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Improving Mathematical Beliefs of Pre-service Teacher Trough Valsiner Zone Learning

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Abstract. This study aims to comprehensively analyze the increase in mathematical beliefs of pre-service teacher of mathematics education at Siliwangi Tasikmalaya University through learning based on the Valsiner Zone in total and based on Mathematical Preliminary Ability (MPA). The method used in this research is quasi experiment, with research population that is pre-service teacher of mathematics education at Siliwangi University of Tasikmalaya and the sample is student who follow course of probability theory in semester V consisting of one experiment class with amount of 42 people and one control class which amounted to 40 people in the Mathematics Education Study Program. Random sampling by class. Data collection techniques are questionnaires of mathematical belief scale. Descriptive analysis there is an improvement of mathematical belief of student in probability theory course, both at theory valsiner class and control class. Further improvement in student mathematical belief with theory valsiner class modeling was higher than that of control class, from the average gain of normalized students in upper, middle and lower MPA categories in the experimental group compared with the mean of normalized student gain in upper, middle and lower MPA categories with the control group although both groups were in the moderate category.

1. Introduction

Between beliefs in mathematics and mathematics learning are interrelated to form a circular process [1]. How mathematics is taught in class, gradually influences students' beliefs about mathematics. Also on the contrary, beliefs influence how students "welcome" their mathematics lessons. For a pre-service teacher of mathematics, having a positive belief in learning mathematics, it is very helpful to become a professional mathematics teacher in the future. Without a positive belief in the material to be taught and how to teach it, a teacher can undergo his profession as a teacher half-heartedly, so that he never attempts to truly become a professional. The main factors of the low mathematical ability of students are caused by errors in interpretation or understanding. matter and only look at the problem part by part, not in full. [2] Revealed that students find difficulties in probability courses due to lack of mastery of concepts so that they often experience misunderstandings in understanding problems. Many students find it difficult to understand the concepts of probability and statistics related to belief factors [3]. The Organization for Economic Co-operation and Development [4] reviews Pisa 2012 and states that students lack perseverance, lack of motivation in learning mathematics, lack of confidence in math skills and higher levels of mathematical anxiety. Furthermore, through good mathematical beliefs, a pre-service teacher is expected to be able to realize a potential situation to be able to think mathematically advanced. The implementation of mathematical beliefs for pre-service math teacher students in learning is one of the important steps that need to be instilled and developed. [5] conclude that reflection of belief is an effective central element in teacher education and professional development. The authentic teacher development model and its benefits for the implementation of teacher professional development include: recognizing the teacher's situation, understanding the teacher's knowledge of mathematics, and the beliefs or beliefs of teachers about the teaching of mathematics itself [6]. That to understand learning done by mathematics teachers, it is not enough to only analyze aspects of their knowledge about mathematics and learning alone, but must also involve aspects of beliefs and conceptions that are adopted [7]. Based on the understanding of beliefs and paying attention to aspects of mathematics learning concerning the material, methods, approaches, models, media, and evaluation techniques, the measured aspects include: students' beliefs about mathematical characteristics, students' beliefs about their own abilities, students' beliefs about the learning process and student confidence in the usefulness of mathematics [8].

