Formatif: Jurnal Ilmiah Pendidikan MIPA, September 2024, 14 (2), 505-504
http://dx.doi.org/10.30998/formatif.v14i2.28950
p-ISSN: 2088-351X e-ISSN: 2502-5457
Accredited (S2) by Ministry of Research and Technology of Indonesia No. 148/M/KPT/2020
Available online at https://journal.lppmunindra.ac.id/index.php/Formatif/index

Development of a Flipped Classroom Learning Model Using the Discord Application to Improve the Student Learning Effectiveness of Class XII of Zion Senior High School, Makassar

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Abstract

This research is a development research or Research and Development (R&D). The product development process refers to the ADDIE model. The research was conducted at SMA Zion Makassar in the even semester of the 2024/2025 academic year. The operational test of the product was carried out in class XII Thames, which consisted of 34 students. The data analysis techniques used were descriptive and inferential statistical analysis on validity, practicality, and effectiveness. The research results showed: (1) the results of the lesson plan product assessment and other instruments from 2 validators were obtained at 0.83 in the valid category; (2) the results of practicality were assessed from the implementation and teacher responses obtained 93.5% in the very practical category; (3) the effectiveness of the product was assessed based on the aspect of student activity observation obtained 97% with a very high category, the aspect of student response obtained 89% in the very high category, the aspect of classical completeness obtained 88% in the high category, the aspect of normalized N-Gain obtained 0.78 very high, and the aspect of the average posttest results obtained 89.53, all aspects met the effective requirements. In addition, normality, homogeneity, and paired sample t-test tests were carried out. The results obtained data were normally distributed and homogeneous because the significance value was >0.05, and there were differences in learning outcomes because the significance value was 0.00 <0.05. Based on this, the product is valid, practical, and effective in improving student learning outcomes.

Keywords: Development, flipped Classroom, Discord.

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How to Cite: Padaunan, A., Djadir, D., & Bernard, B. (2024). Development of a flipped classroom learning model using the discord application to improve the student learning effectiveness of class XII of Zion Senior High School, Makassar. *Formatif: Jurnal Ilmiah Pendidikan MIPA,* 14 (2): 505-520. http://dx.doi.org/10.30998/formatif.v14i2.28950

INTRODUCTION

Every human being needs education in their life process. A good education can encourage future development by developing students' potential, so that students can face and solve the problems they face. In addition, education also needs innovation to help students compete in the future. Education in the current era requires students to have more knowledge and skills, and requires students to master various disciplines. So, the curriculum is considered necessary for the experience of development or renewal.

In the current era of technological industry development, education requires adjustments to the new curriculum according to the needs of the community. On the other hand, technological developments can help teachers in finding references to teaching materials, methods, and even learning models that can be used. In addition, current technological developments can be one of the learning facilities that can support the learning process both offline and online.

Based on the results of the Program for International Student Assessment (PISA) in 2022, which were announced on December 5, 2023. Indonesia is ranked 68 out of 81 countries with a math score of 379, science 398, and reading 371.

The low achievement of students in the field of mathematics when compared to other countries is one indicator of the low problem-solving ability of students in mathematics, so that mathematics is still difficult for students to understand. This is a special concern for mathematics teachers to determine the right learning model to follow up on the PISA results.

As a teacher, making the learning process more effective for students is the main focus in education. This can be combined with the use of technology in education. In the past, the learning process used conventional methods that only required students to copy text and record explanations from the teacher. Along with the times and technology, teachers are required to present learning materials that are contextual, creative, and efficient, and utilize technology. So, teachers must strive to update their insights and abilities in accordance with the times. The Merdeka Curriculum currently implemented refers more to contextual problems, so that students are required to be able to apply knowledge in the real world.

The Merdeka Curriculum requires students to play an active role in the learning process; the teacher only acts as a facilitator for students. In addition, the Merdeka curriculum requires teachers and students to be skilled in using technology in every learning process. So, this becomes the main focus for a teacher on how to provide a creative and innovative learning process by utilizing technology. Therefore, teachers must choose a good and appropriate learning model for students in order to improve their problem-solving abilities.

If you pay attention, the current learning process still tends to be the same as the learning process in ancient times, even though technology has experienced very rapid development. This is evidenced by seeing learning patterns in various schools that still explain the material at the beginning of learning, and at the end give students assignments to do at home. This pattern is still ongoing, resulting in the emergence of various criticisms from parents, namely the lack of rest time for students at home.

