Proscedure Of Modification Problem Based Learning Models By Integrated Flipped Classroom Of Prospective Argumentation Mathematics

Selvia Erita, Muhammad Rusdi, M Naswir, Jefri Marzal

Abstract: This study aims to develop a conceptual procedure for the Problem Based Learning model by integrating flipped classrooms that are focused on conceptual development research based on Theory Driven type F1-O1-S1-A1. This study involved expert review in synthesizing the modified conceptual procedure model of PBL with FC. The observation sheet is used for the conceptualization analysis of the modification of the PBL model with FC which aims to obtain input and expert opinion on the subject matter developed through the application of the Delphi technique to improve mathematical argumentation skills. From the results of modifying the pbl model by integrating the flipped classroom, we get a new model called the Problem Based Learning-Flipped Classroom Model (PBL-FC Model). The PBL-FC model is designed in learning to enable students to construct meanings from spoken, written and graphic messages through interpreting, exemplifying, classifying, summarizing, concluding, comparing and explaining. Data analysis of argumentation skills was carried out using t-test. Based on the significance value of $0.000 \leq 0.05$ by using the t-test, there is an increase in mathematical argumentation skills in the application of the PBL-FC Model. This research recommendation is expected to be a theoretical basis for researchers and educators in measuring other skills.

Index Terms: procedure, problem based learning model, flipped classroom, argumentation

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1 INTRODUCTION

The learning model is a major element in teaching practice. The learning model helps practitioners understand the importance of the relationship between various activities in the lecture process. The learning model is focused on how lecturers transform information so that the learning process can be learner-oriented and they can learn to construct knowledge based on experience. A good learning model includes study material or certain subjects using not so much time and funds, so that students get maximum results. Joyce, Weil, and Calhoun (2015) in their book Model of Teaching explain that the learning model has a basis for thinking about what and how students learn, teaching behavior is in line with the model applied and a learning environment that is conducive to a logical theory according to the creator or the developer. Effective learning design models must understand diverse educational contexts and be responsive to learning situations. Therefore, learning models can be developed and provide new understanding in the learning process (Dick, Carey, & Carey, 2001; Morrison, Ross, Kemp, & Kalman, 2010). The general characteristics of a model are: Helping students learn how to learn, Constructivist orientation, Scaffolding the Learning Process, Formative Assessment and Adjustment, 21st century skills, Cultural literacy and global awareness, Collaborative and cooperative skills and creativity Joyce et al. (2015).

The courses taught in Higher Education generally have a high level of abstraction. Even though it is abstract, various mathematical concepts or theories are arranged based on real phenomena or triggered by the need to solve problems in real situations. Therefore abstract theoretical aspects and applied aspects of mathematics in real situations need to be given in line with learning. Choosing the right learning model will certainly make learning fun. A comfortable situation will make students optimize themselves in the learning process. Indirectly, the lecturer will involve students actively and participatively, this is an effort to form students who have critical and creative thinking skills. The results of research by Gilboy, Heinerichs, and Pazzaglia (2015) by applying the traditional learning model that student attention decreased after the first 10 minutes although they could return at the end of class, students only remembered about 20% of the material presented during the lecture. One of the recommended learning models to use is: Problem Based Learning Model. The Problem Based Leaning model currently used is still valid in general for all levels of education so that the objectives of this research are not achieved with mathematical arguments. Therefore, the authors modify this PBL Model by integrating the Flipped Classroom, then this mathematical argumentation skill will be achieved. Based on the description of this phenomenon, this research is focused on the procedure for drafting the pbl –fc model concept to improve mathematical argumentation skills

2 RESEARCH METHODS

This type of research is quasi-experimental with a quantitative approach with the type of Randomized Control Group Only Design [14]. The research sample consisted of 42 students as research respondents. The research design is as follows: Table 1

Class	Treatment	Post Test
Exsperiment	X	T

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- *Selvia Erita is currently pursuing doctoral degree program in science and mathematics education in Jambi University, Indonesia*
- *Muhammad Rusdi is chemistry in Jambi University, Indonesia. E-mail: rusdimuhammad @unja.ac.id (corresponding email)*
- *M Naswir is chemistry in Jambi University, Indonesia*
- *Jefri Marzal is currently associate professor in mathematics in Jambi University, Indonesia*

control	-	T

while the rubric for assessing the results of the mathematical argumentation skills test from Erduran et al (2004). The rubric for assessing mathematical argumentation skills adapted from Erduran et al with a range of 0-5 can be seen in table 2 below:

TABLE 2
THE ARGUMENTATION ASSESSMENT CRITERIA BASED ON ERDURAN ET AL

Scor/Point	Descriptor/Descriptions
5	• The arguments presented are clear, precise and relevant to strengthen claims so that they can convince others
	• There is a relationship between data and conclusions in the form of clear and precise rules or definitions
	• There is a relationship between data and conclusions in the form of clear and precise rules or definitions
	• A description of the appropriate and relevant evidence to support the warrant
	• conclusions presented are clear and precise
4	• Arguments are not clear and relevant to substantiate claims
	• The relationship between data and conclusions is less clear and precise
	• Explanation of evidence is incorrect, but is relevant to support the warrant
	• The conclusions presented are not clear
3	• Arguments are not clear and relevant to substantiate claims
	• The relationship between data and conclusions is less clear and precise
	• Explanation of evidence is incorrect, but is relevant to support the warrant
	• The conclusions presented are not clear
2	• Give no arguments
	• The relationship between data and conclusions is unclear
	• Explanation of evidence is irrelevant to support a warrant
	• The conclusions presented are not correct
1	• Arguments are simple claims with opposite claims
	• The relationship between data and conclusions is unclear
	• Explanation of evidence is irrelevant to support a warrant
	• The conclusions presented are not correct
0	• Arguments are claims only
	• The relationship between data and conclusions is unclear
	• Explanation of evidence is irrelevant to support a warrant
	• The conclusions presented are not correct

The data categories from the assessment rubric were used to conduct descriptive analysis to provide an overview and through obtaining complete information about prospective mathematics teachers in argumentation skills in mathematics subject matter.

3 RESULT AND DISCUSSION

3.1 Problem Based Learning Models Modification Procedure by Integrating Flipped Classroom Based on Theory-Driven Type F1-O1-S1-A1

The steps involved in modifying the PBL model by integrating the Flipped Classroom are as follows:

First stage, explains how to determine the source of data based on the basic theory of the conceptual model developed. The basic theory examined is a theory derived from the original author or subsequent writers who are figures in the development of the theory. The history of the development of theory becomes very important and must be understood by developers in following the flow of theories that are developed scientifically. Second stage, collecting data by reviewing relevant literature relating to basic theory. In this case, an important part is reviewing the literature in tracing, collecting, analyzing and synthesizing theories related to the research topic, looking at the relationship between focus and research variables both directly and indirectly in helping researchers understand theoretical aspects of the topic research conducted. Third stage, analyzing data by identifying and re-conceptualizing variables / activities from the literature to produce the components of the model. This section describes how researchers identify and conceptualize the conceptual or procedural model by involving experts who have in-depth knowledge of the basic theories of the model being developed. Experts involved should be eclectic so that they have an open nature in accepting different paradigms in the existing learning design. Fourth stage, generating ideas by making logical networks between components of a conceptual model based on relationships between variables / activities. This section explains new ideas that emerge based on the previous steps that have been carried out (the first, second and third stages). New ideas that emerge can be systematically developed in designing learning based on the experience that has been obtained. Fifth stage, illustrates the model by creating a conceptual model of the components using a flow chart. The model developed is a system consisting of several components and processes that are open or closed, natural or artificial. The model as a system must be composed of subsystems that make up the model, because the position of the subsystems in the model shows the scope of operations that can be carried out by these components. The specified component is an operational component in the form of verbs that guides practitioners in preparing for learning.

3.2 Exspert Assessment of The Procedures For Drafting The Modification of The Problem Based Learning Models By Integrated Flipped Classroom

Expert judgment is carried out on the drafting of the PBL and Flipped Classroom model concepts which aim to get feedback and opinions from experts to the main substance of the product being developed. The data listed in table 3 describes expert judgment. Table 3 shows the responses of experts giving 4 and 5 responses to the aspects assessed.

