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by P3 Darmawijoyo

Submission date: 21-Jun-2023 11:41AM (UTC+0700)
Submission ID: 2120126295
File name: P3.pdf (1,017.02K)
Word count: 2948
Character count: 16928

Design of mathematics learning by using role playing to investigate the self-efficacy ability

Design of mathematics learning by using role playing to investigate the self-efficacy ability

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Abstract. This study aims to determine how the use of role playing learning models in mathematics lessons fosters the ability of self-efficacy of high school students. This article is part of a large study with the title Combinatoric Material Learning Design Using Indonesian Realistic Mathematics Education to See Students' Self-efficacy Ability. Mathematics subject matter which is the object of research is the topic of combinatorics. The research method used is design research, consists of three stages: introduction, field trial and analysis. Data collection techniques were obtained through video recordings, questionnaires, and interviews. The subjects of the study were students of the SMAN 15 Palembang. The data analysis technique is done by describing the questionnaires filled by students. The results showed that by using the context of role playing, it could foster the ability of self-efficacy in high school students with good categories.

1. Introduction

The purpose of the mathematics course shows that at the elementary and secondary level through mathematics lessons is to prepare students to be able to face the changing circumstances in life and in an ever-evolving world, through practice acting on the basis of logical, rational, critical, honest, efficient and effective.This is in accordance with the general objectives of mathematics learning formulated by the National Council of Teachers of Mathematics [1], namely: (1) learning to communicate (*mathematical communication*); (2) learning to reason (*mathematical reasoning*); (3) learning to solve problems (mathematical problem solving); (4) learning to associate ideas (mathematical connections); (5) the formation of positive attitude toward mathematics (*positive attitudes toward mathematics)*. While based on the 2013 curriculum (2017 revision) that learning activities in schools are required to form three major components that are related literacy skills, character building, and competence [2].

*Self-efficacy*or self-ability to influence expected results, according to various opinions of experts, defined as a human belief in their ability to exercise a number of measures of control over their self-function and the events in their environment [3]. A believer can do something, has the potential to change events in his environment. Keep in mind that *self-efficacy* is one component of *self-regulated* (*self*-reliance).Confidence is the positive attitude of an individual that enables him to develop a positive judgment both of himself and himselfto the environment/situation it faces. To foster a sense of confidence that is proportional then the individual must start from within oneself. This is very important considering that only the individual concerned can overcome the lack of confidence he

is experiencing.According to Bandura [4], it is important to distinguish between self-confidence and two other concepts often used by behavioral scientists: *self-concepts* and *self-esteem*. Bandura describes *Self-efficacy* as "the ability of trust in organizing and executing the kinds of actions necessary to produce the accomplished achievements. *Self-efficacy* instituted a key component in Bandura's social cognitive theory. Building signifies the beliefs of a person, about his ability to successfully perform a task. It was found that *Self-efficacy* is a major determinant for individual development, their persistence using difficulties, and emotional thinking and reactions that they experience [4]. Furthermore, *Self-efficacy* beliefs play an important role in achievement motivation, interconnect with self-regulating learning processes, and mediating academic achievement.

Perception of *Self-efficacy* can be established by interpreting information from four sources [5],[6]: (1) An authentic *(authentic mastery experiences),* which is the source of the most influential, because of the failure / success of past experience will decrease / improve a person's *Self-efficacy* for a similar experience in the future. Especially the failures that occur at the beginning of the action cannot be attributed to the lack of effort or influence of the external environment; (2) the experience of others *(vicarious experience),* which is to pay attention to the success / failure of others, one can gather the necessary information to make judgments about the ability itself. This model of the experience of others is very influential when he gets a similar situation and poor in the experience; (3) a social or verbal approach, an approach done by believing someone that he or she has the ability to do something. It is important to note that negative statements about a person's competence in a particular area are very bad for those who have lost confidence, such as the assertion that women are not suitable for mathematics learning, will lead women to believe they are not ethical in mathematics; and (4) psychological index, where physical and emotional status will affect one's ability. High emotions, such as math anxiety, will change a person's confidence about his ability.

The relationship between skills, motivation and academic achievement in mathematics has been widely studied. It was found that the beliefs of *Self-efficacy* appear to be influential factors in achievement in education and career choice, compared to other variables such as interest, mathematical experience, perceptions of mathematical beliefs and self-rule [7]. It was also found that the influence of *Self-efficacy* in the performance of Mathematics is as strong as the effect of mental abilities general [5],[8], and that a negative relationship between*Self-efficacy* in solving problems and interest in the case [9]. Another study has reported that *Self-efficacy* in solving problems is a stronger predictor of performance than that attraction, self-concept or feel of the utility of mathematics [9]. It further argues that the relationship of *Self-efficacy* to motivation and self-regulating learning can indirectly affect performance in mathematics, as students with high levels of *Self-efficacy are* motivated and confident in their skills, self-regulatory use strategies and achieve better than others. Other findings relate to the reciprocal nature of the relationship between *Self-efficacy* and performance; past achievements inform today are holding the hopes of *Self-efficacy*, which in turn affects task initiative and perseverance [4].