Based on observations at one of the schools in Makassar city, namely Zion High School Makassar, similar problems were also encountered. Zion High School is quite famous among the community as a school with a very large amount of homework. So, this makes a few parents afraid to send their children to Zion High School. Mathematics is one of the subjects with a high level of homework assignments. In the learning process in class, many teachers focus on completing the target learning material. This results in giving a few practice problems with a low level of difficulty, followed by giving homework for problems with a high level of difficulty. This makes it difficult in learning and they do not get help from the teacher to the fullest extent. This continues to result in student learning outcomes decreasing, as can be seen from the results of students' math tests, which are quite low.

Based on these problems, researchers consider it necessary to conduct a study to find solutions to these problems. One solution that can be used to overcome these problems is to develop a learning model involving technological assistance. This is expected to be able to change learning patterns to be more effective in improving student learning outcomes.

The Flipped Classroom learning model is one of the learning models that can be applied in the current learning process. In the Flipped Classroom learning model, teachers can divide learning time, namely by providing material and videos on a topic online, so that when in class, the teacher can focus more on solving problems and pay attention to improving student problem-solving skills. This can help the learning process at school by saving time in class and making the teacher's attention more focused on students when

learning in class. According to Maolidah (2017), the Flipped Classroom learning model is an innovative learning model to use, as well as more effective in utilizing time in the classroom, so that learning is more efficient and can increase students' knowledge and thinking skills. This is also corroborated by several studies that discuss the effectiveness of the Flipped Classroom learning model in mathematics subjects, namely according to Usman (2023) revealed that the percentage of effectiveness reached 84.48% of students had scores that met the minimum completion criteria, besides that according to Egara (2023), the results of the Flipped Classroom learning model were effective in improving student learning outcomes compared to conventional learning models. So, by using the Flipped Classroom learning model, learning no longer recognizes distance; learning can be done anywhere and anytime.

Communication application becomes an important thing in the learning process of students, as well as the learning process in the classroom. In this study, researchers plan to use the Discord application in the learning process. This is because the Discord application tends to be widely used by the younger generation today, including students in schools. In addition, the Discord application has the same complete features as other applications, and the most important thing is that it is free and does not have a time limit. So, this is very helpful in the Flipped Classroom learning model.

Based on the above, in this study, researchers plan to develop a Flipped Classroom learning model using the Discord application to increase the effectiveness of students' learning.

Based on the background of the problems raised, the general problem in this study is "How is the Process and Results of Developing a Flipped Classroom Learning Model Using Discord Application in Class XII Zion High School that is Valid, Practical, and Effective?". The problem formulations in this study are as follows: (1) What is the process of developing a Flipped Classroom learning model using the Discord application in class XII of Zion High School that is valid, practical, and effective? (2) How is the prototype of the Flipped Classroom learning model developed using the Discord application in class XII of Zion High School? (3) What is the validity level of the development of the Flipped Classroom learning model using the Discord application in class XII of Zion High School? (4) What is the level of practicality of the development of the Flipped Classroom learning model using the Discord application in class XII, Zion High School? (5) What is the effectiveness level of the development of the Flipped Classroom learning model using the Discord application in class XII of Zion High School?

The general objective of the research is to find out the process and results of developing a Flipped Classroom learning model using the Discord application in class XII, Zion High School, that is valid, practical, and effective. Based on the general objectives, it is elaborated into several parts, namely: (1) determine the process of developing a Flipped Classroom learning model using Discord application in class XII Zion High School that is valid, practical, and efficient, (2) determine the prototype of the development of the Flipped Classroom learning model using the Discord application in class XII of Zion High School, (3) determine the validity level of the development of the Flipped Classroom learning model using Discord application in class XII of Zion High School, (4) determine the level of practicality of the development of the Flipped Classroom learning model using the Discord application in class XII Zion High School, (5) determine the effectiveness level of the development of the Flipped Classroom learning model using the Discord application in class XII of Zion High School.

METHODS

This research is a research and development (R&D). The procedure for developing the Flipped Classroom learning model using the Discord application is the ADDIE development model, which was developed to assess the implementation and effectiveness of the Flipped Classroom learning model using the Discord application. Limited trials on the development of the Flipped Classroom learning model research using the Discord application were conducted on eight students of class XII of SMA Zion Makassar in the 2024/2025 academic year. The product trial in this study used class XII Thames SMA Zion Makassar in the 2024/2025 academic year. The Development Stage uses the ADDIE development model, which was developed to see how the implementation and effectiveness of the learning process are affected by the developed product. The development process consists of five parts, namely the analysis, design, development, implementation, and evaluation stages. In general, the development procedure is divided into three stages, namely Before, During, and After, each aspect of which can be seen in Figure 1.

