Improving Calculus Learning Outcomes Using Structured Assignment Methods–Based Modules

Andiani*, Nurdin Ibrahim, and Rusmono

***Abstract*—From observations in the last three years, the average score of informatics engineering students at Universitas Pancasila in Mathematics is 70% below 50. The above analysis requires research to develop a learning model using structured assignment method–based modules to improve calculus learning outcomes. The modules are equipped with an understanding containing examples of questions and their solutions with sequential stages and structured assignments as practice questions that must be submitted before the subsequent lesson begins. They are also equipped with pretests and posttests. Learning Management System (LMS) and Information and Communications Technology (ICT)–based support this blended learning. The research method uses the research and development (RandD) method with its implementation combining two learning development models, namely, the Borg and Gall and Dick and Carey models. The effectiveness of the product was tested by four experts to determine the validity of the test. The application of the calculus learning model employing structured assignment method–based modules is effective for improving calculus learning outcomes. The results of the product effectiveness test revealed an increase of 20.33 points, with an increase in the average score after using the module of 87.67, with the number of students declared complete by 96% compared to the average score before of 67.34, with the number of students declared complete by 70%. The improvement in the calculus learning outcomes appears significant. Therefore, this model can be used for offline and online learning.**

***Index Terms*—Calculus, blended learning, structured assignments based–modules, learning outcomes**

I. Introduction

Calculus is a cross–study course in mathematics. It is mandatory for all undergraduate students from all study programs in the sciences (including all disciplines) and informatics engineering. Mathematics is required to increase the predictive power of science and is necessary as a means to improve deductive reasoning. Calculus solves complex problems that cannot be solved by ordinary algebra and mathematics. Ability in the field of calculus will be indispensable to exploring the area of informatics, which requires actual calculationsand logic.

The low basic ability of prospective new students at Universitas Pancasila to master mathematics material can be seen from the results of the new students' entrance tests in the last three years. The results of an interview with the head of the Center for Information and Communication Technology (CICT) of Universitas Pancasila revealed that the average mathematics score was 70% below 50. Therefore, it is proven that the final score in calculus in the last three semesters was below 70 on average.

Monariska, in her research, stated that the mathematical abilities possessed by students in solving calculus problems included students' weak understanding of the fundamental theorems of calculus, errors in understanding questions, errors in calculation, and errors in writing symbols [1]. Febriyanti *et al.*, in their research, indicated: "There are four aspects discussed in this study, including the teachers; 1) perception of students learning difficulties, 2) teachers' practice in connection with diagnosing students learning difficulties, 3) teachers' actions in response to the results of the diagnosis, 4) parties involved regarding students". Rani *et al.* developed methods to overcome difficulties in learning mathematics and effectively carried out remedies, including providing additional study hours and involving students in learning [2]. The most important thing in teaching mathematics material is that the teacher must emphasize conceptual understanding and procedural skills. Moreover, Hidayati's research identifies three factors causing learning difficulties of a very high type: the interaction of lecturers with students, learning media, and student–learning motivation [3].

The initial research conducted by the writer, namely, the satisfaction of learning calculus, using a questionnaire with 15 questions, found that 99.1% of lecturers socialized semester lesson plans before the lecture started, 4.5% of students liked calculus courses, 27.1% of students enjoyed the ongoing learning method, 94.6% of classes explained the learning objectives of calculus, 93.7% of lecturers provided teaching materials/modules before the lecture began, 51.4% of students had difficulty obtaining reference sources for each material, 18.8% of students stated that the teaching materials/modules provided by the lecturers were packaged in an attractive manner, 27.9% of students noted that the modules/teaching materials provided by lecturers are easy to understand, 28.8% of students understood the materials presented by lecturers, 27% of students understood the feedback well at the end of thelectures in the form of practice questions, 27% of students were able to complete assignments or homework easily, 27% of students responded when the lecturers asked questions, 17.1% of students stated that the learning method provided by lecturers attracted students' interest in learning, 87.4% of students preferred to study calculus offline, and 31.5% of students preferred to study calculus online. The results of the initial research above based on hundred and eleven (111) students as respondents and the condition of calculus learning outcomes in the last three years are required to improve calculus learning outcomes, namely, by having simple modules. The COVID–19 pandemic that hit the world forced every

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The authors are with Universitas Negeri Jakarta, Indonesia.