From the description of *Self-efficacy*, it can be described that *Self-efficacy* is a form of self-confidence. Having a strong confidence will make a person has the motivation, courage, perseverance in carrying out the tasks it provides. *Self-efficacy* can be gained through direct experience, viewing other people's experiences, emotional and psychological aspects.

High-low *Self-efficacy* combines with responsive and unresponsive environments to produce the four most predictable variables: (a) When *Self-efficacy is* high and the environment responsive, the most predictable outcome is success, (b) When *Self-efficacy is* low and the environment is responsive, humans can become depressed when they observe others successfully completing tasks they find difficult, (c) If high *Self-efficacy* meets unresponsive environmental situations, human beings will strive to change environment, e.g. protest, social activism, (d) If low *Self-efficacy* combines with an unresponsive environment, humans will perform apathy, give up easily, feel helpless [3].

Role play is a play pretend activity, which is pretending to be someone else in a fictional game world that is limited by certain rules [10].Role play can be understood by adults from playing theatrics [10],[11]. Features of *role-playing* as in below:

a. "Role-playing is an interactive process in describing the state, possession, and content of an imaginary game world"
b. "The ability to set the game world is allocated to the game participants. The participants recognize the existence of this hierarchical ability".
c. "Participants set the game world through the formation of characters, adjust to the circumstances, ownership and content of the game world".

Playing a role is an activity that can improve and develop skills, by playing a role can establish good cooperation among the participants, because the communication is established among the participants will be able to solve an existing problem. Context in PMRI is the first step in building a student's knowledge of the material to be learned is that the context related to the specific situation and an environment that engages students [12]. Context plays as tool for shaping the concept *(concept forming)*[13]. Role play is chosen as a context in combination learning, since this context is often encountered in student life. Based on the context classification, then role play can be entered into in the personal context of the student. Through role play, students can participate actively in the process of learning mathematics, so that will lead to self-confidence (*self-efficacy*) students.

2. Methods

The sample for this research was 66 students from grade 10 of SMAN 15 Palembang. This research uses *design research* method which is one of the qualitative approach. *Design research* aims to develop *Local Instruction Theory* (LIT) based on an existing *theory* (*theory-driven*) and empirical experiment *(empirically based)* through cooperation between researchers and teachers to improve the relevance of research to policy and practice of education [13]. There's three stages in the *design of research* are: *preparing for the experiment, the experimental design* and *analysis theretrospective* [14]. The basis of this study is the assumption of learning in the classroom with HLT design so as to produce the learning path. The allegations are analyzed and redesigned and revised and then implemented again [15]. This suggests that there is a recurrent process cycle from *thought experiment* to the learning experiment (*instruction experiment*) [16]. The cycle process can be seen as shown by Figure 1.

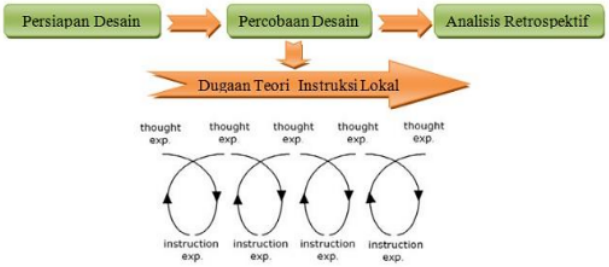


Figure 1. *Design Research* Cycle

Subjects involved in this study were the students of class X SMA Negeri 15 Palembang and a teacher in the classroom as the teacher models and implemented in the odd semester of the academic year 2017/2018. Data collection techniques used in this study are tests, observations, and interviews, and questionnaires. Observations, and interviews are part of qualitative analysis techniques for the *design of research*. Questionnaire used is a Likert scale questionnaire with four choices of answers, namely Strongly Agree (SS), Agree (S), Disagree (TS), and Strongly Disagree (STS).

The results of this questionnaire are analyzed to yield the categories of *self-efficacy* capabilities that are divided into four categories, namely Very High, High, Fair, and Low.

3. Results and Discussion

After implemented *teaching experiment,* questionnaire conducted to know the level of ability of student *self-efficacy*. From student questionnaire about the ability of *self-efficacy* obtained level of ability of *self-efficacy* as presented in Table 1.

Table 1 Category *Student Self-efficacy* Ability

Score	*F*	*Self-efficacy Capabilities Category*	*%*
156 ≤ Score ≤ 192	2	Very high	3
120 ≤ Score < 156	54	High	82
85 ≤ Score < 120	10	Enough	15
48 ≤ Score < 85	0	Low	0

Based on Table 1 obtained the level *of self-efficacy*'*s* ability 3% categorized as very high, 82% high, and 15% of the category enough. Result of data analysis both from descriptive analysis and also show that ability of student *self-efficacy* obtained by mathematic approach to realistic mathematics education. The following will be discussed in improving students' *self-efficacy* abilities in terms of learning factors.