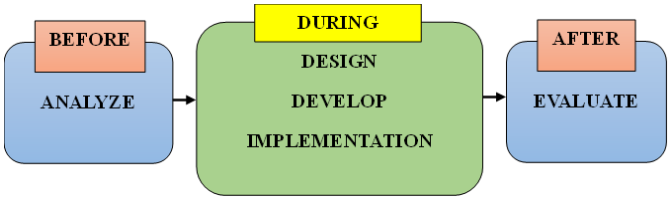

Figure 1. Development Procedure Stages

1. Analyze

The analysis was conducted to determine the right problems and solutions, and to determine the competencies of students, which are the basis for developing the Flipped Classroom Learning Model using the Discord application. At this stage, a preliminary study was conducted, namely an initial interview with teachers to find out the initial problems that occurred in the field. The analysis stage was carried out as an initial stage to find out the conditions, needs, and obstacles, as well as the learning outcomes of students, as seen from the students' daily test scores. The analysis stage consists of initial and final analysis, analysis of student characteristics, analysis of learning content, and analysis of materials.

2. Design

The product to be developed is well designed, so the product development is carried out according to the design that has been made. Before making a design for the product, the development design is first made based on the objectives of the research to be carried out. At this design stage, it consists of making teaching materials, the syntax of the Flipped Classroom learning model that will be combined with the Discord application. At this stage, the researcher will also design the application features that will be used and the flow of online learning objectives, as well as the flow of offline learning in class. Finally, make a plan regarding the final test questions that will be used.

3. Development

The development stage is where the procedural framework is realized to become a product that is ready to be implemented. After the product is finished, validation is carried out by three competent experts to assess whether the prototype of the Flipped Classroom learning model with the Discord application is suitable for use by providing input or suggestions. This stage aims to obtain complete data for product improvement and the perfection of the product to be produced. In addition, it is necessary to determine the level of feasibility of the product developed from the results of the validator's assessment before testing it on Class XII students of Zion High School. The instruments that will be used in

this study are: (1) Validation sheet aims to determine the validity of a syntax and the feasibility of an instrument that will be carried out, (2) Practitioner Assessment Questionnaire sheet aims to receive opinions or suggestions from practitioners regarding the implementation and practicality of the product, (3) Student Activeness Questionnaire sheet aims to determine the extent of student activeness during the product being tested and see the criteria/categories of student activeness and compare them with the criteria table, (4) Teacher and Student Response Questionnaire sheet aims to determine how teachers and students respond during the treatment and compare the level of response with the criteria table, (5) Learning Outcome Test Sheet (Pre-test and post-test) aims to determine students' initial knowledge before and after treatment. It aims to measure the level of improvement in student understanding, and (6) Student Worksheets.

4. Implementation

The implementation stage is carried out to prepare the learning environment and involve students in learning. General procedures related to the implementation stage are preparing teachers and preparing students to learn. Students can begin to build new knowledge and skills needed to cover gaps in previous learning. The implementation stage is to try the product widely. The products produced at the development stage, both in the form of learning models and all research instruments, will be used to test the development products, whether they are valid, practical, and effective for wider use.

5. Evaluate

The evaluation stage aims to measure and answer the formulation of the problem in this study. There are several evaluation stages used, namely (1) Validation of the syntax or prototype of the flipped classroom learning model using the discord application (2) Practicality of the flipped classroom learning model using the discord application (3) Effectiveness of the flipped classroom learning model using the discord application on students' mathematics learning outcomes. Analysis of the effectiveness of the learning model used in this study, namely the analysis of student activity, student responses, increased student learning outcomes, and the average value of student learning outcomes.

RESULTS & DISCUSSION

Results

1. Analyze

The results of observations conducted by researchers at Zion High School regarding the teaching and learning process in mathematics subjects still use textbooks as the main source from teachers, in addition to the use of PowerPoint and other interactive media, which is still not optimal. In the process of learning mathematics in class, teachers focus on delivering the material, but the time to maximize students' understanding is still lacking. This is because teachers focus more on the material that is delivered without seeing what problems the students are facing and trying to help solve them. In addition, another factor that causes this problem is that teachers cannot repeat the explanation, so students must repeat the material at home in order to understand the learning material well. Another obstacle faced by a teacher is the diverse abilities of students in understanding the core of learning, so a learning model is needed that can be accessed at any time and create discussions with other friends outside the classroom. Based on the facilities and infrastructure, SMA Zion provides complete facilities such as Wi-Fi, LCD, and projectors. In addition, the facilities and infrastructure for students at home are also complete and good.

