International Journal of Science and Applied Science: Conference Series P-ISSN: 2549-4635
Int. J. Sci. Appl. Sci.: Conf. Ser., Vol. 2 No. 1 (2017) E-ISSN: 2549-4627
International Conference on Science and Applied Science 2017 doi: 10.20961/ijsascs.v2i1.16696

Improving ability mathematic literacy, self-efficacy and reducing mathematical anxiety with learning Treffinger model at senior high school students

Hafizh Nizham[1,a)], Suhendra[1,b)] and Bambang Avip P.[1,c)]

[1]Department of Mathematics Education, Postgraduate School, Universitas Pendidikan Indonesia
Jl. Dr.Setiabudhi No. 229, Bandung 40154, Indonesia

E-mail:[a)] hafizhnizham@yahoo.co.id
[b)]suhendra_upi@yahoo.com
[c)] bambang_avip@yahoo.com

Abstract. This study is a Quasi Experimental study with the design of The Pretest-Post-Test Non-Equivalent Group Design. Population in this research is all student of class X SHS in South Jakarta. Sampling is done by purposive sampling, to obtain an experimental class and control class. In the experimental class, students learn with Treffinger learning model and control, class learning with conventional learning. This study is also to examine the differences of self-efficacy improvement and students literacy skills, and decreased students' mathematical anxiety. Also, this study also examines the relevance of early mathematical abilities (high, medium, low) with improving students' math literacy skills. The instrument used in this research is literacy skill test, self-efficacy scale, mathematical anxiety scale, observation sheet, and student interview. Data were analyzed by t-test, one-way ANOVA, and two lines. From the results of the data, it is found that: (1) The improvement of literacy ability of students who are learned with Treffinger model learning is not significantly higher than students who learn with conventional. (2) The self-efficacy of students who learning with the Treffinger model learning is better than the student that is learning by conventional. (3) The mathematical anxiety of students learning with Treffinger model learning reduces better than students learning with conventional. (4) There is a difference in the improvement of students' mathematical literacy skills learning by learning the Treffinger model and students learning with conventional learning based on early mathematical abilities. (5) Student response to Treffinger model learning is better than students learning with conventional learning. Therefore, learning model Treffinger can be an alternative model of learning to improve students' mathematical literacy skills, and self-efficacy students, and able to reduce mathematical anxiety.

1. Introduction

Learning mathematics should make students have the ability to understand, reasoning, problem-solving, and ability in applying concepts in everyday life. The description states that students should have the ability of mathematical literacy as what has been described by Niss states that mathematical literacy includes: (1) reasoning and mathematical thinking, (2) mathematical argument, (3) Mathematical communication, (4) Mathematical modeling, (5) Submission and troubleshooting, (6) Mathematical representation, (7) Symbols, and (8) Media and technology. [1]

Int. J. Sci. Appl. Sci.: Conf. Ser., Vol. 2 No. 1 (2017) doi: 10.20961/ijsascs.v2i1.16696

The OECD states that the mathematical literacy is the individual's capacity to recognize and understand the role that mathematics plays in real life, and be able to provide appropriate judgments, utilizing mathematics that meets the needs of a constructive, caring, [2]. Furthermore, the definition of mathematical literacy refers to the individual being able to recognize and identify opportunities to use mathematics and then provide the mathematical structure for problems presented in some contextual form, capable of applying mathematical concepts, facts, procedures, and reasoning to solve mathematical problems Which are formulated to derive conclusions, as well as the individual's ability to contemplate mathematical solutions, outcomes, and interpret them in the context of real-life problems.

In general, students with mathematical literacy can: (1) answer questions in the general context, identify information and solve problems using routine procedures; (2) interpret and recognize situations that require immediate inference; (3) implement the procedure appropriately, using representations from various sources, state the reasons used, and communicate interpretation and reasoning; (4) working effectively with concrete models and contexts it possesses, choosing and integrating all kinds of representations and observing their interrelationships with the real world; (5) working with a model in complex situations, understanding all possible constraints or factors (constraints) that may exist, selecting, differentiating and assessing some strategies to solve complex problems associated with the model by using profound reasoning and mathematical connection capabilities Good, reflect and communicate ideas and thoughts, apply deep insights by using new strategies and new approaches in depth, interpret and present their arguments.

