference is found between total scores of students in the learning domain of numbers and total scores in the learning domain of measurement. Difference of total score averages of students in numbers and measurement is calculated to be 19.96. It is seen that the statistical difference in the learning domains of numbers and measurement is to the favor of the learning domain of numbers. In other words, 4th grade students have better cognitive readiness in the learning domain of numbers when compared to the learning domain of measurement. The reason of this difference may be the fact that students find the learning domain of measurement more difficult and it is harder for them to learn the units of measurement they see for the first time.

3.1.4. Analysis of total scores in learning domains of geometry and measurement

Paired sample t-test is performed to determine whether there is a significant difference between total scores of geometry and measurement in terms of cognitive readiness of 4th grade students according to learning domains of geometry and measurement in math lesson. Table 4 contains comparison results and t-test results in relation to the relationship between total scores of geometry and measurement.

Table 4: Paired sample t-test analysis of total scores in learning domains of geometry and measurement

Learning Domains	N	Average	SS	Correlation	t	df	p
Numbers and Measurement total scores	142 142	42.95 25.85	29.9561 23.040	0.663	9.008	141	0.000*

*p>0.05

Table 4 shows that correlation coefficient between total scores of the learning domains of geometry and measurement, and there is no significant difference in terms of cognitive readiness of students in learning domains of geometry and measurement ($t(141)=9.008$; $p=0.000$; $p<0.05$). In other words, no statistically significant difference is found between total scores of students in the learning domain of geometry and total scores in the learning domain of measurement. Difference of total score averages of students in geometry and measurement is calculated to be 17.1. It is seen that the statistical difference in the learning domains of geometry and measurement is to the favor of the learning domain of geometry. In other words, 4^{th} grade students have better cognitive readiness in the learning domain of geometry when compared to the learning domain of measurement. It is thought that the reason behind this difference is the difficulty students have in conceptually learning the relationship between units of measurement and attach meaning to them in their minds.

3.1.5. Analysis of total scores in learning domains of numbers, geometry and measurement

Dependent sample one-way analysis of variance is performed to determine whether there is any significant difference between total scores of numbers, geometry and measurement in terms of cognitive readiness of 4th

grade students according to learning domains of numbers, geometry and measurement in math lesson. Table 5 contains averages of total scores of numbers, geometry and measurement, Table 6 contains results of one-way analysis of variance, and Table 7 contains paired comparisons of total scores of the learning domains of numbers, geometry and measurement.

Table 5: Average scores of learning domains

Learning Domains	N	Average	SS
Numbers total score	142	45.819	27.0207
Geometry total score	142	42.957	29.956
Measurement total score	142	25.85	23.040

Table 5 shows that total score averages of the learning domains of numbers and geometry have close values. However, total score average of the learning domain of measurement is considerably low when compared to the learning domains of numbers and geometry.

Table 6: One-way analysis of variance of total scores of numbers, geometry and measurement

Variance Source	Sum of Squares	SS	Average of Squares	F	p
Measurement between teaching domains	33132.05	2	16823.277	75.567	0.000*
Error	61820.48	282	222.626		
Total	94952.53	284			

*p>0.05

According to Table 6, results of one-way analysis of variance between teaching domains are statistically significant (F=75.567; p=0.000; p<0.05). Averages in Table 5 must be examined to determine to the favor of which learning domains the significant difference between total scores of the learning domains of numbers, geometry and measurement is. When looked into the averages of learning domains, it is seen that this significant difference is unfavorable for the learning domain of measurement. It other words, it may be suggested that 4th grade students are more ready in the learning domains of numbers and geometry when compared to the learning domain of measurement.

The Table 7 also shows the analysis of variance with paired comparison of the learning domains of numbers (1), geometry (2) and measurement (3).

Table 7 shows that there is no significant difference between total scores of learning domains of numbers and geometry (p=0.287; p>0.05) The fact that difference between total score averages of the learning domains of numbers and geometry is low also shows that lack of a significant difference is natural. However, it is seen that total score of the learning domain of measurement has a statistically significant difference with total scores of

both the domain of numbers and the domain of geometry. Table 7 shows that the difference between total score averages of the learning domain of measurement and the learning domain of numbers is 19.974, and the difference between total score averages of the learning domain of measurement and the learning domain of geometry is 17.113. We may suggest that this is the reason behind the significant difference between the learning domain of measurement and the other two learning domains. Consequently, readiness of 4th grade students for math lesson is at lower level in the learning domain of measurement when compared to the learning domains of numbers and geometry.