Mathematics learning outcomes are something achieved in the teaching and learning process, which is marked by changes in the learner, be it their behavior,

knowledge, skills, and experience. It can be said that learning outcomes are evident when there has been a change from not knowing to knowing. Every problem and obstacle certainly has a solution, so the role of the teacher as a facilitator, mediator, and motivator must know their role, even though the learning process is not at school. The learning outcomes at home and school that are expected to remain the same are the activities of students in the learning process, either directly (Synchronous) or virtually (Asynchronous). In addition, learning outcomes can also be seen from student exam scores. Is there an increase or not?

Based on the observation table, the learning model applied so far in the classroom, especially in mathematics, is monotonous. Students tend to be passive in participating in each lesson. Teachers tend only to spend time explaining the material without paying attention to students' difficulties in solving questions or problems. The online learning process has not been carried out in the Zion High School environment. Online Via WhatsApp is only used for teachers to convey one-way information, where students are only recipients of information regarding materials, assignments and some directions for the teaching and learning process, so that in the learning process students become passive and not centered on students (student centered) Data related to observations made are presented in Table 1.

Table 1. Data from Observation Results of the Learning Process in Class

No.	Observed Aspects	Observation Results
1.	Utilization of teaching hours by teachers in the class	Based on the results of observations on several mathematics teachers, it was found that many teachers still spend their learning time explaining the material directly and focusing on achieving the material targets in the textbook.
2.	Student activities during the learning process	Based on the observation results obtained, students were only passive in listening to explanations and waiting for directions from the teacher to do assignments or copy notes.
3.	Intensity of assignments and number of questions given for homework	Based on the observation results obtained, the intensity of assignments given each week is always maintained. The number of questions given is quite a lot, in the range of 10 - 30 questions, with a short collection time. This is done by most subject teachers so that students have difficulty learning with the many assignment deadlines.

Data Source: Observation of the Learning Process at Zion Makassar High School

At this stage, researchers conduct a study of the features available in the Discord application that can be used to help deliver material online. The features in the Discord application are expected to be able to help in the learning process, which has many advantages, namely being able to display images, videos, text, animations, and group audio that can help students interact with learning resources and discuss with fellow students. So that the learning material can be accessed repeatedly, or can be monitored by parents of students. Several features can be used in the learning process on the Discord application, namely: (1) Server, (2) Channel, (3) Group Call, (4) Share Screen/Live Streaming.

2. Design

The design stage is a follow-up to the analysis stage. At this stage, researchers design products that will be used in the learning process. The design of the flipped classroom learning model using the Discord application is the product that will be developed in this study. The process of explaining learning materials begins online using the Discord application. After that, the learning process was continued in class on a different day, with the hope that the learning process in class could be more efficient and effective by discussing more questions and questions that have a higher level of difficulty. The results after designing the product can be seen in Figure 2.

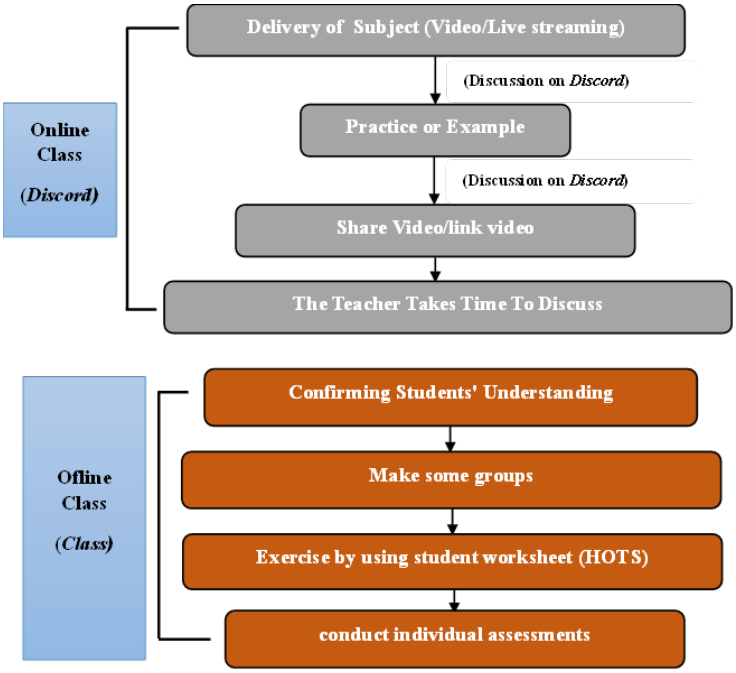

Figure 2. Flipped Classroom Learning Model Product Design

3. Development

The product that has been designed by the researcher at the design stage is developed at this stage, resulting in prototype I, which will be tested to find out whether the product still needs to be developed or is feasible. The resulting product can be seen in Table 2.