In addition to the formation of mathematical literacy skills, good mathematics learning should also consider the psychological problems of students where with the development of positive psychological aspects are expected to influence the formation of students' mathematical literacy skills. One of the psychological aspects that must be developed in the learning of mathematics is self-efficacy which is the most important concept of individual affective properties. Self-efficacy by Bandura, in its capacity, to be able to regulate the activities necessary for a particular performance, and succeeded in doing so [3]. In other words, students who have self-efficacy can do the job well. In line with that, according to Santrock, self-efficacy is someone's belief in his ability. Once the student faces a task and exam from the school, students with higher self-efficacy will do the task and exam more confidently [4].

Furthermore, self-efficacy is important in solving other problems of mathematical discomfort. According to May anxiety arises in proportion to the beliefs of individual beliefs against individual disabilities. The more individuals feel unsure of their ability, the more anxious they will become [5]. Thus, the learning process must be packaged in such a way that in the learning of mathematics students do not experience anxiety. Therefore, students 'beliefs and perceptions of the subjects being studied are important in tackling students' anxiety and will certainly have an effect on student achievement in learning.

Int. J. Sci. Appl. Sci.: Conf. Ser., Vol. 2 No. 1 (2017) doi: 10.20961/ijsascs.v2i1.16696

However, the phenomenon that occurs in the education of Indonesia, especially in the learning of mathematics is the process of learning mathematics in general only improve the ability of low-level thinking procedural and teachers do not put forward the activities of the class that sharpening thinking is done only do lectures in the classroom. In other words, the learning process has not been able to develop the ability of mathematical thinking to a higher level. Not infrequently also learning mathematics in schools only teach how to calculate and find out the results of the problem as submitted by According to Novotna, most teachers prefer algorithm case problem suitable for a clear solution, in which case there is no doubt about the choice of suitable algorithm. In this case, it does not have to undergo a painstaking procedure looking for this algorithm and can eliminate the often lengthy and difficult way to catch a problem [6]. The teacher's role is simpler; he only detects the student was making a mistake and assesses the truth of their solution. That is the reason why teachers often choose problems in which case is an appropriate and easy search algorithm also often hints at the appropriate splitting procedure.

For that in need of learning that can help improve mathematical literacy and create an atmosphere of learning that attracts students so as to improve student self-efficacy as well as reduce or reduce anxiety in learning mathematics. To solve the problem of the problem the author on the classroom learning will be using the Treffinger model learning. According to the Sofa states that the learning model with the development of Treffinger is for the development of the learning process of the main concern [7]. In the first stage of the Treffinger model, students can think directly without fear of rejection. In this model, it also focuses on the involvement of cognitive and affective skills at each level of this model,

Treffinger shows the interdependence between the two to encourage the way students can think directly without fear of rejection. Besides the meaningful process is also used divergent thinking process (the process of thinking of various directions and generate many alternative solutions) and the process of thinking convergent (thinking process that seeks a single answer). Learning from the Treffinger model according to Guildford consists of the following steps: basic tools, practice with the process, and working with real problems. Basic tools include divergent thinking skills (think creatively). In the introduction, divergent functions include the development of fluency, flexibility, originality, and elaboration in thinking. Practice with the process is giving students the opportunity to apply the skills learned at stage I in practical situations. The introduction in phase II includes application, analysis, synthesis, and assessment (evaluation). Working with real problems, that is, applying the skills learned in the first two stages to real-world challenges. Here students use their abilities in ways that are meaningful to their lives [8].

2. Experimental Method

This research is a quasi-experimental research applying Learning Treffinger Model. This method is used to see whether there is an increase in mathematical literacy ability of two groups of students who get different treatment. That is, the experimental group

was given special treatment in the form of learning using Treffingerr model, while the control group got learning with the conventional model (PK). The research of quasi-experiments in this study was chosen because the researcher was not able to completely control the variables from outside the research that could threaten internal validity. Researchers are only able to control certain independent variables that potentially affect the dependent variable so that the experimental and control class conditions remain balanced. The research design used is that Sugiyono stated that Nonequivalent Control Group [9], briefly the design of the study is presented in Figure 1 below:

Experimental class	O	X	O
Control class	O		O

Figure 1 ***Nonequivalent Control Group Design***

O = Giving pretest literacy capability for experimental class and control class
X = Treffinger Learning Model
------- = Samples are not randomly grouped

The sample in this study consists of 2 classes with the number of 40 people. The first class is an experimental class the number of students 18 people who get the learning of mathematics using Learning Model Treffingerr and second class as a class control the number of students 22 people who get conventional learning.