To be able to send pre-service teacher students to achieve the goal of learning mathematics that has confidence, the management or approach to mathematics learning that is designed can be done using Valsiner zone theory. This is because the Valsiner Zone theory has several zones in learning that are capable of constructing student knowledge. Valsiner theory is the development of Piaget's theory of cognitive development and the theory of zone of proximal developmental (ZPD) and constructivism of Vygotsky. Proposes Piaget's development theory representing constructivism, which views cognitive development as a process in which children actively build systems of meaning and understanding of reality through their experiences and interactions [9]. Vygotsky argued like Piaget that students shape knowledge as a result of students' own thoughts and activities through language. A person's cognitive development is caused by schemata changes, namely the structure of organized knowledge in the person's mind. This schema always interacts and adapts to its environment through a process of assimilation and accommodation, in accordance with the constructivism philosophy that learning is a process of constructing knowledge. This means that students will better understand something because they are directly involved in fostering new knowledge so that students will be able to apply their thinking skills in all situations. Review of Revisiting Vygotsky's Concept of Zone of Proximal Development (ZPD): Towards a Stage of Proximity stated that without a doubt the idea of ZPD was an indisputable fact and a significant issue that gave birth to a new zone theory of Zone of Proximal Development (ZPD) becomes Zone of Free Movement (ZFM) by Jaan Valsiner [10]. According to Vygotsky the learning process will occur if children work or handle tasks that have not been learned, but the tasks are still within their reach called the Zone of Proximal Development [9]. With regard to the teacher adapted from valsiner theory, Goos [6] states that the process of teacher learning or development is determined by a variety of interrelated factors that are useful for analyzing the extent to which teachers can adopt new teaching practices. These factors are grouped into three zones, namely the Zone of Proximal Development (ZPD) being the Zone of Free Movement (ZFM), and the Zone of Promotion Action (ZPA). ZPD states the teacher's knowledge and trust. This zone includes teacher knowledge and disciplines such as mathematics and teaching strategies and teacher beliefs in the mathematics discipline. For example, the teacher's beliefs about mathematics are important to be taught and how to best teach them. In particular the design of learning in this study was designed through learning based on Valsiner theory to increase mathematical confidence.

2. Experimental Method

The method used in this study is quasi-experimental, with the study population namely students of mathematics education pre-service teachers at Siliwangi Tasikmalaya University and the sample is students who take the probability theory courses in semester V which consists of one experimental class with a total of 42 people and one control class totaling 40 people in the Mathematics Education Study Program. Sampling is randomly based on class. Data collection techniques are in the form of non-test, namely mathematical confidence scale. The data analysis technique uses two average difference tests from two groups. Data obtained in total and categorized based on MPA upper, middle and lower. In the experimental class the students were grouped into 7 groups with each group consisting of 5 to 6 people with heterogeneous abilities, each group placed students with MPA upper, middle and lower this was done so that each group could contribute so that learning could be more interactive.

3. Results and Discussions

3.1. Descriptive Analysis of Data Increasing Pre-Service Teachers Mathematical Beliefs (MB)

These mathematical beliefs were analyzed based on the modeling of learning and the upper, middle, lower and total MPA categories, with the data obtained from the results of the pretest, posttest consisting of averages, standard deviations, and normalized gain. The following table 1 presents a descriptive analysis of student MB data.

Table 1. Description of Student MB Data Based on MPA Model and Category

Category of MPA	Data Statistics	Modeling in Learning					
		LBVT		Avarege Normalized Gain LBVT	CL		Average Gain Normalized of CL
		Pretest	*Posttest*		*Pretest*	*Posttest*	
Upper	n	12	12	12	10	10	10
	Avarage	66,08	90,67	0,73	57,40	71,40	0,33
	standard deviation	1,676	1,497	0,037	2,066	1,430	0,020
Midle	n	21	21	21	19	19	19
	Avarage	56,62	80,67	0,56	50,11	63,00	0,26
	standard deviation	3,309	3,638	0,057	2,470	2,944	0,025
Lower	n	9	9	9	11	11	11
	Avarage	46,44	70,67	0,45	40,64	51,64	0,19
	standard deviation	2,128	2,291	0,039	2,111	2,908	0,021
Total	n	42	42	42	40	40	40
	Avarage	57,14	81,38	0,58	49,32	61,98	0,26
	standard deviation	7,459	7,667	0,111	6,577	7,751	,057

Based on table 1, the description of student MB data based on modeling and MPA categories are as follows:

It can be seen in the table that there is an increase in student MB in probability theory courses, both in the LBVT class and in the CL class. Further improvement was seen in MB students with higher LBVT modeling compared to CL, it can be seen from the average gain of normalized gain students in the upper, middle and lower MPA categories in the experimental group (LBVT) compared to the normalized gain average of students in the MPA category upper, middle and lower with the control group (CL) even though both groups are in the medium category.

