



# Students' Response to the Use of a Flipped Learning Model (FLM) in Abstract Algebra Course

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**Abstract.** This article describes how students respond to Abstract Algebra Course using FLM. The data in this study are part of research data applying FLM accompanied by teaching materials developed using the 4D model (define, design, develop, and disseminate). The data source was students of the Mathematics Education Study Program who took the Abstract Algebra Course in the July-December 2020 Semester, totaling 13 students. From the data analysis, it was concluded that students responded positively to the implementation of learning using FLM accompanied by teaching materials.

**Keywords:** Students' Response · Flipped Learning Model · Abstract Algebra Course

## 1 Introduction

This research is focused on improving the quality of mathematics learning, especially Abstract Algebra in tertiary institutions. One of the main issues in learning mathematics is the low involvement of students in studying so the low learning outcomes they get. Student involvement in the teaching and learning process is the key to success for these students, students who are low in involvement have an impact on the limited knowledge they can gain in learning [1].

To increase student involvement in the Abstract Algebra course, one of the lecture models that can be adopted is the Flipped Learning Model (FLM). This model is relatively new to being used in developed countries to improve the quality of mathematics courses in universities. Flipped Learning is a reverse learning model. Why is it said upside down? In conventional mathematics learning/lectures, learning of a particular topic begins with students studying in class and continues with homework (studying outside the classroom).

Online learning also leaves challenges where students have different responses when the learning process takes place and when grades have been inputted' on the portal, this is related to rewards that affect the student's behavior [2].

In FLM the plot is reversed, students learn certain topics at home first and then continue learning in class. So, the learning design in this FLM is that students get

acquainted with new material in activities at home (outside the classroom) first, then continue with stabilization activities in the classroom. Learning at FLM begins with individual learning activities, then continues with learning together in the classroom [3]. FLM adheres to constructive [4] learning, where knowledge is constructed by each student individually first and then consolidated through joint activities in class.

The discussion of constructivism in this section is intended to provide a theoretical basis for the flipped learning model (FLM) used in this study. The learning model used in the teaching and learning process in this study is based on many of the principles promoted in constructivism. Constructivism is a theory of learning based on the view that students are active knowledge seekers supported by curiosity [5]. The main concept of constructivism is that learning is an active process of creating knowledge by students, where students construct their knowledge to build understanding [6, 7].

Students do experience obstacles in following the lecturer's directions on the application of the BACA DULU [8] learning model and blended learning in the form of online and offline learning [9], but this is still done by the lecturer as part of the online learning solution as well so that students do not experience boredom and have the motivation to attend lectures. Online learning as well leaving a challenge where students have different responses when the learning process takes place and when the value has been inputted on the portal this is related to rewards that affect the student's behavior.

Higher education institutions, including Universitas Negeri Padang, face many challenges with the number of students growing and the need to modify conventional lecture-based learning to a technology-based basis [10]. To face this challenge, the flipped classroom learning model is one option. Flipped classroom learning (reverse class) is often defined as an instructional strategy and part of mixed learning instruction, in which students seek to understand instructional content before entering class by watching lectures recorded on video or learning via e-learning first. Activities in the classroom are then more focused on students' higher-order thinking skills or knowledge construction, such as small group discussions, dialogues, presentations, and receiving and giving explanations known as the Socratic question process [11].

Furthermore, according to [4] the Flipped Learning Model is a type of mixed learning in which traditional classroom settings are done in reverse. Giving material is shifted outside the classroom, while class time is used to solve problems or do practical work the discussion/collaboration ion between students and lecturers. This relatively new teaching model claims that reversing the classroom can engage students with a more effective learning process, achieving better teaching outcomes.

This study aims to develop an abstract algebra course material based on the Flipped Learning Model (FLM) and see the impact of its use on student involvement and learning outcomes. This research is a study of the implementation of a learning model accompanied by learning materials. The learning materials based on Flipped Learning Model (FLM) were developed using the 4D model (define, design, develop, and disseminate). The learning materials that are compiled and developed are designed to be used by students through e-learning so that students can study the material clearly at home (outside the classroom). The question that will be answered in this article is how the responses of students who take part in abstract algebra courses using FLM about the practicality of the learning material.

