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Relationship Between Proof Schemes Used by Preservice Mathematics Teachers and Gender, Views Towards Proof

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Abstract

The aim of this study is to examine whether there is a relationship between gender and proof schemes used by first and final year preservice teachers attending primary and secondary education mathematics teaching program of a state university in 2011-2012 and also to investigate their general views towards proof. The study was carried out on a total of 98 preservice mathematics teachers. In order to describe current situation screening model was used. Students were asked to solve 9 problems and which proof schemes were belonged to their answers were determined. So as to set down proof schemes classification which was constituted by Harel and Sowder (1998) was used. According to the gender regarding proof schemes used by preservıce teachers in the justification process of problems t table was created. Preservice teachers were interviewed so as to determine their views on proving 4 open ended questions were asked. Conversational data was given in the form of examples and in general terms. According to the results of analysis as significant differences was detected by gender in the use of some of schemes, some was concluded that the difference was not significant. Suggestions have been made on the basis of the data obtained at the end of the research.

Keywords: Preservice Mathematics Teachers, Proof, Proof Schemes, Gender

1. Introduction

Proof that provides assurance of mathematical information, in making and understanding of mathematics is basic activity (Almedia, 2000; Uğurel ve Moralı, 2010). Proof is attempt to put across that the accuracy or incorrection of a judgment, the assertion or result showing sufficient evidence (Garnier, Taylor, 1997; Güler, Özdemir, Dikici, 2012). What meant by proving is to eliminate or to create doubts about the accuracy of observations. Proving includes two sub-processes. First of these is an individual process of understanding the truth in order to eliminate own doubts about the accuracy of an observation, the second is the individual`s persuasion process in order to remove doubts as to the accuracy of an observation of the others. Learning of proof has become the main objective of mathematics curricula in many countries for many generations (Harel ve Sowder, 1998). With increase in the role and significance of proof in mathematics, the developments and mental processes of students in various age groups when they prove has been the subject of research in mathematics education. Harel and Sowder (1998) conducted a

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study about thinking processes that classifies solution levels during proofing by interrogating the reasons behind them. They grouped proof under three proof schemes; external, empirical and analytical. Proof schemes shows that how is persuaded and the way a person persuade others. Three proof schemes are explained below.

External Proof Schemes: Students using these schemes bases upon the accuracy of their knowledge to books, rules or other people such as family, teacher (Flores, 2002; Flores, 2006). These schemes also compose of the proofs which were occurred without understanding the meanings of symbols and without comprehending the reasons algorithmic constructions (Harel and Sowder, 1998).

Empirical Proof Schemes: Students using these schemes give number values to expressions or use similar instances in the confirmation process, and they prefer to account for some situations with their intuitions (Harel and Sowder, 1998).

Analytical Proof Schemes: These schemes involve assumptions with logical inferences and also include reasoning (Flores, 2002). Students with these schemes use various strategies; do generalizations, and benefits mathematical relationships (Flores, 2002; Flores, 2006). According to Harel and Sowder (1998) analytical proof schemes constitutes the maximum level of proof.

The preservice teachers` levels and ways of proving and their viewpoints oriented proof will be reflected on students and will affect their style of lesson processing. Because students by taking the teachers` explanations and thoughts assemble existing structures and are influenced by their views. For this reason, considering preservice teachers` proving patterns and perspectives related to proof is quite important. Hence, it is aimed to determine whether there are any differences between proof schemes used by preservice mathematics teachers with regards to gender and the general views about proof.

2. Methodology

Because the aim of the study is to indicate the actual situation descriptive research model is used. Research group of study consists of 98 pre-service and secondary mathematics teachers (only freshman and seniors) who are having their undergraduate study at public university in 2011-2012 academic year.

9 problems related to general knowledge in mathematics courses and designed according to the pre-service mathematics teacher's level are prepared to indicate the type of the schemes that they use in general mathematics course. 5 experts' opinions is asked about the measurement level to proof ability, representation level of general mathematics course, appropriateness level of class level of the problems. 90 minutes is given to elementary pre-service mathematics teachers' to solve these problems. In the analysis process, answers of elementary pre-service mathematics teachers are evaluated according to proof schemes' properties and classified into 4 categories; external, empirical, analytical, and empty. it is analyzed that whether there is a significant difference between proof schemes used by preservice mathematics teachers or not by using t test with a statistical program, and results are interpreted. In addition, four open-ended questions are asked so as to identify the preservice teachers` views regarding proof. On the basis each question, the general profile of views is constituted.

3. Findings

In this section, the findings obtained in analysis are made in accordance with the problems tackled are presented and interpreted in the forms of tables.