The overall description of the increase in student MB as discussed above has not shown a significant difference when viewed from various factors. The following is a bar diagram of student MB enhancement based on LBVT and CL modeling.

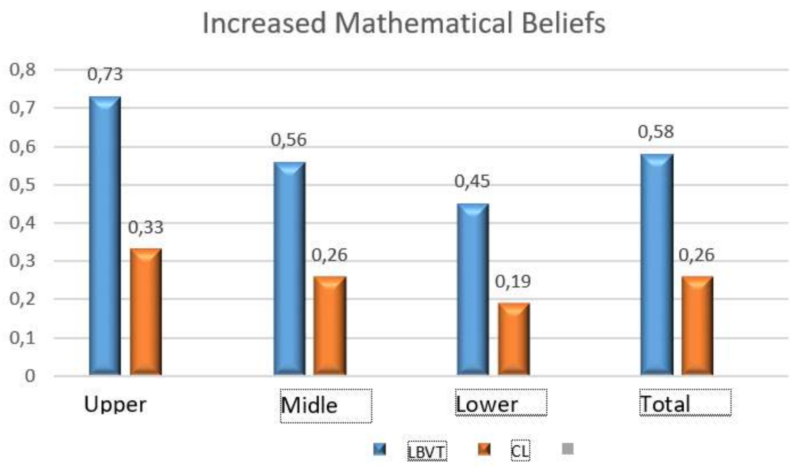

Figure 1. Average Increase in Pre-service Teachers Beliefs

3.2. Inferential Analysis of Data on Increasing Pre-Service Teachers Mathematical Beliefs.

The data processed to find out the increase in pre-service teachers mathematical beliefs is from normalized gain values Mathematical beliefs obtained by students. The increase of MB students who use LBVT modeling shows that MB improvement data based on LBVT modeling comes from a population that is not normally distributed, while for the increase in MB students who use CL modeling it is found that MB improvement data based on CL modeling comes from a population that is normally distributed.

Furthermore, the average difference test for Student MB Improvement Based on the LBVT and CL decision modeling from Mann-Whitney U statistical test on MB with LBVT and CL models was rejected, this means that there was an average difference in the increase of MB students using learning based on LBVT is significantly better than students who study conventionally (CL).

Furthermore, the homogeneity of the variance of the data was tested by using the Levene test, and it was found that the data on the increase in student MB based on learning modeling had a non-homogeneous variance.

Next, testing the difference in student MB enhancement based on LBVT and CL modeling can be done through t-test. The test results show that there are differences in the average MB enhancement data based on learning modeling that get LBVTsignificantly better than students who get CL.

3.3. Testing Differences in Increasing MB by MPA category

Post hoc Games-Howell test results of differences in average gain normalized MB based on MPA categories of the upper, middle and lower for the category between upper MPA and middle, between upper and lower MPA, between middle and upper MPA, between middle and lower MPA, between the lower MPA and the upper, between the bottom MPA and the middle all show that Sig. $<\alpha = 0.05$, which means that there is a significant difference in the increase in student MB between the MPA category. MPA levels that are positive are 0.130 with the upper category and and MPA level the middle category means that the average student MB score from the MPA level in the upper category is better than the MPA level in the middle category, then also for the MPA level which is positive 0.240 with the upper category and the MPA level in the lower category means that the average student MB score from the MPA level in the upper category is better than the lower category MPA level. As for the MPA level which has a positive value of 0.110 with the middle category and MPA level the lower category means that the average student MB score from the MPA level of the middle category is better than the lower category MPA level.

The results obtained show that for the MPA level with the upper, middle, lower and total categories, the effect is greater in increasing MB students in other words, LBVT modeling can be said to be successful in increasing MB in students in all MPA categories.