## 2 Method

This study used a development research design with a 4-D development model designed by Thiagarajan, Semmel, and Semmel [12]. The development model consists of 4 stages which include: defining, design-developing op, and disseminating. This research only reached the stage of development and use in one class of students to see its practicality.

The participants in this study consisted of 13 students of the Abstract Algebra Course in the July-December 2020 semester. This weight of 4 credits. The implementation of the lecture was scheduled twice a week. The implementation of FLM-based lectures is integrated with the online learning system owned by Universitas Negeri Padang (UNP) on the elearning2.unp.ac.id system. Learning materials designed to support the implementation of FLM in Abstract Algebra Course. Students could access all lecture materials on the e-learning system. The distribution of lecture materials is arranged per lecture week according to the syllabus.

In one week there were two lecture schedules, on the first schedule students learned the material that had been prepared on elearning2.unp.ac.id independently. On the second schedule, students and lecturers met virtually using the Zoom Meeting application. At this meeting, students were asked to discuss in small groups with members of 3 or 4 students to solve abstract algebra questions given by the lecturer. These questions can also be accessed by students on the e-learning system. The time provided for discussion in small groups was 60 min, the remaining 40 min are continued with classical discussions to discuss issues that have not been thoroughly discussed in small groups.

Data from Students' responses were used to see the practicality of the device and to see the use of FLM in learning. The instruments used were a closed questionnaire and an open questionnaire. A closed questionnaire was given to students to see the practicality of the devices that have been developed. In each statement in the questionnaire, 4 alternative responses could be chosen by students. The following are the four alternative responses and their weights; strongly agree (weight 4), agree (weight 3), disagree (weight 2), and strongly disagree (weight 1). In the open questionnaire, there are five questions given to students to reveal the practicality of the FLM-based Abstract Algebra lecture materials being developed. The five questions are as follows; 1) Could you take e abstract algebra course using the FLM model assisted by FLM-based learning materials that are integrated with the elearning2.unp.ac.id system? 2) Please explain the advantages and benefits of the FLM-based lecture materials! 3) Please explain the shortcomings of the FLM-based lecture materials! 4) From your experience so far, which one do you prefer to study FLM-based lecture materials through elearning2.unp.ac.id or learn directly from the file/printout? Please explain! 5) To further improve the lecture material, what suggestions/suggestions could you give?

The data from the closed questionnaire were analyzed quantitatively and data from the open questionnaire were analyzed qualitatively. Students' responses to the closed questionnaires were arranged in the form of a Likert scale. This Likert scale was arranged in a positive category, so that positive statements get a score according to what is stated by [13] as follows; 1) Score 4 for the strongly agree (SA) statement, 2) Score 3 for the agree (A) statement, 3) Score 2 for the disagree (D) statement, 4) Score 1 for strongly disagree (SD) statement. Descriptive techniques are used to describe data from the open

questionnaire. There are three stages in analyzing qualitative data, namely reducing data, presenting data, and drawing conclusions.

### 3 Result and Discussion

The practicality of the lecture equipment is seen in the data obtained from closed questionnaires and open questionnaires. A closed questionnaire about practicality was given to 13 students and an open questionnaire was filled in by 3 students who had attended lectures using the FLM-based lecture material that was developed. From the closed questionnaire given, the following data were obtained;

From the data in Table 1, it is concluded that the FLM-based abstract algebra lecture material developed has a practicality value of 87.3% with very practical criteria.

The practicality of the learning material is also seen in the data from the open questionnaire. The following are some of the student’s written answers to questions regarding the advantages and benefits of FLM-based learning materials (Fig. 1).

