European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available on-line at: www.oapub.org/edu

10.5281/zenodo.162458 Volume 2 | Issue 8 | 2016

THE EFFECT OF THE SUCCESS IN TEACHING GEOMETRY OF BASIC LEVEL EDUCATION MATHEMATICS

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Abstract:

The purpose of this study was to investigate primary and secondary mathematics teachers' candidates' effect of the success in geometry education. The sample of the study consists of students first and last class preservice primary mathematics teachers which are enrolled program education at department of mathematics and students first and last class in preservice secondary mathematics teachers enrolled to Necmettin Erbakan University Ahmet Keleşoğlu Faculty of Education. As data collection tool, the 2016 Transition to Higher Education Examination questions asked in geometry was used. Data obtained were analysed using Mann Whitney U test. Based on the findings, investigated that in first and last class of primary classroom teacher candidates and in first and last class of secondary mathematics teacher candidates were revealed in that whether there were statistically significant differences in terms of their success.

Keywords: Mathematics education, geometry education, secondary mathematics teachers' candidates.

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1. Introduction

Mathematics is a branch of science which investigates the characteristics of abstract concepts like number, quantity, geometrical shapes, expressions, operation etc. and relations among these with reasoning methods (Tuncer, 1995). Mathematics, to understand humanity`s objective reality, deals with some concepts to shape it from objective reality and the relations among these concepts. Formulas and symbols are one apiece tool or just the language of mathematics. For this reason mathematics is an abstract systematic of the method that we use in art, law, in short in life (Tepedelenlioğlu, 1995).

Geometry is a branch of science which helps an individual gain vision, ease thinking and reach a solution by realizing the shapes before the eyes (Hızarcı, 2004). Geometry, whose content area is shapes and objects, has an essential place in human life. In science, art, architecture, engineering, in short in every element that humans created geometry makes itself evident and nested with the daily life (Van De Walle, 2001). Geometry gives students opportunity to stimulate their minds, make mind exercises and problem solving, comparing, generalizing and summarizing skills' development. In general, geometry is a significant tool for a student to give meaning to his/her surroundings (NCTM, 2000; Napitupulu, 2001). Geometry has a wide place in understanding the axiomatic structure of mathematics and in mathematics program which containing learning of students. Throughout the geometry topics, students learn geometrical shapes, its structures, how to analyse its characteristics, and their relation with one another. Geometry provides a natural setting for the students in the development of their deduction, proving skills. Students may solve problems thanks to geometry and may create a bond between mathematics and life (Duatepe, 2000).

Mathematics, particularly geometry, is a subject that students approach with bias. To eliminate this bias and to provide a positive attitude for geometry can only be possible with the education to be given to them (Pusey, 2003: 66-74). Geometric thinking structure is closely related to the geometry education given in primary school era. Teacher is an important factor during this process (Terzi, 2010). Geometrical field knowledge and students' knowing on which level they are geometrically are two fundamental points necessary for an efficient geometry teaching (Toluk, taken from 1994: Toluk, Olkun ve Durmuş, 2002). Although geometry has a more concrete structure of mathematics compared to other branches, forming geometrical concepts and algebraic expressions used during problem solving show its abstract structure. Even though presence of concrete structure creates a cognitive positive effect on recognizing geometrical concepts, this situation does not mean that it can be learned more easily

compared to other branches of mathematics. And for this reason, teacher's, as well as field knowledge, transferring his/her knowledge to students, namely the pedagogic field knowledge should also be strong. Transfer of concept delusion or knowledge deficiency which are present in the teacher to the students, without a doubt, will be inevitable. (Altaylı, Konyalıoğlu, Hızarcı, Kaplan, 2014).

Holmes group (1990) that investigates the question `how the twenty-first century teacher should be` explains it as "*if you want to increase the performance of the students, you have to train quality teacher*" (From: Baki et al., 1996). In the conducted studies, the first step to interfere to increase the quality of the education was emphasized the necessity of understanding the value and beliefs of those who had a role in execution of these processes (Carter ve Norwood, 1997).

Some studies emphasized that geometrical thinking levels of primary and secondary education students were below the expected level (Halat, 2006; Alex and Mammen, 2012). In some studies, it was stated that geometrical thinking levels of teachers and teachers` candidate were below the expected level (Olkun, Toluk and Durmuş, 2002; Knight, 2006; Halat, 2008). When the studies conducted with these two different samples are taken into consideration, it can be said that the reason students' geometrical thinking levels were low is related to that teachers' geometrical thinking levels were low. Upon finding out the geometrical thinking levels of teachers and teachers' candidates and determining any lowness's existence, it is of importance to find the possible reasons of this lowness. On taking necessary precautions related to the causes that occurred, it can be provided to increase the geometrical thinking levels of teachers' candidates and teachers, and so students (Çakmak, Güler).