Table 2. Syntax Products of the Flipped Classroom Learning Model using the Discord

ONLINE LEARNING ACTIVITIES (VIA DISCORD APPLICATION)
Introduction (5 Minutes)
• Students join Discord and pray.
• The teacher checks student attendance and provides motivation.
• The teacher asked one of the students to lead the prayer.
• The teacher conveys the objectives and benefits of learning about the topic to be taught.
• The teacher provides an outline of the scope of the material and learning steps.
Core Activities (30 Minutes)
• The teacher explains the definite integral material that will be worked on in class.

<table>
<tr><td colspan="2">• Students pay attention to the teacher's explanation of the material and ask if there is anything they do not understand.</td></tr>
<tr><td colspan="2">• Teachers record meetings and post the recordings to the Discord group.</td></tr>
<tr><td colspan="2">• Students use the Discord application to discuss before class meetings.</td></tr>
<tr><td colspan="2">OFFLINE LEARNING ACTIVITIES (IN CLASS)</td></tr>
<tr><td colspan="2">Introduction (15 Minutes)</td></tr>
<tr><td colspan="2">• The teacher asks students to pray and checks student attendance.</td></tr>
<tr><td colspan="2">• The teacher conveys the learning objectives to be achieved.</td></tr>
<tr><td colspan="2">• The teacher provides an outline of the material that is the topic of discussion.</td></tr>
<tr><td colspan="2">• The teacher divides students into several groups consisting of 5-6 people.</td></tr>
<tr><td colspan="2">• The teacher motivates students regarding the importance of definite integrals.</td></tr>
<tr><td rowspan="8">Core activities (60 Minutes)</td><td>COLLABORATION</td></tr>
<tr><td>The teacher reviews the videos/teaching materials that students have watched with discussions, questions, and answers.</td></tr>
<tr><td>CREATIVITY AND INNOVATION</td></tr>
<tr><td>Through questions and answers with students, teachers reinforce material concepts and provide additional knowledge for students.</td></tr>
<tr><td>COLLABORATION, CREATIVITY</td></tr>
<tr><td>• The teacher gives problems contained in the teaching materials section A, namely Learning Activity 1, to be discussed in each group. (Questions related to Definite Integrals of Algebraic and Trigonometric Functions)
• The role of the teacher during a discussion is to facilitate students so that they are able to write down ideas or thoughts related to the problems given.</td></tr>
<tr><td>COMMUNICATION</td></tr>
<tr><td>Students present the results of their group or individual work, express their opinions on the presentations they have made, and then respond to them by the group or individual who made the presentation.</td></tr>
<tr><td>CRITICAL THINKING AND PROBLEM SOLVING</td></tr>
<tr><td>The teacher gives a test/quiz to determine the level of student understanding (Conducting Formative Assessment in teaching materials)</td></tr>
<tr><td colspan="2">Closing (15 Minutes)</td></tr>
<tr><td colspan="2">• Teachers and students reflect on learning experiences.</td></tr>
<tr><td colspan="2">• The teacher reminds students to study the material that will be covered in the next meeting.</td></tr>
<tr><td colspan="2">• The teacher closes the lesson with a prayer.</td></tr>
</table>

After the product prototype is successfully created, it is continued with validation of product feasibility. Two expert validators carry out product validation and ask for theoretical and practical considerations. The expert validators in this study can be seen in Table 3.

Table 3. Expert Validators

Prof. Dr. Hamzah Upu, M.Ed.	Validator 1
Dr. H. Rahmat Syam, ST, M.Kom	Validator 2

The validation results carried out by the expert validator are:

Table 4. Validation of Research Instruments

No	Validation Type	Score	Percentage	Criteria
1	Validation of the Lesson Plan	4,35	87%	Valid
2	Validation of Student Worksheets	4,27	85%	Valid
3	Validation of Learning Implementation Sheet	4,25	85%	Valid
4	Validation of Student Activity Observation Sheet	4,08	82%	Valid
5	Validation of Teacher Response Questionnaire	4,3	86%	Valid
6	Validation of Student Response Questionnaire	4,36	87%	Valid
7	Validation of Learning Outcomes Tests	4,2	84%	Valid

Based on the validation results for each research instrument, a score of > 75% was obtained, so it was concluded that all research instruments and products had been developed well and were valid, so they could be continued to the implementation stage.

4. Implementation

After going through the product development process, the resulting product is tested on students. This implementation stage is divided into two trial processes, namely limited trials and field trials. The limited trial stage is carried out along with the product development stage, which provides data on whether the product is worthy of being tested in the field. The field trial is carried out after the product is declared valid and implemented in the classroom.

