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THE ROLE OF PROBLEM POSING MATERIALS IN STUDENT'S SELF-EFFICACY BELIEFS

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ABSTRACT
The aim of this study is to analyze the effect of problem posing materials on students self efficacy beliefs. The reason why we make a research on this study is really specially designed materials used during the lessons have positive effect on students' beliefs or not. One of the study to test the other two groups formed the control group used the method of experimental study. There are 20 questions in the self-efficacy test whose first category, second category, third category are respectively affirmative, cognitive and conative. First of all, pilot study was conducted with 128 students from 9th grade students to measure the validity and reliabilty of the test. Data was obtained from experimental school students and reliability of the test was measureb by using SPSS statistical program as .85. The results of the research showed that there is positive correlation between used problem posing materials and self efficacy beliefs of the students'affective, cognitive and conative domains.
Key Words: Self-efficacy, affirmative, cognitive, conative, problem posing**.**

INTRODUCTION

Self efficacy is mostly defined as the one's belief in his/her capabilities to achieve a goal or an outcome and to produce different level of performances (Bandura, 1991). Motivation, cognitive, affective and selection are the parts of self-efficacy. How people feel themselves, how they see the life and how they think toward the events is determined by self-efficacy. Self-efficacious students are motivated by themselves and at least they reach their goals. And students with low self efficacy are not motivated easily and they think that they have negative tendencies to achieve a goal (Bandura, 1995; Margolis & McCabe, 2006). Bandura (1989a) has identified factors that are likely to reduce students' feelings of positive self-efficacy:
1. Instruction that is an important reason for people to gain positive or negative self-efficacy. Teaching strategies used in the classroom can yield a difference to students' self-efficacy (Fencl & Scheel, 2005).
2. Practices is performed in competitive way has an negative effect on self-efficacy
3. Sometimes teachers or instructors categorize the students according to their abilities that make negative effect on self efficacy. Students gain self-efficacy in different situations such as while they solve questions, observing a friend who is solving questions or doing any activity, During the interaction or dialogue with the teachers and mostly the emotional directions driven by themselves.

Schunk (1989) has some approaches about doing any activity with the children regularly that is correct way of self-efficacy ,the students develop or gain many mathematical skills and verbal abilities that increases perceptions on self efficacy helping learners set specific, attainable goals;
1. During the dialogue with the students teachers approach is very important to shape self-efficacy. The behavior of the teachers may give positive or negative self-efficacy. Teachers conduct useful communications with students may change negative self-efficacy to positive direction.

2. Schunk advises that teachers should motivate the students to express their feelings in order to understand the beliefs correctly.
3. Tasks should be designed for the students to have positive usable ways that foster the cognitive processes.
4. Most preconceptions and anxieties, fears are quickly to be removed by instructors during any social interactions.

Bandura (1991) states that type of learning environment and teaching method can improve self efficacy during any educational activity in the classroom. Research was conducted by Fencl and Scheel have similar results. People's beliefs in their efficacy are developed by four main sources of influence.

- Mastery experiences,
- Observing people similar to oneself manage task demands successfully,
- Social persuasion that one has the capabilities to succeed in given activities,
- Resulting from physical and emotional conditions.

Studies show that teachers who have more self-efficacy on their teaching may easily motivate their students and empower the students' cognitive development. The teachers after that use many ways to improve and enhance the students' beliefs. On the other hand the teachers with low self-efficacy have negative effects on the development on students' self-efficacy (Woolfolk Hoy, 2004). The importance of tasks on the development of beliefs of students is another factor that if the tasks are more difficult, the students will have anxiety about achievement of the course or if the tasks are too easy, the students are bored during the lessons.

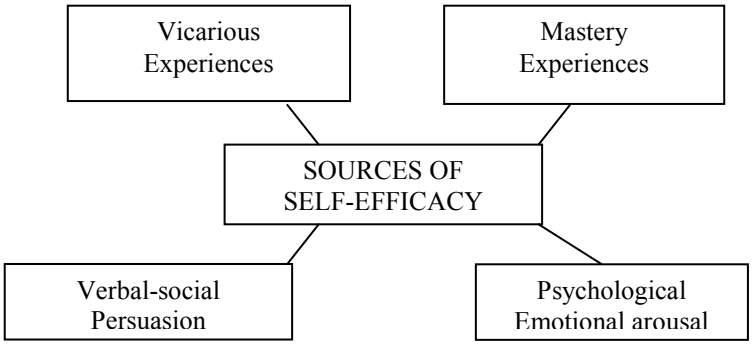

Figure 1: Sources of Self-Efficacy, (Bandura, 1997)