From the above mentioned information, in this study investigation of geometrical information levels of primary and secondary education mathematics teachers' candidates in terms of group variances. In linear to this purpose, answers were sought to the following problems:

1. Is there a significant difference in the geometrical information levels of first and last class students of primary education mathematics teaching?
2. Is there a significant difference between the geometrical information levels of secondary education mathematics teaching first and last class students?
3. Is there a significant difference between the geometrical information levels of primary education mathematics teaching first class and secondary education mathematics teaching first class students?

2. Methodology

2.1 Sample and Working Group

Sampling of the study consist of 36 first and 38 last grade students enrolled in Necmettin Erbakan University Ahmet Kelesoglu Faculty of Education as preservice primary mathematics teacher and 22 first and 19 last grade students of preservice secondary mathematics teachers.

2.2 Data Collecting Tool and Analysis of Data

As a data collecting tool in this study, questions asked in geometry in 2016 Transition to Higher Education Examination are used. Students were given 1 point for each correct answer and no point for incorrect answers in the success test. In a success test, a student may get utmost 7 points.

Before analysing the collected data, normal distribution of data was checked, and according to the result it was decided which parametric or non-parametric statistical technique to be used. Since the sampling number was less than 50, to test the conformity of data to normal distribution Shapiro-Wilks test was used (Yazıcıoğlu, 2004).

As a result of this conducted test, final significance test points were calculated as $p<.05$ and information related to this test results is given in the findings section.
Since the collected data did not show a normal distribution, data of the study was analyzed using Mann Whitney U-test which is a non-parametric equivalent of unrelated t-test used to investigate significant differences.

3. Findings and Comments

Percentage and frequency distribution related to test results applied to preservice primary mathematics teacher department first and last grade are given in Table 3.1.

Table 3.1: Distribution related to test results applied to preservice primary mathematics teacher department first and last grade

Grade Level	Correct number	f	%
	2	1	2.8
	3	1	2.8
Preservice Primary Mathematics Teacher	4	1	2.8
First Grade Students	5	5	13.9
	6	13	36.1

	7	15	41.7
	Total	**36**	**100.0**
	2	0	0
Preservice Primary Mathematics Teacher	3	2	5.3
Last Grade Students	4	2	5.3
	5	2	5.3
	6	8	21.1
	7	24	63.2
	Total	**38**	**100.0**

As it can be seen from the given table above, majority of the preservice mathematics teacher department first grade students participated in the study (41.7%) does not have incorrect answer. Along with this, a significant portion of the teachers' candidate participated in the study (36.1%) have only 1 incorrect answer. Some of them (13.9%) answer 5 questions out of applied test questions. Additionally, majority of the questions were answer incorrectly by a few of the students. These distributions are shown in the figure below.

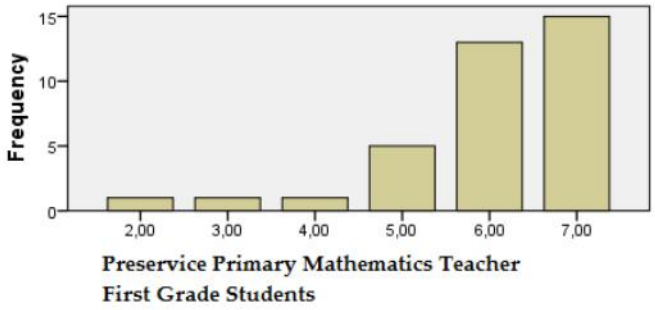

Figure 3.1

More than half of the Preservice Mathematics Teacher department last grade students asked the study questions (63.2%) answered the questions fully correct. At the same time, a significant portion (21.1%) answered only one question incorrect. These distributions are stated on the figure below.

Table 3.2: Distribution related to test results applied to Preservice secondary mathematics teacher department first and last class

Grade Level	Correct Number	f	%
	2	4	18.2
Preservice Secondary Mathematics Teacher	3	4	18.2
First Grade Students	4	3	13.6
	5	4	18.2

	6	6	27.3
	7	1	4.5
	Total	**22**	**100.0**
	2	0	0
Preservice Secondary Mathematics Teacher	3	0	0
Last Grade Students	4	2	10.5
	5	2	10.5
	6	9	47.4
	7	6	31.6
	Total	**19**	**100.0**