The limited trial was conducted by creating a new class consisting of 8 students who were randomly selected, two people as representatives of each class XII at SMA Zion Makassar. This limited trial was conducted 4 times, with the limited trial meeting schedule as seen in Table 5.

Table 5. Limited Trial Meeting Schedule

Meeting	Information
1	Syntax improvements for the flipped classroom learning model using Discord
2	Better utilization of features on the Discord application in learning
3	Further improvements to learning model syntax and application features
4	The resulting product can be used in learning.

Limited trials were conducted by implementing flipped classroom learning using the Discord application, student worksheets, learning implementation sheets, student activity observation sheets, student response questionnaires, teacher response questionnaires, and learning outcome tests.

The operational field trial was conducted in class XII, Thames SMA Zion Makassar, consisting of 34 students. The implementation of learning follows the product created, namely the flipped classroom learning model, using the Discord application. This operational field trial was conducted in 6 material discussion meetings, one pre-test meeting, and one post-test meeting, in detail as in Table 6.

Table 6. Operational Field Test Meeting Schedule

Meeting	Learning materials
1	Pre-test
2	Definite Integral of Algebraic Functions
3	Definite Integrals of Trigonometric Functions
4	Substitution Integral
5	Partial Integral
6	Integral of Area of Region
7	Volume Integral of Rotating Objects
8	Post-test

In the process of implementing learning, this study involved two mathematics teachers as observers and experts/practitioners from the second to the seventh meeting. During the six meetings, the teacher played a role in filling out the observation sheet for the implementation of learning, observing student activities, and teacher response questionnaires for the product. Teachers participated in providing input to researchers to see and improve things that could still be improved to maximize the resulting product. Data from observers will later be used in the evaluation stage to see the effectiveness of the product in developing the learning process.

Based on a casual discussion with the observer, several things add value to the product. According to the observer, the product can help with the problem of using learning time in class. In addition, the product can help teachers overcome the problem of empty classes due to teachers not being present by directly seeing the enthusiasm of students in class.

5. Evaluate

This evaluation stage aims to see what things need to be improved or evaluated from the product and to test all assessment components on the product based on the assessment sheets from experts and teachers.

a. The Analysis of The Validation Data

The analysis of the validation data is used to determine the level of validity or otherwise of the instruments used. The level of validity for each instrument is measured using Aiken's V index analysis. Based on the validation results by expert lecturers (validators), in detail as in Table 7.

Table 7. Validator Result Data Analysis

No	Validation Type	Aiken's V Index	Category
1	Results of Lesson Plan Validity	0,8	High
2	Results of Student Worksheets Validity	0,83	High
3	Results of the Validity Test of Learning Outcome	0,79	Medium
4	Results of the Validity Test of the Implementation Sheet	0,81	High
5	Results of the Validity Test of Student Activity Sheets	0,77	Medium
6	Results of the Validity Test of the Teacher/Practitioner Response Questionnaire	0,81	High
7	Results of the Validity Test of the Student Response Questionnaire	0,84	High

Based on the results of all descriptions of the research instruments used in this study. It is concluded that for all research instruments based on the results of the analysis, Aiken's V index obtained a value greater than 0.4 (> 0.4). All instruments are valid for use with a level of validity in the medium and high categories.

b. Data Analysis of the Practicality/Implementation of the Flipped Classroom Learning Model Using the Discord Application

Flipped classroom learning model product using the Discord application is seen based on data on the learning implementation sheet and the practitioner response questionnaire sheet, in detail as in Table 8.

Table 8. Result of The Practicality Product

No	Validation Type	Percentage	Category
1	Learning Implementation	97%	Very High
2	Teacher/Practitioner Response	90%	Very High

Based on the results of the analysis of the implementation and responses of teachers/practitioners, each of which is in the very practical and effective category. It can be concluded overall regarding the level of practicality of the flipped classroom learning model product, using the Discord application, that 93.5% is in the very practical and effective category to implement.

c. Data Analysis of the Effectiveness of the Flipped Classroom Learning Model Using the Discord Application

The average result of student activities obtained for each meeting is 3.8 to 3.9. When compared with the table of student activity criteria, it can be concluded that the level of student activity during the implementation of the product is in the very high category. After looking at table 4.22, additional information was obtained, namely the average of the combination of each meeting for student activity was obtained at 3.89 or 97% in the very high category so that it can be concluded that the level of student activity during the implementation of the flipped classroom learning model product using the discord application is very high and meets the requirements for effectiveness.

