

**THE DEVELOPMENT OF FLIPPED CLASSROOM MODEL LEARNING DEVICE
BASED ON PROBLEM BASED LEARNING TO IMPROVE CRITICAL THINKING
ABILITY AND SELF-REGULATED LEARNING**

Sarah Inayah¹, Ari Septian², and Citra Laila Ramadhanty³

Universitas Suryakancana

*inayahsarah@unsur.ac.id*¹

*ariseptian@unsur.ac.id*²

*citralr2@gmail.com*³

ABSTRACT

Sophisticated technology offers convenience to information access. The ability of students to use this technology has the potential to form self-regulated learning in them. Self-regulated learning can be improved through the flipped classroom model. The flipped classroom model is also suitable for fostering critical thinking ability. Critical thinking ability can be improved by choosing the right learning model. The learning model referred is Problem Based Learning (PBL). The purpose of this study was to design a flipped classroom model learning device based on problem based learning to improve critical thinking ability and self-regulated learning for pre-service mathematics teachers in the mathematics education study program in the Faculty of Teacher Training and Education, Suryakancana University. This research was conducted specifically for the *Pengolahan Data* course. The research conducted refers to the design of Research and Development (R&D design) from Borg W.R & Gall, M. D (1989). There are four main characteristics in R&D research, namely 1) initial research; 2) developing products based on initial research findings; 3) field test; and 4) revising. The instruments in this study consisted of: course syllabus; Semester Learning Plan; Tutorial video; Student Worksheets; Observation sheet; Test instruments; Non-test instruments; Field notes. The results of the development of this program are final hypothetical program and the device that are ready to be implemented.

Keywords: Flipped Classroom, Problem Based Learning, Critical Thinking Ability, Self-Regulated Learning, Research and Development

INTRODUCTION

Critical thinking ability can be improved by choosing the right learning model. Practicing critical thinking ability can be done through providing complex problems. Students are then asked to identify them independently using all the knowledge and experience that has been previously owned. Then they were asked to work on a solution by collecting ideas in a collaborative manner, known as brainstorming. Through this brainstorming, it can be identified the knowledge needed and what is already owned regarding solving the problem at hand. In the end, students carry out an investigation or research to find a formula that fits the problem and later applies it to the problem.

The learning model in accordance with the above description is Problem Based Learning (PBL). PBL is designed primarily to assist learners in building their critical thinking, problem solving, and intellectual skills, and developing their ability to solve problems with new knowledge. Suyanti (2010). PBL starts with identifying the problem; brainstorming; identify current knowledge; identify knowledge gaps; individual research (iPED Research Network Academic Futures: 2009). PBL promotes responsibility and self-regulated learning, and also actively engages

students in various types of assignments, thus meeting the learning needs of many different students (Marx, Ronald W., et al: 1997).

The flipped classroom model can be combined with Problem-Based Learning (PBL) to become a learning model that can be applied in this century (Loucky, John Paul, and Jean L. Ware, eds: 2016). This learning model can facilitate student learning by using mobile technology and internet (Maloy, Robert W, 2017). What is meant by this combination is flipped classroom learning which then implements problem based learning in face to face learning. This combination called the Flipped Classroom model based on Problem Based Learning.

Departing from this phenomenon, the researchers are interested in raising this theme in the study with the title: "The Development Of Flipped Classroom Model Learning Device Based On Problem Based Learning To Improve Critical Thinking Ability And Self-Regulated Learning For Pre-Service Mathematics Teachers"

THEORETICAL FRAMEWORKS

Critical Thinking Ability is the ability to interpret, analyze, evaluate (an idea, observation results, information, or argument), and make decisions based on evidence (Fisher, 2011; Susiyati, 2014). Meanwhile the indicators that show someone has the ability of critical thinking are 1) analyze and clarify questions; 2) identify and evaluated existing assumption; 3) make clarification with valuable consideration; 4) compile an explanation; and 5) make conclusions and arguments. (Ennis, 2011; Sumarmo, 2012).

Self-regulated learning is a process in which individuals: take the initiative to learn with or without the help of others; diagnose their own learning needs, formulate learning goals; identify learning resources that can be used; selecting and implementing learning strategies, and evaluating learning outcomes. (Lowry, 2000; Sumarmo,2004). Self-regulated learning is needed by individuals who receive independent assignment, project assignment, problem solving and so on. When a person completes a task, he is exposed to many sources of information that are relevant or not relevant to his needs. In this condition, he must have his own initiative and ability to analyze need, formulated goals, select and implement problem solving strategies, select relevant source and evaluated himself.