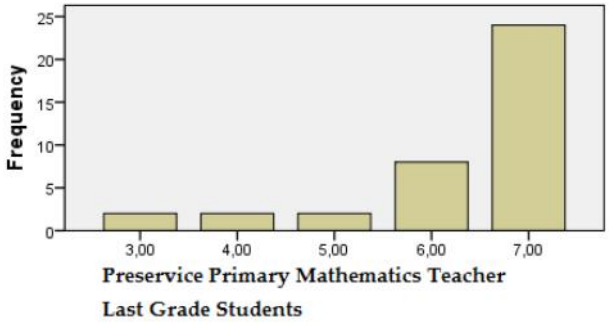

Figure 3.2

Percentage and frequency distribution related to test results applied to Preservice secondary mathematics teacher department first and last class are shown at Table 3.2. Of the group which consisted of preservice secondary mathematics teacher department first grade students, 27.3 percent answered 6 questions correct, 4.5 percent did 7 correct and 13.6 percent did 4 correct. Remaining part, with the same percentage ratios, answered the questions with 2, 3 and 5 correct answers. The figure that shows the distribution of this group is below.

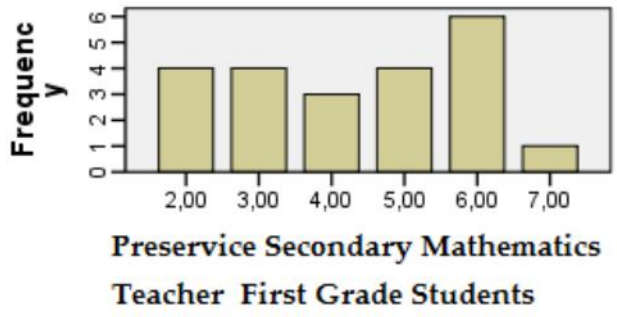

Figure 3.3

According to the study results, of preservice mathematics teacher department last grade students, 47.4% answered 6 of the directed geometry questions correctly. Likewise, 31.6% of the group answered all of the questions correctly. Remaining part, with the same percentage ratio, answered 4 and 5 questions correctly. These expressions were also shown in Table 3.4.

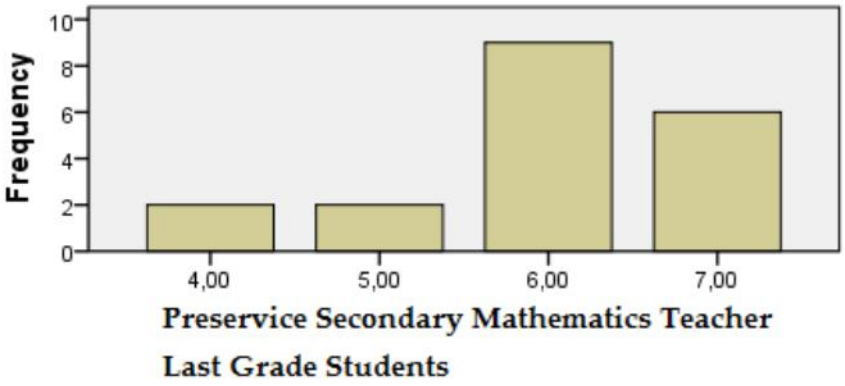

Figure 3.4

Results of Mann Whitney U test which is conducted to determine if there is significant different between preservice mathematics teacher first grade and preservice mathematics teacher last grade students in terms of geometrical knowledge are given in Table 3.3.

Table 3.3: Results of Mann Whitney U-test conducted relating to the test points of groups

Groups	N	Mean Rank	Rank Sum	U	p
Preservice Primary Mathematics Teacher First grade	36	33.75	1215.00	549.00	.109
Preservice Primary Mathematics Teacher Last grade	38	41.05	1560.00		

It can be referred from the Table 3.3 that the difference of the correct numbers` mean rank in the geometry test is 7.3. To check the importance of this difference Mann Whitney U test is conducted. As a result of the test no significant different between the first and the last grade students' correct answer numbers in the 7-item geometry test ($U=549.00$, $p>.05$). Successes in geometry of 1st and 2nd group students have a similar structure as it can be understood from the test results.

Mann Whitney U Test is conducted to see if there is a significant difference in terms of geometric knowledge levels between preservice secondary mathematics teacher first grade students and preservice secondary mathematics teacher last grade students, or not. Obtained results are given at Table 3.4.