*Correspondence: Andiani_7117157700@mhs.unj.ac.id (A.)

university to carry out activities with online systems, including lectures, guidance, and tests. Furthermore, the application of e–learning models and virtual classroom models was carried out. However, the results of Fuchs's research [4] investigating students' perceptions of online learning and emergency distance teaching during the pandemic show a lack of social interaction among peers and an inability to seek academic support, as well as low involvement in distance learning.

From the data above, it can be seen that 87.4% of students liked offline learning. Nevertheless, due to the conditions and situations related to the pandemic, the application of blended learning, is the leading choice of students. Therefore, hybrid, offline, and online learning models will be applied to calculus learning. However, should conditions not permit offline learning, calculus learning must be ready with full online learning. Therefore, learning materials must have been prepared and adjusted so students can learn independently.

In their research, Ika and Sri argue that one thing that affects the learning process is student learning performance [5]. In contrast, the learning methods used in teaching activities affect student learning outcomes. For example, Ika and Sri employed a structured assignment method for mathematics. However, in this approach, Ika did not thoroughly explain whether the structured assignments were distributed to each chapter.

Based on the identification of the new students of Universitas Pancasila, it is understood that there is a fundamental gap among students, namely, heterogeneous students. Most of them attended high school but did not major in exact sciences. Therefore, choosing the proper method to motivate students to be independent is essential through the normal distribution of structured assignments provided in each chapter. Furthermore, assigning structured tasks aims to develop students' independence in learning, specifically in calculus.

II. Literature Review

A. Learning Theory

According to Chandra in his book "Learning Theory and Learning," "learning is a conscious effort process carried out by individuals for a change from not knowing to know, from not having the attitude to being right, from being unskilled to being skilled to do something" [6]. In contrast, Gagne stated that learning is the result of a stimulus and response combination that is continuously reinforced. This reinforcement strengthens the internalized behavior in Gagne's learning process [7]. In his book Gagne "The Conditioning of Learning" [8], he proposes that "Learning is a change in human disposition or capacity, which persists over some time, and which is not simply ascribable to the process of growth." Gagne believes that external factors influence learning, and both interact with each other. Gagne's nine instructional events model is an event designed by educators (external) to assist students' (internal) learning process, including "Gaining Attention, Informing Learner of The Objectives, Stimulating Recall or Prior Learning, Presenting the Stimulus, Providing Learner Guidance, Eliciting Performance, Providing Feedback, Assessing Performance and Enhancing Retention and Transfer." Jean Piaget, by relating the physical environment, proposed that a child does not interact with his or her physical environment as an individual but as part of a social group. Thus, according to Piaget, the basis of learning is a child's activity when interacting with the social and physical environment [9]. Rusman, whose opinion is similar to Burton, wrote a book stating that learning is a change in individual behavior thanks to the interaction between individuals and individuals with the environment so that they can interact with their environment [10]. Another opinion belongs to Skinner, who stated that learning is a process of progressive behavior or "learning is a process of progressive behavior adaptation" [11]. In contrast, Robert said that learning is a process of developing knowledge, skills, or attitudes as a person interacts with information and his environment. Thus, in the learning process, it is necessary to select, compose and deliver information in an appropriate environment and through the interaction of students with their environment [12].

Hakim summarized the definition of learning from several experts in his book "Learning Effectively" into a simple and easy–to–understand explanation: "Learning is a process of change in the human personality, and this change is shown in the form of increasing the quality and quantity of behavior such as increasing skills, knowledge, attitudes, habits, understanding, thinking power and other abilities" [13]. Thus, it is clear that an increase in the quality and quantity of a person's behavior can be considered an accumulation of a person's capacity in any field. Should a person not increase in the quality and quantity of proficiency in a learning process, it can be concluded that the person has not experienced the learning process or, in other words, has failed in the learning process.

B. Learning

According to Juitaning in her book "Educational Psychology" [14], the term learning is closely related to the notion of learning and teaching. Learning, teaching, and learning occur together. Learning can occur without a teacher or other formal teaching and learning activities, while teaching includes everything the teacher does in the classroom. The characteristics of learning, according to Juitaning, are as follows: 1) It is a conscious and deliberate effort; 2) learning must make students learn; 3) goals must be set before the process is carried out; and 4) the implementation is controlled among the content, time, process, and results. According to Suparman [15], learning principles are used to improve instructional development, which is packaged into 12 principles that Suparman adapts from Filbeck's thinking [16]. The following are the 12 principles outlined in brief:

New responses are repeated as a result of previous responses.