3. Results

Inference analysis of n-gain values normalized students' mathematical literacy ability is done with the aim to answer hypothesis 1 related "The ability of student's mathematical literacy in learning using Treffinger model learning improved better than the students who in learning using conventional learning. The data used in this analysis is the normalized n-gain value data of students' literacy capability obtained from the n-gain formula using the pretest and posttest values of the experimental class and control class students. Statistical analysis of the n-gain value data normalized students' mathematical literacy capability was done by using the difference test of the two group's meanings freely. Before using the test difference of the average of the two groups of mutual freedom, it is necessary to do prerequisite test that is normality and homogeneity test.

Table 1. Average Difference Test Result of N-Gain Value Ability of Student Mathematical Literacy

t-test for equality of means			Conclusion	Description
T	*df*	Sig.(2-tailed)		
1,528	38	0.135	H_0 received	No Higher significantly

The table above shows that based on the test results the difference of two average n-gain value of mathematical literacy ability of students obtained sig value. (2-tailed) Of 0.135. Because the hypothesis used is one side (one tailed) that is H_1; $\mu_e > \mu_k$, Then the

value of significance used is a *sig. (1-tailed)* That is $\frac{0,135}{2}$ or 0,0675. Based on the test criteria, sig. (1-tailed) is greater than $\alpha = 0,05$ So H_0 is accepted. Thus obtained the conclusion that the average increase in the ability of mathematical literacy students who obtain learning model Treffinger learning model is not significantly higher compared with students who received conventional learning.

It was previously known that the N-Gain scores of the experimental and control classes met the assumptions of normality and homogeneity, and it has also been concluded that the improvement of the mathematical literacy ability of students acquiring learning by the model of Treffinger learning model was not significantly higher than that of students who received conventional learning. To the authors to test the effect size is a measure of the magnitude of the effect of a variable on other variables, the magnitude of the difference or relationship, which is free from the influence of the size of the sample.

Table 2. Effect Size Learning Effect of Treffinger Model on Literacy Capability

Class	$\bar{x}$	S	$S_{combination}$	*Effect Size*
Experiment	0,61	0,16	0.196	0.5
Control	0,51	0,23		

In the table above shows that the influence of Treffinger model learning on improving the ability of mathematical literacy is 0.5. Based on the interpretation of the effect size given by Coe, the effect size of 0.5 means that 69% of students studying with conventional learning have an increase in mathematics literacy below the average of classes studied by Treffinger model learning based on the classification effect size of 0.5 is classified In the medium classification. [10] Thus, it can be concluded that there is the influence of Treffinger learning model to the increase of literation indicated from the existence of the effect size of 0.5 which states that there is an increase in experimental class literation better than the control class.

In this analysis aims to test the fourth hypothesis: "There is a difference in the improvement of students' mathematical literacy skills taught by Treffinger model learning based on early mathematical ability (EMA)." The experiment was conducted using the difference test of the two groups. The data used are N-gain data normalized ability of mathematical literacy of experiment and control class. The N-gain data normalized the mathematical literacy capabilities of the two classes were grouped according to the mathematical ability of each student i.e., high, medium and low. Then analyzed the mean difference of normalized N-gain between the high experimental group with high control, the moderate experimental group with moderate control and low experimental group with low control. The first step before performing the test is to test the assumption of normality and homogeneity of the N-gain value of the students'

Int. J. Sci. Appl. Sci.: Conf. Ser., Vol. 2 No. 1 (2017) doi: 10.20961/ijsascs.v2i1.16696

mathematical literacy skill of the experimental class and the control class based on each EMA.

