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Development of flipped learning model learning assisted with spada learning management system

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Abstract: This research aims to develop flipped learning model learning tools in Advanced Calculus courses through Online Learning Systems (SPADA). This research is development research with the research subjects being 26 Mathematics Education students. The learning tools developed were in the form of teaching materials and learning videos were validated by two material expert validators and two media expert validators. The research instruments used were teaching material validation sheets, learning video validation sheets, teaching material readability test sheets and student response questionnaires to learning videos. The results of the validation show that the learning tools developed are in the valid category and the student response questionnaire to the learning tools developed shows a good response, so it can be concluded that the learning tools developed in the form of textbooks and learning videos using the Flipped Learning model assisted by the SPADA Learning Management System have met validity, practicality, and effectiveness so that they can be used in the learning process.

Keywords: Development Learning Tools; Flipped Learning; Learning Management System.

Introduction

The pandemic has changed the pattern of teaching along with the Industrial Revolution 4.0 and the Societal Revolution 5.0 requires humans to move according to developments in information technology advances. The Industrial Revolution 4.0 was marked by the rapid development of information technology, while the Societal Revolution 5.0 was marked by the necessity for humans to think computationally (Lee et al., 2018). The world of education is no exception, especially lecturers as education implementers who are required to be able to master developing information technology to support their learning activities. Blended learning-based learning models have been widely used as an alternative learning model that combines face-to-face and online learning (Purwoto et al., 2022). Teachers can choose what learning model is suitable for them to use in learning.

One of the blended learning models that is widely discussed is the Flipped Learning model (Nouri, 2016). According to (Boelens et al., 2017); (Blau & Shamir-Inbal, 2017); (Rasheed et al., 2020); and (Thai et al., 2017), Flipped Learning is a blended learning model through face-to-face interaction (synchronous) with independent learning (asynchronous). In line with that (Chao et al., 2021) argues that the Flipped Learning Model is an innovative pedagogical approach that focuses on learner-centered teaching by reversing the traditional classroom learning system that has been carried out by teachers so far. That means that previously in traditional learning students listened to the lecturer's explanation in the classroom and then worked on a series of problems as homework, Flipped Learning turned it around to students reading literature and assimilating material in the form of videos first independently at home then the lecturer would guide analyzing, and solving problems experienced through discussion (Chen et al., 2014);

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(Sivarajah et al., 2019). That is in line with what Kim in Arslan revealed that in Flipped Learning before class starts students first study the material through a variety of learning resources from various available media such as videos, powerpoints, and LMS (Learning Management System) and record some things that are not understood (Arslan, 2020); (Harjono et al., 2022). Flipped Learning has nine principles consisting of providing incentives to students to prepare for class, providing a mechanism for assessing student understanding, providing quick feedback on both individual and group assignments, providing sufficient time for students to complete assignments provided, facilitating so that students can build learning communities, providing easily accessible technology, providing opportunities for students to obtain explanations of material before class, providing a clear relationship between activities inside and outside the classroom, and provide clear and well-structured guidance (Kim et al., 2014); (Nuryadin et al., 2021).

The results of previous research found, that there was a positive effect of applying Flipped Learning on student motivation and learning outcomes because students were given learning resources in the form of learning videos which they liked more because they could repeat them several times if they did not understand the material (Palinussa & Mananggel, 2021). Likewise (Basal, 2015) argues that if the Flipped Learning learning model is packaged as well as possible by adapting to the principles of Flipped Learning, it can improve student learning outcomes. (Gough et al., 2017) also revealed that learning using a flipped classroom includes active learning and that learning can also improve students' higher-order thinking skills (Sari et al., 2023) and can increase teacher-student interaction. In addition, Flipped Learning can increase student motivation in learning because students enjoy learning using learning videos (Sholikhah & Alyani, 2022; Zulhamdi et al., 2022; Putra et al., 2022). Flipped Learning is also a learning model that supports the Merdeka Belajar policy where the aim and essence put forward by the Merdeka Belajar policy is to explore the greatest potential of educators to innovate and improve the quality of learning independently. The reality is that the curriculum currently being used as an independent curriculum, which is a curriculum that is oriented towards the freedom of teachers and students to innovate and learn independently and creatively (Satriani et al., 2021). Therefore, teachers must be able to develop innovative, interactive, and effective learning models for students and students must also be able to develop their abilities, talents, and interests (Satriani, 2022). In response to this, the Flipped Learning model is the right choice that can be used by educators in carrying out learning processes that utilize digital-based learning systems such as the Learning Management System in managing learning (Pang, 2022). Apart from that, Flipped Learning can increase learning independence in students (van Alten et al., 2020). Flipped learning is active learning that is student-centered and designed to improve the quality of learning (McCord & Jeldes, 2019), and Flipped Learning also provides options related to learning with different cognitive levels (Khairunnisak et al., 2023). Teachers can provide enrichment material for students to work on at home (Turan & Akdag-Cimen, 2020) and what is more important is that Flipped learning provides opportunities for students to learn in various ways anywhere and at any time so that students can explore their curiosity and knowledge (Ahmed & Indurkhya, 2020).