Table 7: Paired comparison of total scores of numbers, geometry and measurement

(I) Factor 1	(J) Factor 2	Difference of Averages (I-J)	SS	p
1	2	2.861	1.706	0.287
	3	19.974*	1.656	0.000
2	1	-2.861	1.706	0.287
	3	17.113*	1.900	0.000
3	1	-19.974*	1.656	0.000
	2	-17.113*	1.900	0.000

3.2. Qualitative Findings

Qualitative findings obtained from the semi-structured interview with primary school teachers of 4th grade classes which have taken MAT are interpreted through the method of descriptive data analysis. Findings obtained from interviews with teachers are given in this section under the headings of readiness for learning domains of numbers, geometry and measurement and generally for math lesson. Three of the interviewed teachers are women and two are men. One of the teachers has a professional experience of 6-10 years, two teachers have an experience of 11-15 years, and two teachers have an experience over 16 years. All teachers have bachelor's degree in primary school teaching programs. Size of classes consisting of five different branches consists of 26-30 teachers.

3.2.1. Teachers' opinions on cognitive readiness of students in the learning domain of numbers

All teachers (f=5) state that students remember addition and subtraction which they have learned in relation to numbers. Some teachers (f=2) express that students have forgotten how to read and roll three-digit numbers and some teachers (f=3) express that students cannot do subtractions with carry. All teachers (f=5) state that students do not remember multiplication and division when they start school. Some teachers (f=3) express that students lose their problem-solving skills in the summer holiday, but they remember skills of math operations. It is seen in general that student's readiness is at a higher level in terms of operation skills in the learning domain of numbers (addition, subtraction and multiplication) when compared to their memorization and interpretation

skills (multiplication table and problem solving).

T3: "...their readiness in subtraction with carry, multiplication and division and concept of fraction is not at the desired level. Particularly their problem solving skills are at a level lower than their operation skills."

T1: "They forget subtraction with carry and especially division. As for multiplication, they forget multiplying with numbers with 6-7-8-9, namely the large numbers. They can do addition and subtraction."

3.2.2. Teachers' opinions on cognitive readiness of students in the learning domain of geometry

Most of the teachers (f=4) express that students remember the geometric objects they encounter and use in their daily lives like cube, cylinder, square and round, but they forget cone and prism and distinguishing the difference between line and plane. Teachers (f=4) state that most of the students can show perimeter of geometric shapes, but they forget corners and edges of geometric objects. It is seen that students are generally at a better readiness level in recognizing geometric shapes and objects like cube and cylinder in the learning domain of geometry, when compared to other topics.

T1: "They do not remember names of geometric objects other than cube. They do not know their expanded states. They confuse line and plane. Most of them do not even remember what a plane is."

T4: "They know cylinder and cube, but do not remember prisms. When you show them a cone, they say it is a cornet."

3.2.3. Teachers' opinions on cognitive readiness of students in the learning domain of measurement

All teachers (f=5) express that students have forgotten units of length, time measurements and perimeter calculations within a problem. Some teachers (f=3) state that students can do simple perimeter calculations like rectangles. Most of the teachers (f=4) totally confuse units of length, especially meter and centimeter; they forget time units; and cannot do perimeter calculations asked in the problem. Since units of length, time and measurement are difficult for students to learn and quickly forgotten, readiness levels of students in the learning domain of measurement is considerably low.

T1: "Length estimation skills are becoming much weaker. For example, I once asked students to estimate my height and there were students who said 30 meters and students who said 100 meters."

T5: "They know how to find perimeter of a rectangular, but they cannot do it when given in a problem. They use the meter, but they cannot tell what their height is. They say cm, but they use it like meter because they forget it."

T3: "They are better in measuring length, but they have difficulty in measuring time. They have difficulty in problems that require perimeter calculation."