Table 3. Summary Result Differences Average N-gain Value Normalized Student Mathematical Literacy Reviewed By EMA

Early Mathematical Ability				
Treffinger Model Learning	**Conventional Learning**	***sig. (1-tailed)***	**Conclusion**	**Description**
High	High	0,348	H_0 accepted	No Significantly Higher
Medium	Medium	0,130	H_0 accepted	No Significantly Higher
Low	Low	0,012	H_0 rejected	Significant Higher

From the table above seen only in the low EMA category, N-Gain students learning with Treffinger model learning are significantly higher than students learning with conventional learning. In contrast to the high and medium categories of EMA, in those categories students who studied with Treffinger model learning were not significantly higher than students learning with conventional learning.

Then to complete the above data about the second hypothesis test in this study is, "mathematics self-efficacy students who learn with learning model Treffinger improvement better than the students who learn by using conventional learning model" in this study used the test equality of two average N -Gain self-efficacy score in the form of t test is used if the self-efficacy score data in both classes meet the normality and homogeneity assumptions. If the assumptions of normality and homogeneity are not met, the Mann Whitney test is used and what if the data is not fulfilled the homogeneity is t tested. The statistical test will be described as follows.

Table 4. Average Difference Test Results Average N-gain Score Normalized Self-efficacy

	N-gain	**Conclusion**	**Description**
Mann-Whitney U	115		
Z	-2,260	H_0 rejected	Significant Higher
Asymp. Sig. (2-tailed)	0,024		

The table above shows that based on the test results, the difference between two mean values of the N-gain self-efficacy of students obtained sig value. (2-tailed) Of 0.024. Because the hypothesis used is one side (one tailed) that is $H_1: \mu_e > \mu_k$, Then the significance value used is a sig. *(1-tailed)* that is $\frac{0,024}{2}$ or 0,012. Based on the test

criteria, sig. (1-tailed) $< \alpha = 0{,}05$ So H_0 is rejected. Thus it is concluded that the average increase in self-efficacy of students learning with Treffinger model learning is significantly better than that of students learning with conventional learning.

Then to complete the above data about the second hypothesis test in this study is, "mathematical anxiety of students who learn with learning model Treffinger reduction is better than the students who learn by using conventional learning model" in this study used the test equality of two average N- Gain scores of mathematical anxiety in the form of t test is used if the mathematical anxiety score data in both classes meet the normality and homogeneity assumptions. If the assumptions of normality and homogeneity are not met, the Mann Whitney test is used and what if the data is not fulfilled the homogeneity is t tested. The statistical test will be described as follows.

In the N-gain of mathematical anxiety in each class, some are negative because of the reduction or decrease in anxiety that occurs after the learning in the experimental class and the control class or N-gain is equal to zero because there is no change in mathematical anxiety to the student.

Table 5. Test Results Average Difference N-gain Reduction Score Normalized Anxiety

	N-gain	**Conclusion**	**Description**
Mann-Whitney U	61		
Z	-3,727	H_0 rejected	Significant Higher
Asymp. Sig. (2-tailed)	0,000		

The table above shows that based on the test results the difference of two average N-gain anxiety score of students obtained sig value. (2-tailed) by 0,000. Because the hypothesis used is one side (one tailed) that is H_1: $\mu_e > \mu_k$, Then the significance value used is a sig. (1-tailed) That is $\frac{0{,}000}{2}$ or 0,000. Based on the test criteria, sig. (1-tailed) $< \alpha = 0{,}05$ So H_0 is rejected. Thus it is concluded that the mean reduction of students' anxiety learning with Treffinger model learning is significantly better than that of students learning with conventional learning.

4. Discussion

The authors also noted some of the students' responses to the Treffinger learning, among others, the students were more active in asking questions, making opinions, making conclusions, or even making examples of cases in daily life so that learning seemed more active although sometimes still seen students did not have a strong self-efficacy Often still looks anxious in learning. From the interview result, it is concluded that the link between self-efficacy, mathematical anxiety, and literacy ability is very influential. If students have self-efficacy, then students tend not to have anxiety which results will improve students' literacy skills. However, if students do not have self-efficacy, then students tend to feel anxiety that the results can adversely affect the ability of student literacy. Basically, every student feels that there are differences in Treffinger model learning that makes them more self-efficacy, and reduces their

mathematical anxiety. The general student response to learning model Treffinger based on self-efficacy indicators are: (1) Being able to overcome the problems faced, (2) Make sure of success in working on the problem, (3) Be brave to face challenges, (4) Be brave to take risks, (5) Be aware of strengths and weaknesses, (6) Be able to interact with others, (7) Being tough or not easily give up.