Currently, the learning process of the mathematics education study program has actually used a blended learning model by utilizing various available Learning Management Systems such as Google Classroom, Edmodo, and the LMS developed by Universitas Muhammadiyah Makassar. However, based on the survey results, the learning process using the SPADA LMS is still at a percentage of 65% of all existing courses even though the use of information technology is very supportive of learning where lecturers already have accounts to access SPADA, 100% of lecturers have personal computers and adequate campus internet access. Likewise with students based on observations 95% of students have smartphones and laptops that can be used to access SPADA. From the survey above, the problem faced is not in the limited infrastructure but lies in the disinterest of lecturers to develop flipped learning tools. Based on the results of interviews conducted during observation, researchers can conclude that the reason they do not develop flipped learning tools is that they do not have a flipped learning tool template that can be used as a reference for developing learning tools in the courses taught. Especially in the Mathematics Education Study Programme, the survey showed that only about 45% of the total courses were taught using SPADA but even then, they were not equipped with learning tools that meet the expected standards. Most lecturers only upload PowerPoints or videos taken from YouTube to upload to their SPADA. This means that the SPADA system still lacks learning resources that are presented to students for them to learn. Students need more varied teaching materials and learning videos so that each lecturer can make their own learning videos that are in accordance with the expected Learning Outcomes. Developing learning resources in the form of teaching materials and learning videos by lecturers will have an impact on students being able to obtain more diverse learning resources so that students can gain

more knowledge from learning resources presented in SPADA.

Therefore, the main objective of this research is to develop a flipped learning model learning tool for Advanced Calculus courses through LMS SPADA in the form of textbooks and learning videos that can be valid, practical, and effective and can be used in the learning process.

Method

This research is a development type of research to produce learning tools in the form of an Advanced Calculus Textbook through LMS SPADA, and learning videos. The resulting product is a learning video packaged in LMS SPADA. The development refers to Plomp which consists of 5 phases including the initial study phase where in this case the researcher analyses the conditions that occur through observations and interviews and provides a questionnaire to students related to the flipped learning model. Furthermore, the design stage is the stage of preparing a device development implementation plan, then proceeding with the stages of construction, testing, evaluation, and revision, namely the stage of making learning devices in the form of teaching materials for Advanced Calculus Materials and making learning videos which are then validated, tested, evaluated and then revised the developed learning devices, the next stage is the implementation stage where the learning devices that have been revised are then applied through the SPADA.

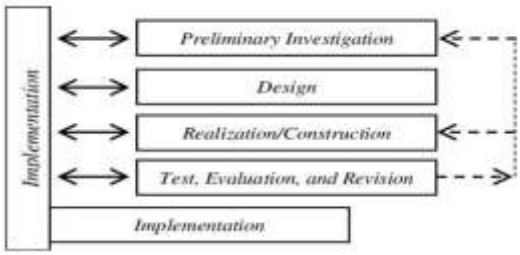

Figure 1. Development design Ploomps

Learning Management System. The following is the development design according to Ploomp. The subjects used in this study were 26 students of the mathematics education study program at FKIP Muhammadiyah Makassar University with two validators. The data was collected in the form of material expert validation results on textbooks, validation results from the material expert team on learning videos, media expert validation results on learning videos, student readability test results on textbooks, and student response questionnaire results on learning videos. The average score from the results of the expert assessment adjusted to the criteria for evaluating the device which can be seen in the following table 1.

Table 1. Leaning device validation assesment criteria

Value	Qualification	Desicion
$3.6 \leq \underline{X} \leq 4$	Very valid	Ready to use in the field
$2.6 \leq \underline{X} \leq 3.5$	Valid	Products can be continued by adding things that are lacking and not too big and making certain considerations
$1.6 \leq \underline{X} \leq 2.5$	Fairly Valid	Revise again carefully and look for product weaknesses to improve
$1 \leq \underline{X} \leq 1.5$	Unvalid	Make major product revisions