Flipped Classroom is a learning model to flip the conditions of a conventional class, where students can watch lecture material through video lectures or vodcasts before coming to class, then spend class time for other learning activities. The flipped classroom model expands the traditional roles and responsibilities of lecturers and students. Lecturers are required to design plans both in online and offline sessions. For online sessions, the lecturer prepares videos and for offline sessions the lecturer designs student preparations for activity-based class sessions. Students are responsible for exploring online material in an independent way. They try to acquire basic knowledge before class, and then actively apply it in collaborative classes. If they do not get basic knowledge, of course it will hamper the face-to-face session. (Wolff, Lutz-Christian, and Jenny Chan, 2016; Information Resources Management Association, 2015; Student, M. Ed, 2015).

Problem Based Learning is learning that provides complex problems to students and then asked students to identify the problem; brainstorming; identify current knowledge; identify knowledge gaps; then individual research. Students involved in PBL were initially given little information about complex problems. They should seek further information from the teacher or facilitator. Students work through what they know and what they still need to know, and they re-evaluate their ideas and problem-solving progress given the new information they have acquired. Because the problem is complex and students often make mistakes or need to revise their hypotheses, it is important for them to record their work, using the whiteboard to trace the facts they have discovered or the decisions they have made. (Trianto, 2007; Hmelo-Silver, 2004; iPED Research Network Academic Futures; 2009).

METHOD

The research conducted refers to the design of Research and Development (R&D design) from Borg W.R & Gall, M. D (1989). There are four main characteristics in R&D research, namely 1) studying research finding pertinent to the product to be develop; 2) developing the product based on these findings; 3) field testing it in the setting where it will be use eventually; and 4) revising it to correct the deficiencies found in the field testing stage.

This research was conducted in Suryakancana University at Mathematics Education Study Program. The instruments in this study consisted of instructional videos; teaching materials and student worksheets; test instruments; non-test instruments; and field notes. All instruments used have been declared valid according to the expert judgment.

FINDINGS AND DISCUSSION

In carrying out learning activities, it begins with the development of a learning plan with a flipped classroom model based on problem based learning in data processing courses. This activity is the main activity in this study. As with development research design, this research starts from preliminary studies, product development, field tests and product revisions.

Preliminary studies, product development, field tests and product revisions are inseparable activities in this research. In more detail, these steps can be described in Figure 1 below