Table 3.4: Mann Whitney U-test Results relating the Test Points of the Groups

Groups	N	Mean Rank	Rank Sum	U	p
Preservice Secondary Mathematics Teacher First grade	22	15.23	335.00	82.00	.001
Preservice Secondary Mathematics Teacher Last grade	19	27.68	526.00		

From the Table 3.4, it can be seen that secondary education first grade group's mean rank is 15.23 and secondary education last grade group's mean rank is 27.68. As a result of Mann Whitney U-test, it is confirmed that the difference between group's geometry test points is statistically significant ($U=82.00$; $p<.05$). This finding show that compared to preservice secondary mathematics teacher first grade students, preservice secondary mathematics teacher last grade students have a significantly increased geometry success point.

At Table 3.5, results of Mann Whitney U-test conducted to determine if there is a significant difference between the geometrical knowledge levels of preservice primary mathematics teacher first grade students and preservice secondary mathematics teacher first grade students.

Table 3.5: Results of Mann Whitney U-test related to Test Points of Groups

Groups	N	Mean Rank	Rank Sum	U	p
Preservice primary mathematics teacher first grade	22	18.45	406.00	153.000	.000
Preservice secondary mathematics teacher first grade	36	36.25	1305.00		

When the Table 3.5 was inspected, it was found that means rank of preservice primary mathematics teacher first grade group was 18.45 and means rank of preservice secondary mathematics teacher first grade group was 36.25. It was also confirmed that the difference of test results of preservice primary mathematics teacher first grade students and preservice secondary mathematics teacher first grade students was statistically significant ($U=153.00$; $p<.05$). According to this finding, it can be said that the groups are not equal in terms of success.

4. Results and Suggestions

In this study in which the success in geometry of preservice primary mathematics teacher students and preservice secondary mathematics teacher students are compared, the following results are found.

In terms of mean of correct answers in geometry test, it has been detected that there is no significant difference in geometric knowledge levels of preservice primary mathematics teacher first grade students and preservice primary mathematics teacher

last grade students. When correct number of answers of the test between preservice mathematics teacher last grade students and preservice mathematics teacher first grade students is compared, significant differences in favor of preservice secondary mathematics teacher last grade students are found. A significant different is confirmed between the test results of preservice primary mathematics teacher first grade student and preservice secondary mathematics teacher first grade students. Therefore, there was no different between the higher education entry examination scores of both of these two groups, we can attribute this success to the geometry course given in the first grade. As a result, we can say that, based on the observation of the study, there is a direct proportion between having geometry course and success.

In education, the topic of teacher`s training and increasing their quality is one of the most accentuated and discussed one. To train a teacher who can respond to the needs of the information era it is essential to choose individuals who have the expected knowledge and skills from a teacher (Oğuzkan, 1985). Along with this, it is expected to provide these individuals with the education that can support the knowledge and skills so that quality teachers can be trained. Ausubel ve Robinson (1969) have defined the qualifications of a good teacher as; "*high mental capacity, strong field knowledge, academically prepared, sufficient development and teaching knowledge, having desired characteristics*" (Güçlü, 1996).

Proficiency fields of teachers are accumulated under three titles which are in general field knowledge, professional teaching knowledge and general culture. There are foreseen to be provided to the teachers' candidate during the preservice teacher training phase. As students have an education on a certain topic, their thinking level on that topic is expected to increase. An education which does not increase the thinking level of a student remained limited or even makes no headway (Clements & Battista, 1992). In this context, importance of the content of the undergraduate education comes to existence. Courses in the programs of teacher training institutes and content of these courses are regulated according to the foreseen proficiency to be provided to the teachers.

Durmus, Toluk and Olkun, during their studies, stated that students of mathematics teacher did not show the expected progress, both in geometry test and van Hiele Geometric Thinking Test, in areas of geometry that requires high level thinking like generalizing, classification (Durmuş, Toluk, Olkun).

Dindyal (2005), during his study, confirmed positive and significant relations between students' algebraic thinking levels and geometric thinking levels, and while one increases, the other one also increases, and while one decreases the other one also decreases. He also shows that geometric thinking level is not only connected to the

geometry courses. Geometric thinking is not only related to algebra. Spatial thinking contains skills related to the use of space and geometric forms (Olkun, 2003).

When the studies conducted in this field are investigated, it is generally observed that in institutions where mathematics teachers are trained lack of geometry courses, in general, is confirmed and therefore mathematics teachers' candidates are also insufficient in terms of geometric knowledge level. In accordance with the finding and results obtained in this study, the followings can be suggested:

- The courses which are in the programs of the institutes that train mathematics teachers and content of these courses should be regulated according to the proficiencies foreseen to bring to the teachers.
- Class hour and content of the course which is present to primary mathematics teaching department should be increased.
- Geometry courses should be added to the elective courses in the curriculum of last grades.
- Teachers' candidate should be given change to test their knowledge and to develop skills and insufficient knowledge and skills efforts should be given.

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