The results show that for each question on the questionnaire sheet, the student's response obtained a minimum percentage of 86% and a maximum of 92%. This shows that each question indicator received a very high response from students regarding the use of the product during the learning process. In addition, it can be seen in the table above regarding the final value and final percentage for the student response questionnaire to the use of the product, which obtained a value of 89 and 89% (> 85%). This, when compared to the student response criteria table, is in the very high category, meaning that students have a very high response to the use of the product in the learning process. Based on the minor hypothesis test 2, with a final value $\mu_R = 89\%$(> 85%), It is concluded that H_0it is rejected and H_1accepted. This means that the flipped classroom learning model product using the Discord application has a very high response and meets the effectiveness requirements.

The percentage of students who obtained post-test scores was in the complete category, as many as 34 students, with a percentage of 88%. That the value $\mu_{KM} > 85\%$ This means that the product has a very high classical completeness and meets the effective requirements.

The average normalized N-Gain score is 0.78 ($\mu_g \geq 0{,}3$It). It can be concluded that the flipped classroom learning model, using the Discord application, has an increase in cognitive learning outcomes in the high category. At the same time, the percentage value

obtained from the normalized N-Gain results is 78% (> 75%), which, when compared to the normalized N-Gain effectiveness table, is in the effective category. So it can be concluded that the flipped classroom learning model, using the Discord application, improves students' cognitive learning outcomes and meets the effective requirements.

The average post-test results of students obtained a score of 89.53, greater than the minimum completion criteria. So it can be concluded that the flipped classroom learning model product using the Discord application descriptively has good results greater than the minimum completion criteria and meets the effective requirements. The results of the normality test, the significance value obtained was 0.108 (pre-test) and 0.704 (post-test), which means it is greater than $\alpha = 0{,}05$. Therefore, it is concluded that the research data is normally distributed. The homogeneity test obtained a significance value greater than $\alpha = 0{,}05$. So it can be concluded that the research data is homogeneous. Because all prerequisite tests are met, it can be continued to the average test of students' cognitive learning outcomes using the paired sample t-test. The significance value is 0.009, which is smaller than $\alpha = 0{,}05$. So there is a relationship between pre-test and post-test on students' cognitive mathematics learning outcomes. The significance value is 0.000, which is smaller than $\alpha = 0{,}05$. So it can be concluded that there is a difference between the pretest and post-test, so that the average cognitive learning outcomes of students after using the flipped classroom learning model product, using the Discord application, meet the effective requirements.

The summary of the results of the descriptive and inferential statistical data analysis can be seen in Table 9.

Table 9. Summary of Achievement Analysis

Descriptive Statistical Analysis	Inferential Statistical Analysis
Average Student Activity $\bar{x}_{AP} = 3{,}89$ or 97%is in the very active category	Compared to the student activity criteria table
Average Student Response $\bar{x}_{R} = 89\%$is in the very high category	Average Student Response Score $\mu_R = 89\%$ $\mu_R > 85\%$then $H_o$rejected, H_1accepted
Classical Completion $\bar{x}_{KM} = 88\%$is in the completed category	Classical Completion $\mu_{KM} = 88\%$ $\mu_{KM} > 85\%$then $H_o$rejected, H_1accepted
Normalized Gain Average $\bar{x}_{g} = 0{,}78$is in the high category	Normalized Gain Average $\mu_g = 0{,}78$ $\mu_g > 0{,}3$then $H_o$rejected, H_1accepted
Average Learning Outcome Test (post-test) $\bar{x}_{HB} = 89{,}53$	Average Learning Outcome Test $\mu_{HB} = 89{,}53$ $\mu_{HB} \geq 75$then $H_o$rejected, H_1accepted
	Hypothesis Testing Paired-Samples Test $\rho_{value} = 0{,}000$ $H_o$rejected, H_1accepted

Discussion

This research focuses on the development of a flipped classroom learning model using the Discord application, using the ADDIE development model. The things that become the focus in this research are how the product development process, the level of product validity, product practicality, and product effectiveness are described as follows:

1. Product Development Process

The product development process uses the ADDIE model in accordance with the theory put forward by Sudjana and Branch R. The ADDIE model consists of analysis, design, development, implementation, and evaluation stages. The first stage is to analyze a problem that arises and look for alternative solutions. The problem that arises in this study is how to use time in the learning process efficiently. The problem has been solved by using the flipped classroom learning model product combined with the Discord application for online learning.

Furthermore, the design stage in this research produces a flipped classroom learning model syntax combined with the Discord application. After the product has been designed. Then the next stage is the product development process. This process is carried out with the help of expert validators and with a limited trial of the product, which aims to find out what things can still be developed in the product.

After the development stage is complete, the product implementation stage is followed, which in this study was carried out in class XII, Thames SMA Zion. After the product is implemented, the last step is to evaluate the product, which is done with descriptive and inferential statistical tests.