Mathematics self-efficacy has been considered as an important factor for students' judgments of their capabilities to solve specific math problems, perform math-related tasks, or succeed in math related courses (Betz & Hackett, 1989). Zimmerman (2000) indicates that self-efficacy beliefs are more important factor that any other factors in mathematics education. It determines achievement, attitudes and future careers of the students. Confidence of the students through the process of learning mathematics is considered as a future predictor of mathemetics performance (Hackett, 1985). Students with high self-efficacy are better on mathematics performance than on general mental ability (Pajares & Kranzler, 1995). According to studies, self efficacy beliefs especially in problem-solving are a stronger predictor of mathematics performance (Pajares & Graham, 1999). Collins (1982) found that students who have high self-efficacy on working with difficult tasks are more resistive than the students who have low self-efficacy. Pajares and Kranzler (1995) found that the influence of self-efficacy on math performance was as strong as was that of general mental ability. Across ability levels, students whose self efficacy is higher are more accurate in their mathematics computation and show greater persistence on difficult items than do students whose selfefficacy is low (Collins, 1982).

The correlation between self efficacy and motivation is high on the performance of Mathematics (Pintrich, 1999) since students with high level of SE are motivated and they achieve better than others. Results of many researches also indicate that there is a positive correlation between self efficacy beliefs and mathematical abilities and negative correlation between math anxiety and self efficacy (Fennema & Sherman, 1978). Self efficacy beliefs are also more affected by mathematics instruction. Students with low efficacy don't want to participate the math or math related lessons (Galassi, 1984). Many researchers indicate that self efficacy beliefs are one of the reasons of motivation that has a positive effect on mathematics achievement. Bandura and Schunk (1981) showed that there is a high correlation between self efficacy beliefs and school tasks performances. But According to Bandura this is not similar with the self-concept that is formed as a result of experiences or as a result of evaluation of others.

Meanwhile self concepts are general areas and more specific areas according to Shavelson (1983) model. According to result of Brahm Norwich (1987) prior task attainment could be a source of self-efficacy the research also shows that there is no significant relation between self-concept and self efficacy. This finding is similar with the Bandura' view that is self concept variables is not strongly predictive of future self efficacy.

Self-efficacy can be defined as "one's belief that he/she is able to organize and apply plans in order to achieve a certain task" Bandura (1997). Self-efficacy beliefs in problem posing have positive effect on students' mathematics performance (Pajares & Miller, 1995). National Curriculum and Evaluation Standars for School for Mathematics (NTCM, 1989) expilictly states that "students should have some experince recognizing and formulating their own problems, an activity that is the heart of doing mathematics". It also states that importance duty of the mathematics teachers are to provide opportunities for students to pose their own problems: "Students should be given opportunities to formulate problems from given situations and create new problems by modifying the conditions of a given problem". The statements indicates that problem posing in mathematics teaching and learning is nearly similar meaning of constructing knowledge by yourself that fosters self efficacy. While problem posing enriches the students'ability to pose problems, self efficacy is gained by the students at the same time. Self-efficacybeliefs that are constructed through problem posing instruction also increases mathematics achievement (Bandura & Locke, 2003). The correlation between self efficacy and motivation is high on the performance of Mathematics (Pintrich, 1999). Problem posing increases motivation and optimism (Brown & Walter, 1983). If you combine these two statements, you can say that problem posing has a positive influence on self efficacy. Moreover problem posing reduces anxiety that is a negative factor on self efficacy beliefs. Problem posing which gives students more freedom and dialogue with the teachers provides a good development for self efficacy. Kliman and Richards (1992) accepted that problem posing enlarges the inner control of the students. Inner control is an effective component of self efficacy construction.

