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2013

Turning Dreams into Reality: Current Trends in Mathematics,
Science and Computer Science Education

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Development of Learning By Designing for Supporting the Learning Process In Class And Its Effect On Student Learning Effectiveness of Computer Science UPI Academic Year 2012/2013

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ABSTRACT

Development of teaching methods *Learning by Doing* is *Learning by Designing* methods with the goal of helping students learn to design, create, and invent something. Benefits of learning with *Learning by Design* is a method of engaging students as active participants, providing the ability to control and responsibility for the learning process, encouraging creative problem-solving design project. *Learning by Designing* method consists of 5 steps that Emagine, Create, Experiment, Share, and Reflect on the learning cycle. This condition as inspire research titled Development of *Learning By Designing* For Supporting Classroom Learning Process and Its Effect on Student Learning Effectiveness of Computer Science UPI Academic Year 2012/2013

Kata Kunci : *Learning by Doing*, *Learning by Designing*, Scratch

1. INTRODUCTION

Indonesia's infrastructure, the country is not left behind in the affairs of the use of technology. Through a Presidential Decree. 6/2001, the Indonesian government has launched an e-education begin. This means that the government has started to try to initiate the use of ICT in education. Even to support the implementation of the Decree, the Directorate General of Higher Education Ministry of Education to facilitate the development of ICT infrastructure and network for higher education institutions in Indonesia. It is intended to increase computer literacy (computer literacy) for educators and educational sertapeserta teaching in 2009. Therefore, it can be said that for teachers, ICT is a key in improving the quality of education. In this context, ICT can be used as a medium of learning, teacher professional development, and development of learning management systems and learning resources (Brojonegoro, 2006).

Students currently living in the digital age, with a marked use of technologies of information in their lives. Although they interact with digital media all the time, only a few are able to create their own games, animations, or simulations. As if they can only read but can not write. Digital capabilities not only the ability chatting, browsing, and interacting, but also the ability to design, create, and create the media Information and Communication Technology. In particular, programming support computational thinking that helps students learn problem-solving strategies, represent the idea of their own thinking, and design in the form of programs.

In the previous research has shown learning method *Learning by Doing* is learning by students passively receive information, but are actively engaged in exploring, experiment, and express themselves. One of the development of teaching methods *Learning by Doing* is *Learning by Designing* methods with the goal of helping students learn to design, create, and invent something (Mitchel Resnick 2002). The benefits of *Learning by Designing* learning methods are:

- Activities designed to actively engage students, provide the ability to control and be responsible for the learning process.
- Designing activities encourage creative problem solving.
- These activities are often interdisciplinary design which brings together the ideas of arithmetic, art, technology, and science.

- Activities designed to help students learn to put themselves in other people's minds, because they need to consider how others will use the things they make.
- Design activities provide an opportunity for reflection and collaboration.
- Design activities consist of a flow of positive feedback of learning, namely: when students are designing, they get new ideas, thus driving them to design new things.

Scratch is a new programming model, developed by the Lifelong Kindergarten research group at the MIT Media Lab ([Http : / / scratch.mit.edu](http://scratch.mit.edu)). Scratch supports floating research skills by learning 21st Century Learning Skills, as described on the website address [Http : / / www.21stcenturyskills.org](http://www.21stcenturyskills.org). Scratch programming method developed consists of four steps, namely Emagine, Create, Experiment, Share is perfect for applying Learning by Designing.

This condition inspired us to undertake a research study entitled Development of Learning By Designing For Supporting Classroom Learning Process and Its Effect on Student Learning Effectiveness. Thus, the main objective of this research is to develop a method of Learning by Designing by utilizing interactive media in the form of pouring knowledge / ideas of students in the form of design expected Scratch multimedia programming can optimally support the learning process in the classroom and give effect to the effectiveness of the learning students.