In addition, there is also a response of students in general to learning model Treffinger based on mathematical anxiety indicators, namely: (1) Being no trouble concentrating. (2) Be not hesitant when facing a difficult math test, (3) Being not worried about learning, (4) Being not afraid of being wrong when working in a new way, (5) Be thorough on the test work, (6) Be comfortable and not feel nervous when giving an opinion, (7) Being not afraid to repair work that is less precise.

However, when compared with the results of the control class interviews there are differences in responses that they often disclose that almost every student thinks it is helpful with the LKS, so they try many exercises about literacy skills. So it can be concluded if they have a good self-efficacy and tend not to have anxiety when learning occurs not because of conventional learning, but because they get the same LKS with the experimental class so that it appears that the high ability class control students are still less likely to have self-efficacy Which is good, and still has a mathematical anxiety this is inversely proportional to the high ability students in the experimental class. Thus, it can be concluded from the results of the observation sheet and interview results that students' responses to the Treffinger learning model are better than the conventional learning model

5. Conclusion

From the results of the data, it is found that: (1) The improvement of literacy ability of students who learning with Treffinger model learning is not significantly higher than students who were learned with conventional learning. (2) The self-efficacy of students who learning with the Treffinger model is better than the student that is learning by conventional learning. (3) The mathematical anxiety of students learning with Treffinger model learning reduces better than students learning with conventional learning. (4) There is a difference in the improvement of students' mathematical literacy skills learning by learning the Treffinger model and students learning with conventional learning based on early mathematical abilities. (5) Student response to Treffinger model learning is better than students learning with conventional learning. Therefore, learning model Treffinger can be an alternative model of learning to improve students' mathematical literacy skills, and self-efficacy students, and able to reduce mathematical anxiety.

References

[1] Kusumah, (2011). Literasi Matematis. Prosiding Seminar Nasional Pendidikan MIPA. Lampung: FKIP Universitas Lampung.

[2] OECD. 2013. PISA 2012 Results: What Students Know and Can Do: Student

Performance in Mathematics, Reading, and Science. (Volume 1). Diakses Tanggal 31 January 2017 dari https://www.oecd.org/pisa/keyfindings/pisa-2012-results-volume-I.pdf

[3] Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. Educational Psychologist.

[4] Santrock, John. W. (2007). Psikologi Pendidikan. Jakarta: Prenada Media Group

[5] Sujarwo, S. (2014). Hubungan Antara Efikasi Diri Dengan Kecemasan Belajar Matematika Pada Siswa Ips Kelas Xi Sma Karya Ibu Palembang. Jurnal Ilmiah PSYCHE Vol.8 No.1 Juli 2014: 61-71. Palembang: Fakultas Psikologi Universitas Bina Darma

[6] Novotná, J. (2014). Problem Solving in School Mathematics Based on Heuristic Strategies. Journal on Efficiency and Responsibility in Education and Science, Vol. 7, No. 1, pp. 1-6, online ISSN 1803-1617, printed ISSN 2336-2375

[7] Alhaddad, A (2015). Enhancing Students' Communication Skills Through Treffinger Teaching Model. IndoMS-JME, Volume 6, No. 1, January 2015, pp. 31-39. Palembang: Universitas Sriwijaya.

[8] Faridatun, T (2011). Pembelajaran Matematika Dengan Setting Model Treffinger Untuk Mengembangkan Kreativitas Siswa. PEDAGOGIA Vol. 1, No. 1, Desember 2011. Sidoarjo: Universitas Muhammadiyah Sidoarjo

[9] Sugiyono (2008). Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta. Cet. Ke-4.

[10] Coe, R. (2002). It's The Effect Size, Stupid: What The Effect Size Is And Why It's Important. Makalah Pada The British Educational Research Association Annual Conference, Exeter.