METHOD

Research Design

For research two classes were formed one experimental class and another control class. According to data obtained before and after study experimantal research methodology is used. Pre test and post test control grouped experimantal research design is also used. In this kind of design experimental and control group exists and the method is called quasi experimental design (Gronlund, 2000). The method is aimed to compare the varibles of the study of which they are gathered by quantitively and the results can be discovered by cause effect relationship. This method can also be called as non-equivalent control grouped design. Participants of mathematical power Scale.There were (N=58) students in the study and all of them girls from Girls College. Two classes were formed from the students randomly. 28 students from 8A is experimental class and 30 students from 8B were the control group students. Participants in the case study. Participants of the study were selected among five classes according to

their last year mathematical average scores. Two classes were formed because their mathematical school documents nearly have the same value (3.83 and 3.79) out of 5.

Instruments

Mathematics efficacy scale that was adapted from Tanner and Jones (2003) includes 20 statements which were sorted into three domains such as affirmative, cognitive and conative. Affect is a student's internal belief system (Fennema, 1989). The affective domain includes students' "beliefs about themselves and their capacity to learn mathematics; their self esteem and their perceived status as learners; their beliefs about the nature of mathematical understanding; and their potential to succeed in the subject" (Tanner & Jones, 2003). Questions from 1 to 8 covers from affective domain, questions from 9 to 15 from cognitive domain and questions from 16 to 20 from conative domain. Each domain includes positive and negative questions. The cognitive domain considers students' awareness of their own mathematical knowledge: their strengths and weaknesses; their abstraction and reification of processes; and their development of links between aspects of the subject (Tanner and Jones, 2000). Cognition refers to the process of coming to know and understand; the process of storing, processing, and retrieving information. The cognitive factor describes thinking processes and the use of knowledge, such as, associating, reasoning, or evaluating. Conation refers to the act of striving, of focusing attention and energy, and purposeful actions. Conation is about staying power, and survival. The conative domain includes students' intentions and dispositions to learn, their approach to monitoring their own learning and to self-assessment. Conation includes students' dispositions to strive to learn and the strategies they employ in support of their learning. It includes their inclination to plan, monitor, and evaluate their work and their predilection to mindfulness and reflection. The reliability of the test that was found by using SPSS.16 was .89 To evaluate the reliability we use five Likert scale shown below. Before we apply the scale experimental and control groups, the test was applied to 9^{th} grades in the same school and the data was analyzed and Cronbach's Alpha was calculated as .89 Three different categories were used in the scale as affective, cognitive and conative.

Data collection

Before we construct the groups an efficacy scale was applied to both groups. The data was obtained according to points that were gathered by students. And for each domain of the scale was considered separately. For example the results of the students according to affective domain were group and divided by two equal averages and the same methods for the other domains were repeated. Our aim is to construct the groups at an equal rate before study. Moreover the points were given to the students according to their activities during the lesson. The activities were problem posing tasks that were prepared for this study. When we construct the groups, we consider the average scores of the self efficacy scale in order to equate the students.

Data analysis

Data was analyzed by following way; the points that students collected during lessons in experimental group and the self efficacy evaluation scores of the same students were the post test results. For control groups just post self–efficacy results were considered. The post test and pre test results of both groups were analyzed by SPSS.16 statistical program.

FINDINGS AND RESULTS

Table 1: The Results of Pre-Test for Control and Experimental Group

	N	Mean	Std. Deviation	Std. Error Mean
Control	58	3.0690	1.09002	.14313
Experimental	58	3.0862	.90388	.11869

At the beginning of the study both groups control and experimental shows the nearly similar averages such as control group has an average of 3.06 and experimental group has an average of 3.08. And the averages after problem posing tools used in experimental group has increased 3.9 meanwhile the average for control group is 3.2. So we can say that problem posing tools were used in experimental group has changed the self efficacy beliefs of the experimental groups study.

Table 2: Independent t-Values for Pre-Test

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Control	21.442	58	.000	3.06897 (this is mean not mean difference)	2.7824	3.3556
Experimental	26.003	58	.000	3.08621	2.8485	3.3239

As it was shown that the mean values of self efficacy scores of both groups were 3.06 and 3.08 before the study was started. The experimental and control groups were constructed randomly. Their mathematical marks in their school documents were nearly equal average. T value is not significant. That means there are not significant differences between students in control and experimental groups. This was before application of problem posing tools in experimental groups.