Based on the findings that the factors of application of role play learning have a significant effect in improving students' mathematical *self-efficacy*. This is possible because it is triggered by mathematics teaching materials used for students to play an active role in understanding and finding the concept of mathematics, especially the concept of combinations and permutations. Learning mathematics in the classroom with reference to the principles and characteristics of this role play will awaken the ability *of* Student *Self-efficacy*. This fact is in line with [4], that *Self-efficacy*can be generated from students through four sources, namely (1) Authentic experiences (*experiences*) *vicarious experience*, (3) Social or verbal approach (*verbal persuasion*), (4) Psychological aspects (*physiological affective states*).

The four sources of *Self-efficacy* can be raised in the learning process in the classroom, e.g. the process of rediscovery *(Reinvention)* mathematical concepts, is a direct experience of the student, the process of presenting his work, is the experience of others, and the process of group discussion will shape social aspects and psychological aspects. Figure 2 is an activity in role playing hands in finding a combination concept.

Future 2. Students again Role Playing Shaking to Understanding the Permutation Concept

Figure 3 is the result of group work in shaking activities to produce a combination concept.

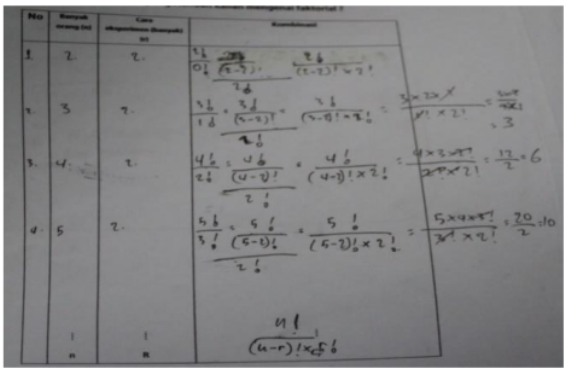
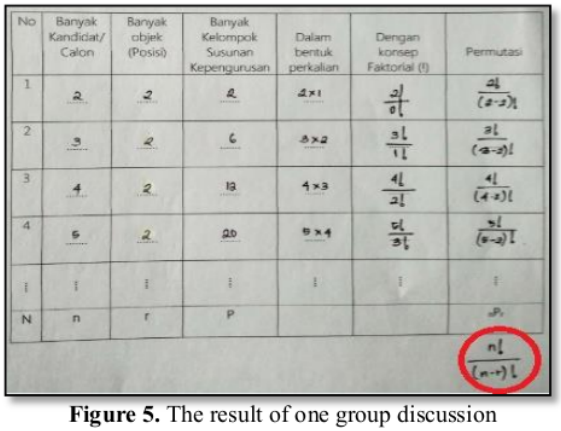


Figure 3. Results Discussion after shake handling

Figure 4 is a student activity in playing the role of class election to understand the concept of permutation.

Figure 4. Student activity when presenting the results of the discussion

The result of the activity is obtained by the concept of permutation as in Figure 5.



No	Banyak Kandidat/ Calon	Banyak objek (Posisi)	Banyak Kelompok Susunan Kepengurusan	Dalam bentuk perkalian	Dengan konsep Faktorial (!)	Permutasi
1	2	2	2	2×1	$\frac{2!}{0!}$	$\frac{2!}{(2-2)!}$
2	3	2	6	3×2	$\frac{3!}{1!}$	$\frac{3!}{(3-2)!}$
3	4	2	12	4×3	$\frac{4!}{2!}$	$\frac{4!}{(4-2)!}$
4	5	2	20	5×4	$\frac{5!}{3!}$	$\frac{5!}{(5-2)!}$
⋮	⋮	⋮	⋮	⋮	⋮	⋮
N	n	r	P			$_nP_r$
						$\frac{n!}{(n-r)!}$

Figure 5. The result of one group discussion

This activity demonstrates the development of students' *self-efficacy* abilities in the learning process of mathematics. Dare to appear in front of the class shows the courage and to the self-assuredstudents. Through the context of role play can also train students to be confident and love math lessons. This is inline with research by Ryandi [17] who stated that through the context of role play can increase students' interest in math lessons. This statement is in line with the student's expression in the following interview.

Q: Do you enjoy playing role playing in math lesson?
S : yes, very fun.
P : Why?
S : Because by playing this role, we can directly practice math lesson(combination material) and besides also we can all be active and directly involved in understanding the concept of material combination.

From the day of the interview it can be said that through implementation of role play in learning mathematics can involve students in digging and understanding math concepts. This is evident in planting students' self-esteem values in accordance with *self-efficacy* theory.

4. Conclusion

Based on the results of research and discussion, it can be concluded that role play can grow the ability of mathematics *self-efficacy* of high school students especially on the subject of combination and combination.From this research it can also be suggested that mathematics teachers can use the context of playing this role to learn mathematics.

5. Acknowledgement

We gratefully express our gratitude to the Rector of UniversitasSriwijaya, which are kindly funding the research reported in this paper. E.I. PustaSiligar and RarriBianRyandi are assist in the collection of research data

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