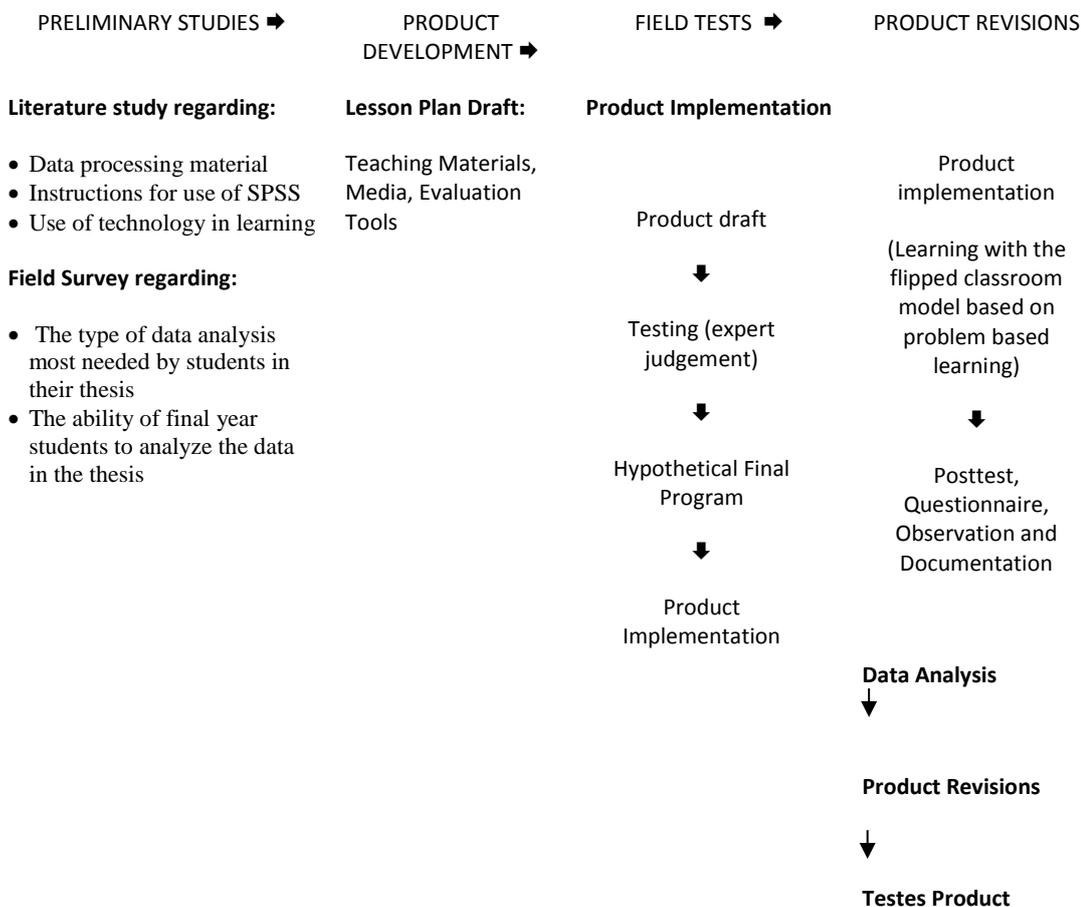


Figure 1 Product Development Design Sequence

The products developed are instructional materials in the form of learning videos, teaching materials and student worksheets as well as learning strategy for Flipped Classroom Model based on Problem-Based Learning. Based on the results of preliminary study on the implementation of learning with The Flipped Classroom Model Based on Problem Based Learning in descriptive statistics, average comparison analysis and non-parametric statistics. After the material is selected, learning videos are made and the teaching materials, student worksheets as well as Learning Strategy for the Flipped Classroom Model Based on Problem Based Learning are arranged. This stage produces a product draft that is ready to be implemented. Before the product is implemented, an expert assesses the program draft first, then revises the program draft based on the assessment. This assessment activity is carried out to increase the validity of the contents of the product draft. The assessment is carried out to produce a product that really fits the criteria and the needs in implementing the Flipped Classroom Model Based on Problem Based Learning which can improve the critical thinking ability and self-regulated learning of prospective teacher students. The results of the expert's judgment are the basis for producing a hypothetical product as set out in Figure 2 below

Learning Materials:

1. Descriptive Statistics, presenting data in the form of tables or graphs as well as summary statistics assisted by SPSS through the Frequencies, Descriptive, Explore, and Crosstabs menu
2. An Average Comparative Analysis consisting of One-Sample T Test, Independent-Samples T Test, Paired Samples T Test and One-Way ANOVA
3. Non-Parametric statistics consisting of the chi square two sample test, the Mc nemar test, the Mann Whitney U test and the Wilcoxon Signed Ranks

Flipped classroom Model

1. Outside the classroom
 - a. Study the material through learning videos
 - b. Take notes based on the material and formulate questions
 - c. Looking for answers to the questions

The technical model of flipped classroom outside the classroom is presented with a different approach, based on the material presented and the approach chosen:

- a. Descriptive statistics material is carried out with an offline approach, namely the lecturer provides a learning video file that students must study at their previous meeting through USB flash drive.
- b. The average comparison analysis material is carried out with an online approach, where the lecturer provides a link from a video that has previously been uploaded on YouTube
- c. Non-Parametric Statistical Materials are carried out by using an online approach and using social network learning, namely schoology in implementing it.

The approach is carried out differently to provide variations so that students do not get boredom.