Table 1. T test Table related to Proof Schemes Used by First and Last Grade Pre-service Elementary Mathematics Teachers in Implementation According to Gender

Schemes	Gender	N	$\overline{X}$	S	Sd	t	P
External	Female	33	1,757	1,146	51,306	,051	,959
	Male	27	1,740	1,347			
	Total	60					
Emprical	Female	33	3,212	1,268	55,261	3,199	,002
	Male	27	2,148	1,292			
	Total	60					
Analytical	Female	33	2,606	1,223	52,389	-,178	,860
	Male	27	2,666	1,386			
	Total	60					
Empty	Female	33	1,424	1,299	57,575	-3,217	,002
	Male	27	2,444	1,154			
	Total	60					

According to results of analysis there is a significant difference the proof schemes in terms of empirical schemes and empty questions with regard to gender. When the averages in the table taken into consideration it is seen that female students use empirical schemes more than male students and leave the questions unanswered less than them. In addition there is no significant relationship between gender along with external and analytical schemes. Also it is seen that female students use empirical schemes mostly whereas male students use analytical schemes.

Table 2. Mann-Whitney U Table related to Proof Schemes Used by First and Last Grade Pre-service Secondary Mathematics Teachers in Implementation According to Gender

Schemes	Gender	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	p
External	Female	21	18,84	414,50	161,500	-,445	,656
	Male	17	20,41	326,50			
	Total	38					
Emprical	Female	21	20,02	440,50	164,500	-,357	,721
	Male	17	18,78	300,50			
	Total	38					
Analytical	Female	21	18,52	407,50	154,500	-,655	,512
	Male	17	20,84	333,50			
	Total	38					
Empty	Female	21	21,25	467,50	137,500	-1,172	,241
	Male	17	17,09	273,50			
	Total	38					

The results of analysis show there is no significant differences between proof schemes that pre-service mathematics teachers used in implementation with regard to gender and also in terms of empty questions significance between

proof schemes isn't different according to gender. When the averages in the table taken into consideration it is seen that female students use empirical schemes and leave the questions unanswered more than male students, while male students use analytical schemes and external schemes more than female students.

One of the four open ended questions asked to understand the general views of preservice teachers about proof is 'what are the difficulties you face with proofing'. Generally they experience difficulties about determining how to start proof, how to end proof, recalling the formulas, and organizing their ideas in the paper.

The second question is 'do you think it is necessary to proof, why, why not'. Most of the respondents defended that proof is necessary to confirm the validity, to comprehend the topic, to understand the origin of a theory. Also the importance of proof to prevent memorizing and persuasion is emphasized.

Third question is 'what do you care when you proof? can you generally explain the way you proof and the ways of thinking in this process'. In this question students answered as 'I checked the desired outcome, I checked the given list and I use my knowledge in accordance with the items, I try to choose the most practical ways'.

The last question is 'how do you feel when you answer or cannot answer a question'. Preservice teachers indicated that they feel happy, motivated and encouraged when they proof. They also declare, they feel discouraged, disappointed and unhappy when they can`t proof.

4. Results

In experimental scheme and blanks questions preservice elementary mathematics teachers' results present significant differences based on gender variable. Female students use experimental scheme more than males, and males left this questions blank. It can be inferred that female students do not trust proof, thus they look for experimental ways to control their solution. It can be considered that males left questions blank because they do not want to work on the problem. Thus, gender variable reflects the way a student proofs and later it can affect their students in the future. There is no significant relationship between male and female students in terms of secondary preschool mathematics teachers. But they defend proof is necessary in education and they experience some difficulties in the way they proof. They pay attention to find the practical solution and tend to use the date given to find the solution. In addition to this preservice teachers defends the importance of proof and the success level of them in proof affects their feelings about mathematics.

References

Almeida, D. A. (2000). Survey of Mathematics Undergraduates' Interaction With Proof: Some Implications for Mathematics Education, International Journal of Mathematical Education in Science and Technology, 31, 6, 869-890.

Flores, A. (2002). How Do Children Know That What They Learn in Mathematics is True?, Teaching Children Mathematics, 8, 5, 269–274.

Flores, A. (2006). How Do Students Know What They Learn in Middle School Mathematics is True?, School Science and Mathematics, 106, 3, 124-132.

Garnier, R. and Taylor, J. (1997), 100% Mathematical Proof, John Wily&Sonsn Pub.

Güler, G.. and Dikici, R. (2012). Ortaöğretim Matematik Öğretmeni Adaylarının Matematiksel İspat Hakkındaki Görüşleri. *Kastamonu Eğitim Dergisi* 20 (2), 571-590.

Harel, G. and Sowder, L. (1998). Students' Proof Schemes: Results From Exploratory Studies, In A. Schoenfeld, J. Kaput and E. Dubinsky (Eds.), Research in Collegiate Mathematics Education III, 234-283, Providence, RI, American Mathematical Society.

Uğurel, I. and Moralı, S. (2010). Bir Ortaöğretim Matematik Dersindeki İspat Yapma Etlinliğine Yönelik Sınıfiçi Tartışma Sürecine Öğrenci Söylemleri Çerçevesinde Yakından Bakış, Buca Eğitim Fakültesi Dergisi, 28, 135-154.