2. RESEARCH METHOD

The study was conducted by using the method of classroom action research the details of which will be carried out as follows

1. Early preparation stages, include the following activities: identifying problems and formulating action scenario, the following is a description of the activity
 - a. Identify the problem is identifying the problem of low learning effectiveness and student achievement semester Computer Science Program in the course of research subjects. Based on these problems, it can be defined research goals.
 - b. action scenarios, namely the learning plan research subjects Subjects with Learning By Designing method. Action plan was drawn up in the form of proposals with respect to the sequence of actions performed, when it will be done, the selection of subject matter that will be the object, how monitoring, collection, data analysis and reflection, evaluation and licensing program chair of Computer Science studies.
2. Implementation phase , the implementation of the action plan consisting of four cycles . Each cycle includes activities ;
 - a. Planning , preparation of plans based on the results of the initial planning stages . At this stage includes actions to be performed to repair , improve or change the desired behaviors and attitudes as the solution of problems . This plan is flexible in the sense that can be changed according to the real condition of the existing
 - b. Implementation , at this stage consists of any activity conducted by researchers in an attempt repairs , improvement or change is implemented based on the plan of action . Type of action taken in TOD should always be based on theoretical and empirical considerations for the results obtained by increasing the performance and results of the program are optimal .
 - c. Observations , carried out in the framework of formal data collection in the study . In this activity, the researchers looked at the results or impact of the actions taken or imposed against the student . The term is used as observation data collected through observation techniques .
 - d. Reflection , consists of the activities of analysis, synthesis , interpretation of the information obtained during the action activity . In the course of this research study , see , and considering the results or effects of the action . Any information collected needs to be studied linkages with each other and the relation with the theory or the existing research results and relevant . Through deep reflection can be concluded that steady and sharp . Reflection is a very important part of TOD is to understand the processes and outcomes that occur , the form changes as a result of the action taken .

The first cycle , the learning material with Learning By Designing method . After the implementation of learning held discussions with the lecturer of the same subjects to reflect the activities and take the final conclusion to determine the next action . In the second cycle of learning with Learning By Designing method . The steps in the second cycle , similar to that done in the first cycle , namely planning , implementation , observation and reflection. Cycle II is an improvement of the shortcomings / weaknesses that still exist in the learning cycle I. The third cycle of learning with the learning materials Learning By Designing method . The steps on the third cycle of action , similar to that done in the second cycle , namely planning , implementation , observation and reflection . an improvement on the third cycle deficiencies / weaknesses that still occur in the second cycle of learning . In the fourth cycle of learning with the learning materials Learning By Designing method . The steps in the cycle of

action IV , similar to that done in the third cycle , namely: planning , implementation , observation and reflection . cycle IV is an improvement to the shortcomings / weaknesses that still occur in the third cycle of learning . TOD conducted at four meetings . Each 3 x 50 -minute meeting .

3. Reporting phase, is the phase of research reports, which is preceded by a discussion professors who administer the same subject for feedback, and certainty, perfection of research results can be accounted for. At this stage the data that have been collected are then analyzed using qualitative descriptive analysis model which consists of three activities, namely: data collection as well as data reduction, data display, and conclusion. Data analysis was based on a study of the theory of normative criteria to obtain the success and obstacles that occur in learning, both students and lecturers were further consideration to determine the follow-up.

Research steps above can be clarified by the following chart:

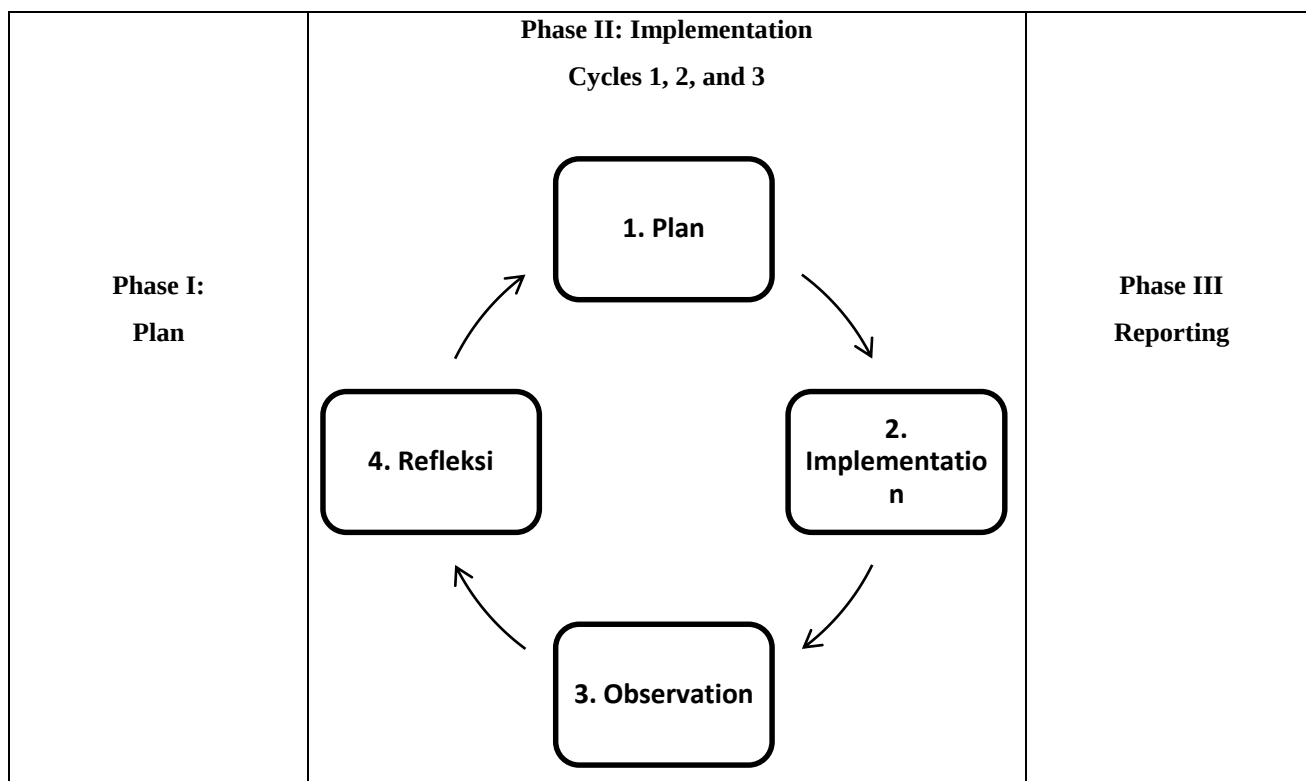


Figure 2.1: Step-by-step research

2.1. *Learning by Designing* method

In the previous research has shown learning method Learning by Doing is learning by students passively receive information, but are actively engaged in exploring, experiment, and express themselves. One of the development of teaching methods Learning by Doing is Learning by Designing methods with the goal of helping students learn to design, create, and invent something (Mitchel Resnick 2002).

Scratch is a new programming model, developed by the Lifelong Kindergarten research group at the MIT Media Lab ([Http : / / scratch.mit.edu](http://scratch.mit.edu)). Scratch supports floating research skills by learning 21st Century Learning Skills, as described on the website address [Http : / / www.21stcenturyskills.org](http://www.21stcenturyskills.org). Learning by Designing method using a model consisting of 5 stages step Scratch that Emagine, Create, Experiment, Share, Reflect is very suitable for implementing Learning by Designing (Figure 3.1).

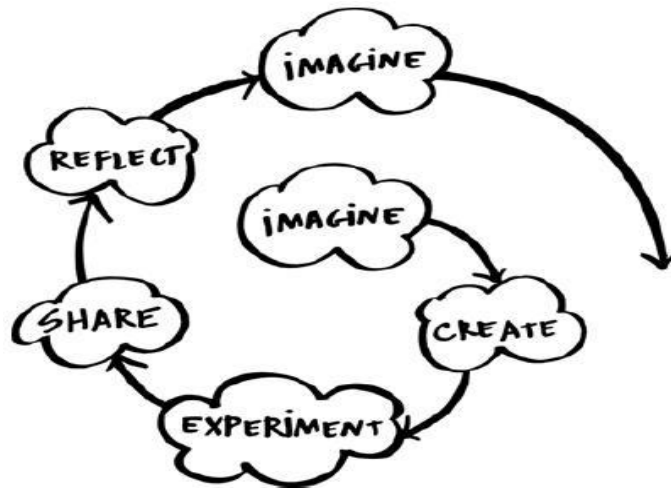


Figure 2.2: Methodology training Scratch
(Lifelong Kindergarten Group, MIT Media Lab)

The explanation of 5 (five) stages are:

1. Imagine

Is the process of thinking ideas imagination of a problem-solving process.

2. Create

Is the process of making of Scratch program design thinking ideas imagination of a problem-solving process.

3. Experiment

Is a result of the design process to try Scratch program or system for real-world learning.