3.2.4. Teachers' opinions on cognitive readiness of students for math lesson

All teachers (f=5) state that students do nothing in their summer holidays, they do not do the repetitions and homeworks given, and uninterested families do not follow their children. It is emphasized that, as a result, students forget many topics not only in math lesson but also in Turkish and science lessons, but their readiness levels in math lesson is at the lowest level among all. Most of the teachers (f=4) express that 3-4 weeks in the beginning of each semester are spent for reminding students the previous topics. All teachers (f=5) state that homeworks and lesson repetitions given for summer holiday must be followed up, especially by parents, in order to increase readiness levels of teachers.

T1: "As children do not study in the summer holiday, they forget especially the math topics. I strived for 1 month last year. Just to remind them four operations. Actually, they would not forget it if they had done the homeworks I had given for the summer."

T2: "It wouldn't be wrong to say they they are not ready at all. They forget topics not only in math, but also in science and Turkish. They always forget writing, operation rules, general culture, multiplication, division, large numbers, and reading. I have to turn over it from the beginning. I have a great difficulty in doing this. I cannot start teaching new topics because of this."

T3: "Their readiness level in math is lower when compared to Turkish and science. Although they can do money calculations, they cannot calculate time. They cannot read the analog clock on the wall. They do not find it meaningful that one hour is 60 minutes. In uninterested families, children do not do any academic study for 3-4 months and become blunt."

4. Conclusion and suggestions

The following conclusions are reached on the basis of the research findings.

- There is no significant difference between total scores of the learning domains of numbers, geometry and measurement and general total scores in readiness level of 4^{th} grade students for math lesson by the gender variable.
- There is no significant difference between total scores of the learning domains of numbers and geometry in readiness level of 4^{th} grade students for math lesson.
- There is a significant difference between total scores of the learning domains of numbers and measurement in readiness level of 4^{th} grade students for math lesson to the favor of the learning domain of numbers.
- There is a significant difference between total scores of the learning domains of geometry and measurement in readiness level of 4^{th} grade students for math lesson to the favor of the learning domain of geometry.
- There is a significant difference between total scores of the learning domains of numbers, geometry and measurement in readiness level of 4^{th} grade students for math lesson unfavorably for the learning domain of measurement.

Qualitative data of the research support the quantitative data. Primary school teachers think that students remember counting, addition, subtraction and multiplication in the learning domain of numbers, but they forget their previous knowledge about multiplication table, multiplication with carry, division and problem solving. Similarly, teachers state that students remember line, geometric shapes and cube in the learning domain of geometry, but they do not remember plane, difference between line and plane, and geometric objects. Teachers also think that, except for simple perimeter calculations, students forget and frequently confuse length, mass, clock reading, time slots and measurement units. As a result, it is understood that students have a better readiness level in the learning domains of numbers and geometry when compared to the learning domain of measurement, and the quantitative data supports this.

Yet, according to the results of this research, readiness level of 4th grade students in all learning domains and generally in math lesson is low [27:11]. Success rates of averages of total scores of students in each learning domain are as follows: 45.81% in the learning domain of numbers, 42.95% in the learning domain of geometry, 25.85% in the learning domain of measurement, and 37.05% generally in math lesson. Although the readiness level in the learning domains of number and geometry is higher than the readiness level in the learning domain of measurement, all domains are below 50% in terms of academic success. This shows that 4th grade students start the academic year with low readiness levels for math lesson. Therefore, it should be determined whether all students have gained previous math acquisitions in the beginning of each academic year for all grades of primary education. Following this determination, students may be grouped by their cognitive readiness levels. For each group, environments where appropriate exercises for completion of the identified deficiencies of students must be set up.

Teachers express that students do not do any academic study in their summer holidays. Therefore, students must be given exercises like homeworks, projects etc. that they can do during holidays for their acquisitions. Students who start education with a high cognitive readiness level gain new acquisitions faster and attach meaning to them in their minds [16, 19, 22]. Attracting activities that can bring students to the school environment may be performed for students from the relevant age group to use their time in holidays for academic purposes.

For 5^{th} grade students, one week before each academic year is designated as the orientation week by MEB. In this process, students are expected to get used to their new school and teachers. Through a similar attempt, this duration may be extended and cognitive readiness levels of students may be increased. Specialists of the field must also take place in education programs for cognitive readiness of students and activities for improvement of these programs. It is thought that such cooperation will reveal the significance of cognitive readiness in math education and positively contribute to more meaningful and faster learning in the subsequent stages.

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