2. In the classroom
 - a. A new problem is given with the assumption that students already understand the material because the presentation has been carried out through the video media that has been given both through online and offline approaches.
 - b. Discussion of the problem to be solved, until finally finding a solution to the problem

Problem Based Learning Model

The Problem Based Learning steps that will be implemented consist of

1. Identify the Problem
2. Brainstorming
3. Identifying Current Knowledge
4. Identifying Knowledge Gaps
5. Individual Research

Learning in Model *Flipped Classroom* based on *Problem Based Learning*

Problem Based Learning Steps	Strategy Implementation (Model Flipped Classroom)	
	Outside the classroom	In the classroom
	Identify the Problem	Study the material sent by the lecturer
Brainstorming	Formulate questions related to the material that has been studied if you find confusion	Conduct a discussion related to the problem that the lecturer just gave
Identifying Current Knowledge	Make small notes related to the material that has been studied	Develop a plan for solving problems
Identifying Knowledge Gaps	Search for answers to confusion through the notes that have been made	Carry out a problem-solving plan Evaluating the results of the implementation plan
Individual Research	Doing search for answers to confusion through other sources independently, before being taken to the classroom	Discuss the material in small groups with the knowledge that has been learned at home until it is ready to be implemented

Evaluation

Evaluation of Learning Outcomes: Student Worksheets, Mid-Term Exam and Questionnaire

Evaluation of the Learning process: Observation sheet

Recommendation

Time management is needed in order to run effectively and efficiently.

Figure 2 Hypothetical Products of Flipped Classroom Model Learning Based on Problem Based Learning in data processing courses

A hypothetical program is a program that is ready to be implemented. In the hypothetical program, there are also evaluation tools and instruments that support program implementation.

Furthermore, the hypothetical program will be implemented in a class. The implementation is in the form of learning with the flipped classroom model based on problem based learning. Evaluation of the results and the learning process will be a source for revising so that the product is tested and even better.

This paper discusses the stage of how the flipped classroom model based on problem based learning is developed and ready to be implemented. Meanwhile, the result of the implementation and product revisions will be discussed in other papers.

CONCLUSION

The steps for implementing learning with the Flipped Classroom Model Based on Problem Based Learning in data processing courses are developed with both outside and inside classroom learning with the steps of identifying problems, brainstorming, identifying current knowledge, identifying knowledge gaps and individual research.

REFERENCES

- Borg W.R & Gall, M. D. (1989). *Educational Research : An Introduction*, Fifth Edition. New York: Longman Inc.
- Ennis, R.H. (2011). *The Nature of Critical Thinking: An Outline of Critical Thinking Disposition and Abilities*.
- Hmelo-Silver, C. E. (2004). *Problem-Based Learning: What and How Do Students Learn?* *Educational Psychology Review*, 16, 3, (pp.235-265).
- Information Resources Management Association. (2015) *Curriculum design and classroom management..* (pp.837)
- iPED Research Network Academic Futures. (2009): *Inquiries into Higher Education and Pedagogy*.(pp. 86). London: Cambridge Scholars Publishing.
- Loucky, John Paul, and Jean L. Ware, eds. (2016). *Flipped Instruction Methods and Digital Technologies in the Language Learning Classroom*. (pp.186). IGI Global.
- Lowry, C. M. (2000). *Supporting and Facilitating Self-Directed Learning*. ERIC Digest No 93,1989-00-00
- Maloy, Robert W., et al. (2017). *Transforming learning with new technologies*. (pp.43)
- Marx, Ronald W., et al. (1997). "Enacting project-based science." *The elementary school journal* 97.4, (pp.341-358)
- Student, M. Ed. (2015). *Flipped Classroom: How To Flip And Not To Flop..*1065
- Sumarmo, Utari. (2004). *Kemandirian Belajar: Apa, Mengapa, dan Bagaimana Dikembangkan Pada Peserta Didik*. Makalah pada Seminar Tingkat Nasional FPMIPA UNY Yogyakarta tahun 2006
- Sumarmo, Utari, dkk. (2012). Kemampuan Disposisi Berpikir Logis, Kritis, dan Kreatif Matematika (Eksperimen terhadap Siswa SMA Menggunakan Pembelajaran Berbasis Masalah dan Strategi *Think talk Write*). *Jurnal Pengajaran MIPA*, 17(1), (pp.17-33)
- Suyanti, Dwi Retno. (2010). *Strategi Pembelajaran Kimia*. Yogyakarta: Graha Ilmu
- Trianto.2010. *Mendesain Model Pembelajaran Inovatif-Prograsif*. Jakarta :Prenada Media UNNES PRESS
- Wolff, Lutz-Christian, and Jenny Chan. *Flipped classrooms for legal education*. Springer, 2016. (pp.10)