4. Share

Is the process of trying to share with fellow students Scratch programming goals for mutual communication and discussion of the development of Scratch programmers design that has been created.

5. Reflect

Scratch is a programming evaluation process that has been made, as input to create the Scratch programming designs better.

2.2 Research Design

Experimental research design used was a pre-experimental namely One-Group Pretest-posttest, where there is a group who were given treatment by using a media PC and later observe the results, before implementation to prior treatment with demikan results of treatment pretest / treatment can be determined more accurately , because there is a comparison between the situation before and after a given treatment. Design One-Group Pretest-posttest can be described as follows:

O₁ X O₂

Figure 2.3 One-group pretest-posttest

Description:

O₁ = value pretest (before given treatment)

O₂ = value posttest (after given treatment)

2.2.1 Test Gain

Gain test done to determine the extent of increase in student learning outcomes using mathematical learning methods perklaian and principal sub division. Gain test is done by calculating the gain index using the following formula:

$$g = \frac{\text{posttest score} - \text{pretest score}}{\text{max imum possible score} - \text{pretest score}}$$

(quoted by Meltzer, 2002)

Index gain calculation results are interpreted using the following classification according to Hake

Table 2.1 Interpretation Gain Index

Index Gain	Interpretation
$(\langle g \rangle) > 0.7$	<i>High-g</i>
$0.7 > (\langle g \rangle) > 0.3$	<i>Medium-g</i>
$(\langle g \rangle) < 0.3$	<i>Low-g</i>

2.2.2 Data Analysis Questionnaire

Statements contained in the questionnaire consisted of revelation favorable and unfavorable statements. Statements are based on the aspects under study. The purpose of the questionnaire was made to determine the response or attitude that students are learning is done using the method Learning by Designing. According Sugiono Likert scale can be used to measure the attitudes, opinions and perceptions of a person or group of people

Score questionnaire in this study were interpreted as follows

Table 2.2 Interpretation of Score Questionnaire

Alternative Answers	Statement Score	
	<i>Favorable</i>	<i>Unfavorable</i>
Strongly Agree	5	1
Agree	4	2
Not Agree	2	4
Strongly Not Agree	1	5

While the percentage category refers to the opinion poll results kunjaradiningrat (in suhermarn 2003) interpreted as follows

Table 2.3 Percentage Category Questionnaire Results

Percentage	Category
0%	there is no
1%-25%	fraction
26-49%	nearly half of
50%	Half
51%-75%	in general
76%-99%	largely
100%	wholly

3. RESULT AND ANALYSIS

Before the test instrument can be used in research, first test instrument to students who have earned a Media Education lecture material (beyond the study sample). Results of the test instrument is processed and tested for mengetahui difficulty index, discrimination power, validity and reliability of the instrument to be used in research. The first experiment tests the instrument consists of 25 essays and a second experiment consists of 25 essays.

3.1 Population and Research Sample

Experiments conducted research methods including quantitative part of the study population according Sugiyono that definition is an object / subject that has certain qualities and characteristics that set by the researchers to be studied and then drawn conclusions. Based on the statement that the population in this study were college students at the Education Media Education courses UPI Computer Science 2012/2013. While the definition of the sample according to Sugiyono are part of the population. The samples used in the study have differences between experiment 1 and experiment 2 the difference is due to several things including

1. Not all college students in the Education Media Education courses UPI Computer Science 2012/2013 following the lecture
2. There are students who are absent due to illness, or alpha license at the time of experiment 1 and experiment 2

Here are the number of samples in detail in experiments 1 and experiment 2

Table 3.1 Total Population and Sample student

Data	Number
Media Education lectures students on Computer Science Education courses UPI 2012/2013	30 Student (Population)
Students who attended the experiment 1	30 Student (Sample)
Students who attended the experiment 2	30 Student (Sample)
Students who attended the experiment 3	30 Student (Sample)

3.2 Description Interpretation Student

Description interpretation improvement of student learning is a picture of student learning outcomes after the use of instructional media computer. Student learning outcomes were measured using a test instrument. The test instrument is given two (2) phases before the application of instructional media computer called the pretest and after the application of instructional media computer called the posttest. Measurement of student learning as much as 3 times the experiment is carried out to determine the effectiveness of the application of computer learning media. Tables 3.1 and 3.1 illustrate diagrams of student learning outcomes before and after implementation of a computer instructional media