1) Behavior *is controlled not only by the response consequences but also under the conditions influenced by or* signs *in the learner's environment.*
2) Behaviors that arise from certain signs will disappear or decrease in frequency should they not be reinforced by

giving pleasant consequences.
3) Learning in the form of responses to little signs will also be transferred to other limited situations.
4) Generalizing and differentiating are the basis for learning something as complex as problem–solving.
5) The student's psychological state facing the lesson will affect their attention and persistence during the learning process.
6) Learning activities that are divided into small steps and accompanied by feedback completing each stage will help students.
7) The need to break down complex learning materials into small activities can be reduced if the learning materials can be realized in a model.
8) High–level (complex) skills, such as problem–solving, are formed from more specific basic skills.
9) Learning will be faster, more efficient, and more fun should students be given information about the quality of their performance and how to improve it.
10) Students' development and learning pace vary greatly; some progress quickly, and some are slower.
11) With preparation, students can develop the ability to organize their learning activities and generate feedback to respond correctly.

C. Structured Assignment

A structured assignment is a task to improve students' understanding of learning material. The lecturer determines the time for collecting the assignment in the next lesson or the next day [17]. Students must complete the task and submit it by the specified time limit. According to Suherman [18], the structured assignment learning method can be interpreted as a learning method where the lecturer can assign students to study the topic to be discussed in advance and assign them to find evidence of the theorem to be solved individually or in groups. The results are concerned with the lecturer, whereas J. Bruner in Trianto [19] describes the structured assignment method as a method of learning mathematics in which students often have difficulties comprehending the material's scope. Therefore, structured assignments are given after studyingone topic of learning material.

Lecturers will know the ability of their students to understand new material. The students are free to choose the assignment because they carry them out. The provision of structured tasks in daily learning is given concerning the learning objectives and indicators. Structured projects are ideally asked to submit no later than a week or before the next lesson. The lecturer provides regular structured assignments at the end of each class. Thus, students will always be consistent. Structured assignments will improve student learning every day at home. Respondents were divided into control and experimental groups in the research on the impact of giving structured and unstructured assignments. The results show that the control group (structured) outperformed the experimental group (unstructured), with a significant difference between the two groups in terms of diversity, according to Miri [20]. Giving structured assignments with individual feedback positively affects student learning outcomes, according to Mesra [21]. According to Mirna, feedback must be applied in the learning process to improve student learning outcomes both individually and in a group [22].

D. Blended Learning

Combining conventional learning (face–to–face) with information and communication technology–based learning is a mixed learning or blended learning model. Blended learning is more flexible and less rigid [23]. The research aims to determine whether there is a significant difference in effects between face–to–face and online programs. The results of the research state that online programs are as effective as face–to–face learning programs [24].

Combining face–to–face and online learning in the classroom increases students' active independent learning. According to Rusman [25]: "Blended learning is a combination of the characteristics of traditional learning and an electronic learning environment or blended learning, combining web–based learning, video streaming, synchronous and asynchronous audio communication with traditional face–to–face learning." According to Ibrahim [26], blended learning is synonymous with understanding the integration of independent learning (independent online learning and independent offline learning with print modules) and face–to–face learning. Carman's concept [27] states that there are five (5) bases of blended learning:
1) Live Events: Synchronous, instructor–led learning events in which all learners participate simultaneously, such as in a live "virtual classroom."
2) Self–Paced Learning: Learning experiences that the learner completes individually, at his or her speed, and on his or her own time, such as interactive, internet–based, or CD–ROM training.
3) Collaboration: Environments in which learners communicate with one another, for example, e–mail, threaded discussions, or online chats.
4) Assessment: A measure of learners' knowledge. Preassessments come before live or self–paced events to determine prior knowledge, and postassessments occur after live or self–paced learning events to measure learning transfer.
5) Performance Support Materials: On–the–job reference materials that enhance learning retention and transfer, including PDA downloads, printable references, summaries, and job aids.

E. Moodle

Modular Object–Oriented Dynamic Learning Environment (Moodle) is a software package produced for internet–based learning activities and websites that uses principles of social constructionist pedagogy. It is also known as a learning management system (LMS) or curriculum and information management system (CIMS) [28].

LMS is a tool used for authentication, registration, and learning access. This LMS aims to automate administrative tasks such as creating materials, registering, and providing reports for managers. Through Moodle, lecturers can interact with their students to meet their learning needs. In contrast, Effendi and Zhuang [29] said that the LMS is a system that helps administration and functions as an e–learning content

platform. Through Moodle and LMS, lecturers can interact with their students to meet their learning needs. LMS is provided for pretest and posttest as well as module and structured assignments for online learning in the classroom. In contrast, in offline (face–to–face) direct learning (direct instruction), the lecturers will explain the stages of solving problems in greater detail.