2. Product Validity Level

The product validity level in this study includes several research instruments validated by two expert validators, as well as a limited trial of the product. Seven research instruments are validated, namely the product instrument of the flipped classroom learning model lesson plan using the Discord application, product implementation observation sheet, learner activity observation sheet, learner response sheet, teacher/practitioner response sheet, learner worksheet, and learning outcomes test instrument. Based on the results of the above analysis, the product validity level is high. Then the product is valid for use in the learning process.

3. Product practicality

The level of product practicality in this study was measured based on the learning implementation sheet using the product and the teacher response questionnaire sheet after seeing the application of the product in the learning process. Based on the results of the above research, the level of practicality of the resulting product is practical and effective, with a percentage of 93.5%.

4. Product Effectiveness

The effectiveness of the product in the learning process in this study was measured based on aspects of the level of activity of students during learning, students' responses to learning using the product, classical completeness of students after learning using the product, increasing students' cognitive learning outcomes, and the average test of students' cognitive learning outcomes exceeding minimum completion criteria. Based on the results of the above research, the following assessment indicators are obtained for each aspect, which is in the effective category. It can be concluded that the use of the flipped classroom learning model, products using the Discord application, is effective in the learning process.

The results obtained in this study are in line with several relevant studies previously stated, namely the flipped classroom learning model is valid, practical, effective and efficient for use in the learning process, and the discord application is valid, practical, effective and efficient in improving student learning outcomes in the classroom learning process. This research combines the discord application and the flipped classroom learning model in the learning process, and the results are valid, practical, and effective in improving student learning outcomes in the learning process and streamlining learning time. So this research is new because it combines the flipped classroom learning model with the Discord application.

CONCLUSION

Based on the results of the research and discussion that have been carried out, the conclusions that can be drawn are as follows: 1) Product development of a flipped classroom learning model using the Discord application based on the ADDIE development type. The analysis stage carried out the initial analysis activities by observing the learning process in class XII, Zion High School. Analyze the character of students to find out the number of students for each class and the sources and learning tools that support the classroom. Discord content analysis to find out features that are useful in the learning process and product development. Material analysis to find out the material and questions that are tailored to the learning objectives. The results obtained at this stage are problems regarding the less effective and efficient mathematics learning process that occurs at Zion High School, Makassar. The Design Stage is carried out by selecting the Discord application and creating a learning process flow by combining learning at home and school. The results obtained at this stage are the product design of the flipped classroom learning model combined with the Discord application as support for online learning. The development stage consists of expert validation of all instruments and products used in learning. Limited trial activities support the development process to find out whether existing products and instruments still need to be developed. The results obtained at this stage are valid products that have been validated by expert validators and tested during limited trials during the development process. The implementation stage was carried out by trying out the product and research instruments in class XII at Thames Zion High School. This implementation was carried out for eight meetings, with six meetings discussing integral material, while two meetings were for pretest and post-test. During the implementation of the product, the learning process was assisted by two teachers/practitioners as observers to fill in the research instruments and provide input on the products applied in the learning process. The Evaluation Stage is carried out to see things that need to be improved during the research process, both at the beginning, middle, and end. Moreover, this stage aims to obtain data regarding the validity, practicality, and effectiveness of the products produced. The results obtained at this stage are valid, practical, and effective, as shown by the flipped classroom learning model. 2) This research produces a product in the form of a Learning Implementation Plan for the flipped classroom learning model using the Discord application as a support tool for online learning. 3) The product validity level of lesson plans, student worksheets, learning outcomes tests, implementation sheets, learner activity observation sheets, learner response questionnaires, and teacher/practitioner responses produced using the Aiken'S formula obtained a V value of 0.83, 0.83, 0.79, 0.81, 0.77, 0.81, 0.84 which are all greater than 0.4, so the product validity level is “valid”. 4) The level of practicality of the product is measured through the learning implementation sheet and the results of the teacher/practitioner's response to the use of the flipped classroom learning model using the Discord application in learning. The

results obtained are 93.5% with the category "very practical." 5) The level of product effectiveness is measured through 5 indicators, namely the percentage of student activeness obtained by 97% in the "very active" category, the percentage of student responses obtained by 89% in the "very high" category, the percentage of classical completeness of students obtained by 88% in the "very high" category, the increase in student learning outcomes by 0.78 in the high improvement category and the percentage of effectiveness of increasing 78% in the "effective" category. The average cognitive learning outcomes of students of 89.53 are greater than the minimum completion criteria of 75, so the category is effective. So, it can be concluded that the level of effectiveness of the flipped classroom learning model product using the Discord application is "effective" for use in integral learning at Zion High School.

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