The next test is the Post Hoc test - One Way Anova test, this test intends to see the difference in normalized MB student gain data for each MPA category. The testing criteria are as follows, if the variance of the data group is homogeneous or in other words not different then the test conducted is the Bonferroni test, and if the variance is different or not the same then testing is done using the Games-Howell test. The test results show that the normalized gain analysis of MB students who get LBTV and CL variance is not homogeneous therefore the next test is the Games-Howell test.

The results of the homogeneity test of normalized MB gain data based on MPA Total and learning modeling show that the decision of H0 is rejected which means that the normalized gain variance data for MB increases based on the total MPA category is not homogeneous. So testing the Post Hoc test - One Way Anova uses the Games-Howell test.

The following table is the result of MB normalized gain analysis from the three MPA categories:

Table 2. Post Hoc Test Results Difference in Gain Average Normalized BM by MPA Category

Modeling	**Statistic Test**	**MPA Level (I)**	**MPA Level (J)**	**Mean Difference (I – J)**	***Sig.***	**Result**
LBTV dan CL	*Games-Howell test*	Upper	Midle	0,130*	0,037	There is a difference
			Lower	0,240*	0,000	There is a difference
		Midle	Upper	-0,130*	0,037	There is a difference
			Lower	0,110*	0,022	There is a difference
		Lower	Upper	-0,240*	0,000	There is a difference
			Midle	-0,110*	0,022	There is a difference

Table 2. Post hoc Games-Howell test the difference in average normalized gain of MB based on the total MPA category of top, middle and bottom for the category between the upper and middle MPA, between the upper and lower MPA, between the middle MPA with the upper, between the middle MPA and the lower , between the lower MPA and the top, the lower MPA with the middle all indicate that Sig. $< \alpha = 0.05$, which means that there is a significant difference in the increase in student MB between the MPA categories. It can be seen also in table 2 that for the MPA level the positive value of 0.130 in the column (IJ) with the upper category (I) and the MPA level in the middle category (J) means that the average MB score of the upper MPA level category (I) better than the MPA level in the middle category (J), then also for the MPA level which has a positive value of 0.240 in the column (IJ) with the upper category (I) and the lower category MPA level (J) means that the average MB score students from the upper level (I) category of MPA are better than the lower category MPA level (J). As for the MPA level which has a positive value of 0.110 in the column (IJ) with the middle category (I) and the MPA level in the lower category (J) means that the average MB score of the MPA level in the middle (I) category is better than the MPA level. lower category (J).

From the results in table 2 it is shown that for the MPA level the upper, middle, lower and total categories have more influence in increasing student MB in other words LBTV modeling can be said to be successful in increasing MB for students in all MPA categories.

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4. Conclusion

The growing sense of confidence in students is because they feel happy in the LBVT process students are given the freedom to interact both through inter-group and between groups so that they can express themselves optimally in uncovering and finding solutions to any problems given in teaching materials.

- In total, the increase in students' mathematical confidence in LBVT is higher than CL class, with moderate category on LBVT and low in CL.
- Based on the MPA level, it was concluded that the increase in mathematical confidence at the upper, middle and lower MPA levels in the LBVT group was higher compared to the CL group.

Inferential analysis results

- In total, it was concluded that there was a difference in the average of MB improvement data based on learning modeling that gained LBVT significantly better than students who received CL.
- Based on the level of MPA, LBVT and CL in the upper, middle, lower and total MPA category, it was concluded that there was an average difference in the increase in student MB based on the upper, middle, lower and total MPA categories that used learning based on Valsiner theory (LBVT) significantly better than students who study conventionally (CL).
- Through the post hoc test, conclusions are drawn to the MPA level with the upper category better than the MPA level in the middle category, then also the upper MPA level is better than the lower category MPA level. As for the MPA level with the middle category is better than the lower category MPA level.

The conclusion of the Hoc post test for MPA level with the upper, middle, lower and total categories is more influential in increasing student MB in other words LBVT modeling can be said to be successful in increasing MB in students in all MPA categories.

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