Result and Discussion

The first stage carried out was an initial study related to curriculum analysis including assignment material, assignments, and indicators for student cognitive analysis. The material provided is Advanced Calculus taught in semester 3. Students' cognitive analysis is based on prerequisite course grades, namely Differential and Integral Calculus. The format of textbooks and learning videos is adjusted to be attractive so that students are motivated to learn, work together, and construct their own knowledge. After the learning device was designed, the researcher asked several experts to validate it at the realization or construction stage. Validation is carried out by two validators. The validation results for textbooks can be seen in the following table:

Table 2. The Results of The Material Expert Validation Of Textbooks

Rated aspect	V1		V2	
	1	2	1	2
Form	3	3	3	4
Language	3	4	4	4
Content	3	4	3	4
Average	3	3.67	3.33	4
Average Total		3.50		

From the table 2, data obtained that the results of textbook validation with aspects assessed in the format, language, and content show that the overall average score for the accumulation of two validators is 3.50. Based on the assessment criteria it is in the Valid category.

From the table 3, data obtained that the results of the validation of learning videos with aspects assessed in the form of quality of material and quality of

motivation show an overall average value of 3.64. Based on the assessment criteria, it is in the Valid category.

From the table 4, data is obtained that the results of validation of learning videos by media experts with aspects assessed including aspects of language use and media quality show an overall average value of 3.87. Based on the assessment criteria it is in the Valid category. After revisions have been made regarding the validator's suggestions, the device is ready to be tested on students. Trials were carried out on 26 students regarding student readability tests on textbooks, so student responses can be seen in the following table 5.

Table 3. Material expert validation results on learning videos

Rated aspect	V1	V2
Material quality		
1. The accuracy of the content with the comptenceies to be achieved	4	4
2. Completeness of material with learning outcomes	3	4
3. Material breakdown	4	3
Motivation quality		
1. The presentation of material can attract students' interest in learning	3	4
2. The presentation of the material makes students listen well	4	3
3. Presentation of material can foster curiosly	3	4
4. Presentation of material can increase students activity.	4	4
Score average	3.57	3.71
Score Total	3.64	

Table 4. Media expert validation results on learning videos

No	Questions	Video 1 V1	Video 1 V2	Video 2 V1	Video 2 V2
		1	2	1	2
	Aspect of language used				
1	the video uses good Indonesian	3	4	4	4
2	The use of fonts is appropriate and easy to read for users	4	4	4	4
3	Accuracy in the use and writing of foreign languages	4	4	4	4
4	Presentation of sentences in languages that is clear and easy to understand	3	4	4	4
	Ascpects of media quality				
5	The clarity of the displayed image/video	4	4	4	4
6	The suitability of the video images displayed with the material presented	4	4	4	4
7	There are trasition effect on the video to attract the users attention	4	4	3	4
8	Clarity of use of sound effects	4	4	4	4
9	Material is accordance with basic competencies	4	4	4	4
10	Clarity of video content	4	4	4	4
11	Video effectiveness	3	4	3	4
12	Appropriateness of the shape and size of the letters used	4	4	4	4
13	Video is suitable for use in learning	3	4	3	4
	Score Average	3.69	4	3.77	4
	Score Total		3.85		3.89

Table 5. Student Readability Test Results for Texbooks

Ass Indicator	Statement	SD	DA	A	SA
Interest	The appearance of the texbook is attractive	0	0	20	6
	The textbooks make me more enthusiastic	0	0	26	0
	The text book support me in mastering advanced Calculus	0	0	24	2
Material	The material presented is easy to understand	0	0	23	3

Ass Indicator	Statement	SD	DA	A	SA
	The presentation of the material in this textbook encourages discussion with other friends	0	0	22	4
	This book contains activities and questions that can test my ability in advanced Calculus	0	0	9	17
Language	The sentences used are easy to understand	0	0	15	11
	The language used is simple and easy to understand	0	0	20	6
	Score Average			59.6	24.5
	Score Total				3.23

From the table 5, student readability test data on textbooks obtained includes interest, material, and language, which shows that students choose to agree and strongly agree with the indicators of the statement above. Furthermore, the student response questionnaire to the learning video can be seen as follows:

Table 6. Results of Response Questionnaries to Learning Video

Question	SD	DA	A	SA
Learning Objectives are clear	0	0	14	12
The sentence presentation is easy to understand	0	0	26	0
The material discussed is interesting	0	0	6	20
The Clarity of the video supports the learning process	0	0	5	21
Use of clear soud effect	0	0	20	6
Contents according basic competencies	0	0	19	7
Learning video are the one of learning resources	0	0	2	24
The learning videos really helped me to understand advanced Calculus	0	0	4	22
I love using leaning video for learn Advanced Calculus	0	0	26	0
Average			40.65	49.76
				3.48

Based on the results of the student response questionnaire to the learning video, data obtained that students chose to agree and strongly agree with the statement indicators above. Thus, it can be concluded that students responded well to the learning videos that were developed. From the overall assessment above, it can be concluded that the textbooks and learning videos for advanced calculus courses using the flipped learning model are said to be practical. The following is an figure 1 of the appearance of advanced calculus textbooks developed in SPADA. And figure 2 is an image of learning video development in SPADA.