Table 3.2 Average Value pretest and posttest experiments 1, 2 and 3

Experiment	Average Value	
	Pretest	Posttest
Experiment 1	60.71	90.21
Experiment 2	70.68	93.61
Experiment 3	80.75	96.81

The results in table 3.2 can be represented in the diagram 4.1 to better describe the increase or decrease in test results

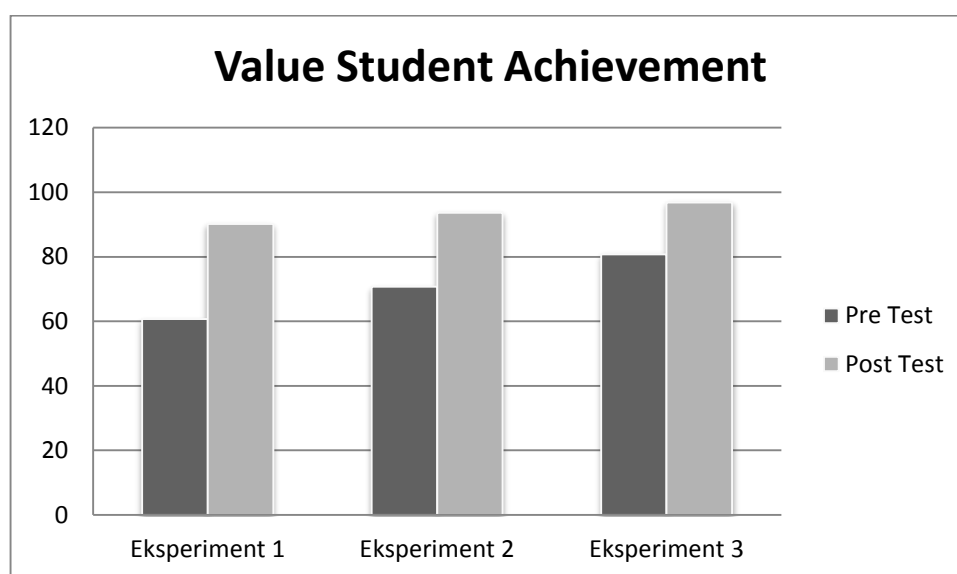


Diagram 3.1 Average Score Pretest and Postet in Experiment 1, 2 and 3

3.3 Analysis of Normalized Gain Index

Gain index analysis is performed to determine whether increased cognitive ability in mastering the subject of study materials or subject matter using the Media Education learning Learning by Designing better.

Table 3.3 Average Value pretest and posttest experimental and Gain Index

Experiment	Average Value		Experiment
	Pretest	Posttest	Index Gain
Experiment 1	60.71	90.21	0.75
Experiment 2	70.68	93.61	0.78
Experiment 3	80.75	96.81	0.83