III. Methodology

This study aims to improve calculus learning outcomes using a structured assignment–based module. The student survey results show that 27% of students complete their assignments easily, and 27.1% like the present learning method. In other words, 72.9% of students dislike the learning method.

The research was conducted at Universitas Pancasila for second–semester students in the Informatics Engineering Study Program, Faculty of Engineering, located on Srengseng Sawah Street Jagakarsa South Jakarta. Research activities were carried out for one semester during the pandemic in the odd semester of 2021–2022.

The research method used in this study is research and development (RandD) with a combination of two learning models, namely, the Borg and Gall model and the Dick and Carey model, which will produce a structured assignment method–based learning module for the calculus course. According to Borg and Gall [30]: "Educational RandD is an industry–based development model in which the findings of the research are used to design new products and procedures, which then are systematically field–tested, evaluated, and refined until they meet specified criteria of effectiveness, quality or similar standards." Industry–based models are also used to design new products and procedures. They are then field–tested, evaluated, and refined until the research findings meet specific criteria of effectiveness, quality, or standards. Dick and Carey [31] use a system approach, as shown in Fig. 1.

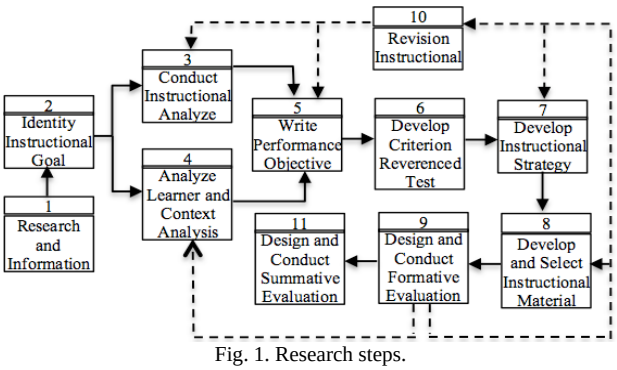

Fig. 1. Research steps.

The Figure shows the ten stages of Dick and Carey. However, in these stages, it is necessary to add an initial research stage, the first stage of the Borg and Gall model, and the research and information collecting stage. The research stages are in the following order. 1) Research and Information Collection is carried out, involving preliminary research by conducting the interview and observing the learning process of a calculus course, documents, and calculus scores in the last three semesters, and literature studies for research preparation. 2) The need for learning objectives is identified according to the results of the interviews and observations, planning a Discussion Group Forum (DGF) with students, alums, lecturers, the head of the study program, and stakeholders, which was carried out online. 3) This activity resulted in an analysis of learning strategies and the form of modules that were developed that would be made to achieve research objectives. 4) Activities are carried out to obtain competency or knowledge that students must possess. 5) Learning objectives and general and specific instructional objectives are determined. 6) Design an assessment instrument for evaluating the learning process. 7) Learning strategies are developed by compiling a one–semester lesson plan with material content for fourteen face–to–face meetings. Structured task–based modules are developed by printing and storing them in the LMS. 8) A structured assignment–based calculus module with a blended learning application model is designed. In achieving the goal, the module is made according to the competency standard and equipped with a module competency map, pretest, material description, understanding of structured tasks, and posttest. 9) The instrument is validated by the instrument validator to be used by instructional design experts, material experts, and linguists to ensure that the module designs developed through one–to–one evaluation, small group, and field trials in producing learning modules that are feasible and effective. 10) Revisions or improvements are made to learning activities. 11) The implementation is carried out with a summative evaluation to determine the extent to which the students master calculus material in one semester. The test results measure students' ability as users of product development.

IV. Results and Discussion

The results of a preliminary study with one hundred and ten students who had taken calculus courses were used to determine the learning model required by students. The results of the related respondents are as follows:

1) A total of 51.4% of students had difficulty obtaining reference sources for each material, meaning that fun and easy–to–understand learning resources were needed. They can be accessed anytime and anywhere, not always in books but in learning videos.
2) A total of 18.8% of students stated that the teaching materials/modules provided by the lecturers were attractively packaged, meaning that 81.2% of students noted that the modules were not attractive. A total of 27.9% of students stated that the modules/teaching materials provided by lecturers were easy to understand, meaning that 72.1% of students noted that the modules/teaching materials were difficult to understand. A total of 28.8% of students understood the material presented by lecturers, meaning that 71.2% of students did not understand the material presented by the lecturers.