According to (Palinussa & Mananggel, 2021), in making learning videos or teaching materials, it must have more individual, shorter and interactive feedback so that students do not feel bored. There are many studies that mention that the use of learning media in the form of videos can improve several student abilities which are of course supported by the appropriate learning model. According to (Beckman et al., 2014) students' understanding of concepts can increase if they utilise technology in the learning process such as presenting learning videos, besides that it can make students more skilled and independent to construct their knowledge with activities and learning resources through the media used (Xiao et al., 2019), and can help students solve poblems (Hanney, 2018). In addition (Kellman & Krasne, 2018) stated that using technology in learning will give a different response to students, namely students prefer learning with features that can improve the way students think in understanding the material provided. There is also research that suggests that using a video-assisted flipped learning model can also improve students' creative thinking skills Harjono et al.

(2022) Sholikhah & Alyani (2022), Zulhamdi et al. (2022), it can improve students' critical thinking skills Novitri et al. (2022), can improve students' argument skills Epinur & Minarni (2023), and can increase student engagement and learning motivation (Putra et al., 2022).

Thus, the development of learning tools in the form of textbooks and learning videos in each course is something that teachers should consider in order to achieve learning objectives in the classroom.

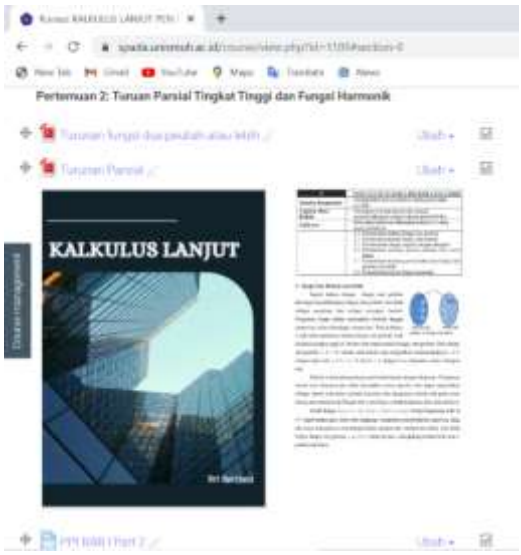

Figure 2. textbooks developed at SPADA

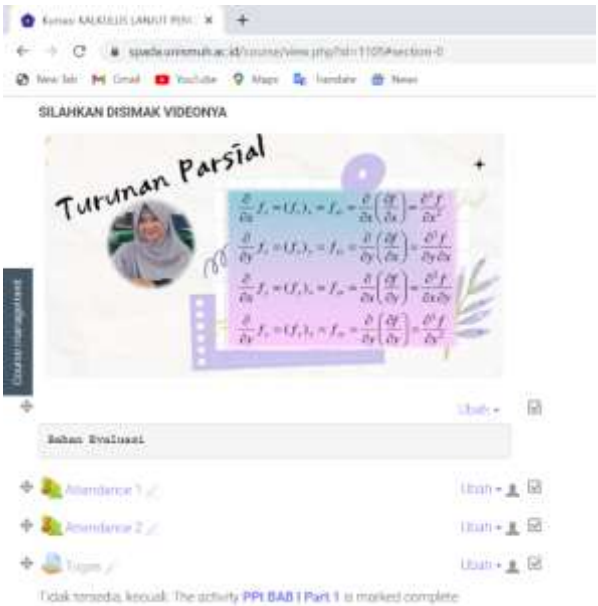

Figure 3. Leearning Videos in SPADA

Conclusion

Based on the research results above, it concluded that the learning tools developed in the form of textbooks and learning videos using the Flipped Learning Model assisted by the SPADA Learning Management System have met validity, practicality, and effectiveness so that they can be used in the learning process. An indication of students' interest in studying advanced calculus is the ease of accessing learning resources in the form of textbooks and learning videos via SPADA with more flexible times so that students can study anywhere and at any time.

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Author Contributins

Conceptualization, S; methodology, S, W. A.; validation, S, A..; formal analysis, S, W.; investigation, S, A; resources, S, W.; data curation, S, A.: writing—original draft preparation, S, W.; writing—review and editing, S, W. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The funders had no role in the design of the study, in the collection, analyses, or interpretation of data, in the writing of the manuscript or in the dicision to publish the results.

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