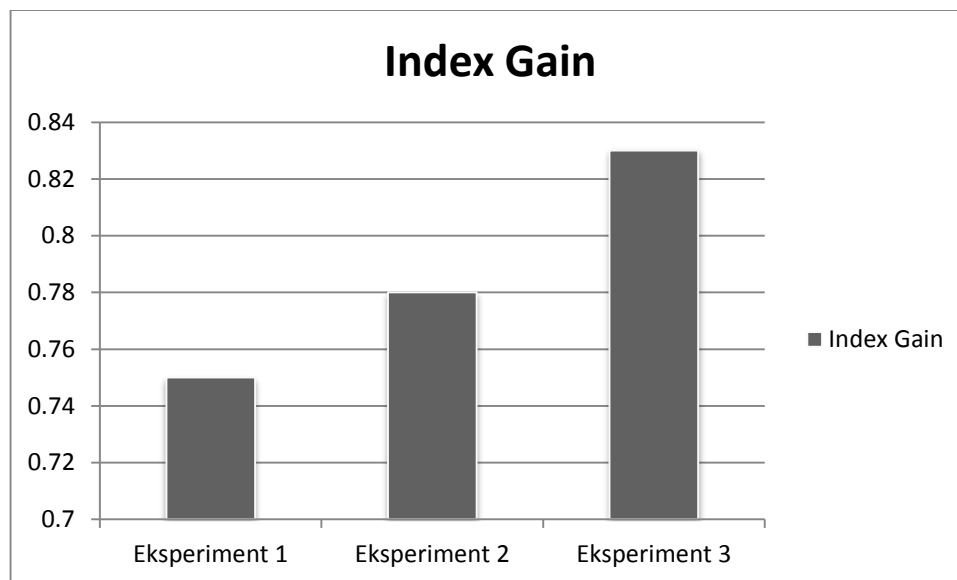


Diagram3.2 Index Gain in Experiment 1, 2 and 3

3.4 Data Analysis Observations

Observation in a study conducted to obtain data on the implementation of classroom teaching and learning process samples using Learning by Designing. Observation data consists of 3 main parts:

1. Data on the implementation of student learning Cooperative Learning with computer media.
2. Data of students and teachers about classroom activities, teaching effectiveness and teacher activities.
3. Data enforceability of any stage in the learning method Learning by Designing

Of these can be used to measure the achievement of the indicators of the effectiveness of learning

This technique is used to obtain data on the implementation of classroom teaching and learning process samples using computer media. There are 3 objects observed were students, teachers and learning implementation. Observations made by the teacher and observer

Table 3.4 Observations Implementation Learning methods *Learning by Designing*

No	stages of Learning	Achieved Experiments 1		Achieved Experiments 1		Achieved Experiments 1	
		Yes	No	Yes	No	Yes	No
1	Explain the lecture material with Learning by Designing methods to students	√		√		√	
2	Interaktive demonstrating how to learn by the method of Learning by Designing	√		√		√	
3	Actively involve the students to discuss the use of learning methods Learning by Designing	√		√		√	
4	Give to students to use methods of learning Learning by Designing	√		√		√	
5	Give quizzes to lecture material	√		√		√	
6	Discuss the quiz with the method Learning by Designing	√		√		√	

Table 3.5 Results Observation Application of Learning Activity Media Education courses with the method Learning by Designing

NO		ASPECTS OF OBSERVATIONS	Experiment			Average	Interpretation
		STUDENT ACTIVITIES	1	2	3		
1	a.	Students' attention to the learning materials	4	5	5	4.67	majority
	b.	Activity asks students	4	4	5	4.33	majority
	c.	Courage students to communicate and act	4	5	5	4.67	majority
	d.	Activity of students in using the Learning by Designing	4	5	5	4.67	majority
	e.	Students' interest in learning the method Learning by Designing	4	5	5	4.67	majority
	f.	Students' interest in learning the method Learning by Designing.	4	5	5	4.67	majority
	g.	cooperation group	4	4	5	4.33	majority
2		EFFECTIVENESS OF LEARNING					
	a.	Events Unit Class (SAP) developed	4	4	5	4.33	majority
	b.	SAP conformance with learning activities in the classroom	4	4	5	4.33	majority
	c.	Use of the method Learning by Designing	4	5	5	4.67	majority
	d.	Suitability of the method Learning by Designing with learning materials	4	5	5	4.67	majority
	e.	Timeliness of the achievement of learning materials	3	4	5	4	majority
3		TEACHERS ACTIVITIES					
	a.	Ability conditioned classroom into a learning atmosphere	4	5	5	4.67	majority
	b.	The ability to use the method Learning by Designing	4	4	5	4.33	majority
	c.	the ability to participate	4	4	5	4.33	majority
	d.	Ability to manage group	4	5	5	4.67	majority
	e.	Communication skills with students	4	5	5	4.67	majority
	f.	Communication skills with students	4	5	5	4.67	majority
	g.	Understanding of the learning material	4	5	5	4.67	majority
	h.	implementation of the evaluation	4	4	5	4.33	majority
	i.	The ability to close the learning activities.	4	4	5	4.33	majority

4. CONCLUSION

In general, this research is expected to contribute to improving the quality and innovation of learning in schools. Development of Learning By Designing learning methods to support the learning process in the classroom and its impact on student learning effectively achieved. Experiments 1,2, and 3 showed an increase in the value of pretest and posttest with an average final value of 96.81, high gain index is 0.83, and classroom observations with an average value of 4.5 (majority good).

In particular, the authors hope this research can provide benefits to improved learning for students, teachers, and education. To further method Learning by Designing can be developed and improved for cases teaching diverse.

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