Table 3: The Results of Post Test for Both Groups

	N	Mean	Std. Deviation	Std. Error Mean
Control	58	3.2586	1.06886	.14035
Experimental	58	3.9310	.87584	.11500

Table 3 shows the mean of the self efficacy scores for 3 categories that were affective, cognitive and conative questions. The mean for experimental group after application of problem posing materials during the teaching mathematical concepts was increased from 3.23 to 3.93. That means the effect of tools designed by problem posing plays an important role on the self efficacy beliefs for the students. But the mean of control group that were taught mathematical concepts by traditional ways increased from 3.06 to 3.25. The change of mean in experimental group was 0.85 while in control group was 0.19.

Table 4: Independent t-Values for Post Test

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Control	23.218	57	.000	3.25862	2.9776	3.5397
Experimental	34.182	57	.000	3.93103	3.7007	4.1613

Table 4 shows that t-test is significant and there are a differences in mean scores of experimental groups students that had problem posing materials during the teaching of mathematical concepts. Post test results also indicated that self efficacy beliefs were directly related the lesson materials that were

used during mathematical lessons. The strategy of problem posing lesson designs empowered by posed mathematical tools had very effective in increase of students motivation and interest toward to mathematical lessons. Performance of experimental group students has improved from pre to post test. So Methods of tools based on problem posing techniques were very effective in order to increase students' self efficacy beliefs.

CONCLUSIONS AND RECOMMENDATIONS

The results of the study show that the self efficacy beliefs were affected mostly from the tools that were used in the activity of teaching and learning process. The number of students (n=12) answered the question "There is no capability in me to try in mathematics." was high in pretest. But when we compare the post test especially students from experimental group changed their beliefs about this question after learning the math concepts by problem posing activities that provides the students more participation and freedom to express their ideas easily. Another belief in affective domain that we compared before and after study was the question of "Some people are naturally good at mathematics." Really considerable number of students in pre test believed that mathematics can't be taught but it was inherent. Here the difficulty of the materials that were used by teachers was important. Because some teachers used to teach mathematical concepts by starting difficult tasks that were very difficult to understand for students. Because of this reason students develop such a kind of belief that mathematics cannot be learned easily but it was natural or more and more study required to understand.

Post test results indicated that the students changed this belief in experimental group after studying problem posing activities. The tools prepared as problem posing techniques foster the students cognitive domain in a way of more diverse, a flexible thinking and enhances problem solving skills. This is not only for students but also for students. This idea is similar to (Brown and Walter 1993; English, 1996) that also recommends to the teachers that teachers can prepare lesson materials based on problem posing activities which directly affect the students' understandings of mathematical concepts in the problem posed and solving process. If teachers remember their students' case, they can understand their self efficacy beliefs that were formed basically during the class. Not only to increase the students motivation or interest, was it also a way of effective teaching and learning of mathematics. Bandura (1977) believed that self efficacy beliefs were the combination of three psychological domains that were affective, cognitive and conative. Our self efficacy scale was based on this idea and how we can function three components by using problem posing tools during the mathematical lessons. That's why teachers should not avoid preparing the lesson materials that foster these three components. Flexibility fosters cognitive component and understanding the problem fosters the affective domain.

The results of the study also showed that in affective domain some negative self efficacy beliefs changed because of the effect of tools based on problem posing. The problem posing activities that profits to the students enjoyment, motivation and tendency in the area of interest. These are also components of attitude and self efficacy. In conclusion, what kind of materials which were used to change either positive or negative direction of self efficacy beliefs of the students were many important. Self efficacy beliefs in problem posing should be a part of mathematics teaching and learning. Learning the mathematical concepts to the students, according to study, was directly proportional with self efficacy beliefs that constitute motivation and enjoyment. Also the materials used in problem posing plays an important role not only in cognitive domain of the students but also affective and conative domains were also affected more. To increase the students' affective, cognitive and conative domains of the students, the teachers should increase the interest of the students to mathematics lessons especially during the lecture and problem solving periods. Because research indicated that the students had less interest to the lessons, they have low achievement and low self-efficacy. Moreover students accept that you are good at what you like and you like what you are good

at. The materials designed from teachers were very important in order to increase the motivation and interest for the students. Even if the teachers should be careful to use the first examples just after they finished the subject matter area. The real life examples mostly used in problem posing situations also have positive effects to increase the students' interest. Another thing that teachers should carefully consider that there were some students that have mathematical potential but they don't want to use it during the lessons, this point may be used in group studies if this kind of students get some responsibilities.

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