**Table 1.** Distribution of Student Answers, Values, and Criteria for Practicality

No	Rated Aspect of Practicality	Number of Answers per Score			
		SA (4)	A (3)	D (2)	SD (1)
1	I like the look of the learning materials (typeface, font size, and layout).	9	4	0	0
2	I can follow the learning flow of the learning materials.	7	6	0	0
3	I can learn the definition and explanation very well.	8	4	1	0
4	I can study the theorems and proofs very well.	6	6	1	0
5	I can study the examples given very well.	7	4	2	0
6	I can use this lecture material for independent study.	8	3	2	0
7	I can read the questions given very well.	8	5	0	0
8	The questions given accommodate me to discuss as a group or in class.	6	5	2	0
<b>Amount</b>		<b>59</b>	<b>37</b>	<b>8</b>	<b>0</b>
<b>Amount x Score</b>		<b>236</b>	<b>111</b>	<b>16</b>	
<b>Practical Value</b>		<b>87,3%</b>			
<b>Criteria</b>		<b>Very Practical</b>			

Bahan ajar berbasis Flipped Learning Model membuat proses belajar-mengajar lebih menyenangkan karena pemberian materi sebelum kelas dimulai sehingga dapat meningkatkan proses pembelajaran, mengaktifkan dan mendorong siswa lebih dalam dan luas antara dosen dan mahasiswa untuk membahas hal-hal yang substansial serta memacu kreatifitas mahasiswa dan daya imajinasi untuk menyelesaikan soal-soal atau masalah yang diberikan pada bahan ajar tersebut.

**Fig. 1.** Dwi’s answer about the advantages and benefits of FLM-based learning materials.

Salah satu manfaat dari bahan perkuliahan berbasis FLM yaitu, mahasiswa dapat mudah mengakses bahan perkuliahan dan dapat diulangi kapanpun dan dimana pun. Bahan kuliah juga dapat disimpan. Hal ini lebih praktis daripada mahasiswa harus menghadiri perkuliahan dan dosen yang dimana dalam situasi seperti seriang ini. Mahasiswa bisa melihat rekaman video atau berupa file bahan perkuliahan yang distore oleh dosen, sehingga proses perkuliahan bisa dilakukan secara mandiri dan berulang-ulang.

**Fig. 2.** Sindy's answer about the advantages and benefits of FLM-based lecture materials.

Kelebihan kuliah berbasis FLM adalah waktu diluar lebih banyak dan dapat ditela fatis muka, kesempatan untuk belajar kapanpun pada kita, lingkungan belajar penuh dengan alat familiar. Manfaatnya, karena waktu belajar tidak dibatasi sehingga kita dapat mengulang-ulang materi tersebut hingga kita benar-benar paham akan materi tersebut, informan yang berkaitan / mendukung materi tersebut dapat dicari dimanapun sehingga lebih luang.

**Fig. 3.** Macchia's answer about the advantages and benefits of FLM-based lecture materials.

In the answer above, Dwi argues that FLM-based teaching materials make learning time efficient because the material has been given to the e-learning system before the class starts. This allows Dwi to streamline the learning process and allows him to explore and elaborate more deeply and broadly on the material given. Dwi also argued that the activities designed were able to spur student creativity and imagination in solving the questions given to the teaching materials (Fig. 2).

Sindy revealed that one of the benefits of FLM-based learning material is that students can easily access lecture materials that can be accessed anytime and anywhere because the material has been placed in the UNP e-learning system. Furthermore, Sindy stated that she could save lecture materials and she could study them independently and repeatedly.

In Fig. 3, it can be seen that Maichia argues that the advantage of FLM-based learning is the availability of more time for independent study because FLM is given student-centered learning opportunities and students can learn in an environment and tools that are familiar to them. Furthermore, Maichia revealed that with the freedom to use her study time independently, she could study the material repeatedly and look for related information so that she could understand it well.

So, from the results of student responses who have used the FLM-based abstract algebra learning material, it is revealed that they can use the device well. These tools facilitate them to deepen their knowledge and understanding.

## 4 Conclusion

Student responses about the practicality of lecture tools are seen in how these devices can be used by students. The data for this was obtained from closed and open questionnaires. From the closed questionnaire data analysis, it can be concluded that the lecture devices developed have very practical criteria. From the analysis of the open questionnaire data, it was concluded that the tool facilitated them to deepen their knowledge and understanding, and the tool supported them in their independent learning process. So

from the practical aspect of the device developed, it can be used by students in Algebraic Structure lectures with the FLM model.

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