TABLE 3
EXSPERT ASSESMENT OF THE PROCEDUR FOR DRAFTING THE MODIFICATION OF THE MODEL PROBLEM BASED LEARNING BY INTEGRATING THE FLIPPED CLASSROOM

No	Rated aspect	Assesment				
		1	2	3	4	5
1	All stage contained in the preparation of concepts are needed in the modification				√	

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	of the problem based learning model by integrating Flipped classroom	
2	The stage contained in the preparation of the modification problem based learning model by integrating Flipped classroom procedur that have been developed are arranged in a systematic sequence	√
3	The stage of modification of the problem based learning model by integrating Flipped classroom that been developed in a accordance with learning theories and pattern of scientists work in stages of the steps of the scientific method	√
4	Synchronize modified image of the problem based learning model by integrating Flipped classroom model that has been developed in accordance with the steps of the problem based learning model by integrating Flipped classroom syntax	√
5	The stage of modification of the problem based learning model by integrating Flipped classroom that have been developed are easy to use for both beginners and senior lectures in preparing for leaning	√
6	Modified problem based learning model by integrating Flipped classroom can actively involve students in learning activities	√
7	Modification of the problem based learning model by integrating Flipped classroom can produce an efficient learning process to improve argumentation	√
8	Modification of the problem based learning model by integrating Flipped classroom that has been developed can be implemented in lectures on yhe matematika diskrit	√
9	Modification of the problem based learning model by integrating Flipped classroom that has been developed is easily implemneted by lectures, both beginner and senior lecturers in the matematika diskrit	√
10	Evaluation and assessment are clearly stated on the modification of the problem based learning model by integrating Flipped classroom	√

3.3 The Influence of Problem Based Learning Models-Flipped Classroom on Mathematical Argumentation Skills

Based on statistical data analysis, mathematical argumentation skills data were obtained in tables 4 and 5 below:
Test the normality of mathematical argumentation skills

TABLE 4
TESTS OF NORMALITY

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	sig	Statistic	df	sig
Class Exsperiment	.136	22	.200	.959	22	.467
Class Control	.128	20	.200	.925	20	0.091

Based on the normality test, the significance value for the experimental class and control class is 0.200. It can be

concluded that the data is normally distributed, then it is followed by the t test. Based on the t test, the significance value is 0.000 ≤ 0.05. This means that there is an effect of the PBL-FC model on mathematical argumentation skills.

TABLE 5
T-TEST OF PROSPECTIVE MATHEMATICAL

		Levene's Test for Equality of Variances					
		F	sig	t	df	Sig (2-tailed)	Mean Difference
Result	Equal variances Assumed	3.216	0.080	3.880	40	.000	3.50455
	Equal Variances not Assumed			.950	37.18	.000	3.50455

Based on the t test, a significance value of 0.000 is obtained, which means that the significance value is smaller than the specified level of significance, namely 0.05, so that the null hypothesis is rejected. The results of this study indicate that students who use the problem-based learning-flipped classroom model are better than students who do not use the problem-based learning-flipped classroom model.

4 CONCLUSSION

Based on the results of the study it can be concluded that the procedure for drafting the modified concept of the problem-based learning model by integrating Flipped Classroom using the F1-O1-A1-S1 type procedure of conceptual learning design can improve students' mathematical argumentation skills. The stages of the procedure for drafting the modified concept of the problem-based learning model by integrating the Flipped Classroom (PBL-FC Model) include reviewing and presenting problems, understanding and encouraging problem solving, facilitating and processing problem solving, discussing the results of solving and providing reinforcement, evaluating and concluding learning. BASED ON THE NORMALITY TEST, A SIGNIFICANCE VALUE OF 0.200 IS OBTAINED. A SIGNIFICANCE VALUE OF 0.200 IS GREATER THAN 0.05. IT CAN BE CONCLUDED THAT THE DATA ARE NORMALLY DISTRIBUTED. THE VALUE OF 0.000 ≤ 0.05 USES THE T-TEST, WHICH MEANS THAT THERE IS AN INCREASE IN MATHEMATICAL ARGUMENTATION SKILLS IN THE APPLICATION OF THE PROBLEM BASED LEARNING-FLIPPED CLASSROOM MODEL. MODELPBL-FC EFFECTIVELY IMPROVES STUDENTS' SKILLS IN PROVIDING VERBAL OR WRITTEN REASONS IN DECIDING REASONS FOR SOLVING PROBLEMS, STUDENTS ARE ABLE TO PROVIDE AUTHENTIC DATA FROM THE REASONS FOR STATEMENTS EXPRESSED WHEN CLAIMING, STUDENTS ARE ABLE TO PROVIDE STATEMENTS AND CAN RELATE THE REASONS FOR CLAIMS SUPPORTED BY DATA, STUDENTS CAN SOLVE THE PROBLEM USING THE EXISTING THEOREMS.

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