Based on the data above, it is necessary to have a learning module product that is produced in the form of print and nonprint media (e–learning). The module will be integrated into the learning design using the Dick and Carey design

model at the learning strategy stage so that calculus learning competence is achieved in 14 face–to–face meetings. Donnely and Fitzmaurice [32] stated, "In the process of devising a module, the key is to forge educationally sound and logical links between learner needs, aims, learning outcomes, resources, learning and learning and teaching strategies of assessment criteria and evaluation.*"*Prasetya [33] stated that in electronic module development in the COVID–19 pandemic era, students are becoming accustomed to online learning. In his research, Agus used the ADDIE research and development method to determine student responses to electronic modules. The results are that 58.1% of students stated that they are very good, 22.5% of students stated that they are good, 19.4% of students stated that they are sufficient,and no students gave bad or very bad responses.

1) A total of 27% of students understood the feedback at the end of the lecture in practice questions, 27% of students could complete assignments or homework easily, and 27% of students responded when the lecturers asked questions. On the other hand, the data above show that 73% of students did not understand the feedback at the end of the lecture, 73% could not complete assignments or homework, and 73% did not respond when the lecturers asked questions.
2) A total of 17.1% of students stated that the learning method provided by lecturers attracted students' interest in learning, meaning that 82.9% of students were not interested in learning with the model provided by the lecturers. Therefore, a learning method that attracts students' interest in learning is required and should increase students' mastery level (competence).

From the data above, it can be concluded that students want a simple, practical, and easy–to–understand learning module with examples of questions and explicit and sequential stages for solving them. Students are given assignments with a structured method to deepen the material, meaning they must submit their assignments before the next meeting starts. Independent offline learning and independent online learning with printed modules uploaded to LMS, according to Ibrahim (2015) [26], are blended learning, synonymous with the understanding of integrating independent learning.

V. ICT–Supported Calculus Learning Concept Design

A. Conceptual Model Design

21st–century education is not only regional but also has developed at a global level because of the sophistication of ICT (information communication technology), which helps a lecturer in delivering material in class and implementing other changes that occur in the classroom [34]. However, there are obstacles to using ICT, as found by Sutama *et al.* [35] in their research, including students' lack of enthusiasm for learning and poor internet networks. Furthermore, some students are not yet skilled in using applications/technology. In line with the findings of Albet *et al.* [36], they found that teachers believed online learning was ineffective during the COVID–19 pandemic. One of the reasons for this conclusion was their inability to adapt to the new culture of online teaching, which could be a result of their classes not being prepared for online instruction. Therefore, the findings imply that suitable online learning designs should be organized more comprehensively.

Based on the problems above, the current recommended learning model is not purely online but rather uses blended learning developed for a calculus course. Calculus learning with 14 meetings is divided into six face–to–face meetings, eight online sessions or, as needed, support by ICT, namely, LMS equipped with Moodle.

1) The introduction to the module contains information on course descriptions, relevance, module–specific instructional objectives, learning guidelines, and competency maps. The module ends with a summary, assessment guide, glossary, and module learning links.
2) Learning materials are provided in printed modules and downloadable files in LMS. The material contains explanations, examples of questions and their solutions with sequential stages, and structured assignments that must be submitted before the next lesson begins. Learning activities start with a pretest and end with a conditional posttest.
3) LMS uses a classroom for online learning, while offline (face–to–face) is for direct learning, where the lecturers will explain the stages of solving problems in more detail.

B. Procedural Model Design

The procedural model is a descriptive model that describes or outlines the procedural stages that must be followed to produce a product. The procedural model describes the steps from start to finish. This model is foundin Dick and Carey, Borg and Gall's learning design models and the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model [30]. Based on the theory, the process must be carried out to achieve the objectives of thisresearch, namely, to increase the students' scores in the calculus course by applying the calculus learning model using a structured assignment method–based module. The stages for implementing the ICT–supported model are as follows:

Phase 1: In this phase, the lecturers open the lecture by explaining the learning objectives and the materials to be studied for one semester, motivating students, so the hat calculus course is no longer scary. Next, a question– and–answer discussion about the concept of learning formulates problems that hinder the studentlearning process. After that, the lecturers give a multiple–choice pretest that has been validated and is available at LMS. Again, it is to determine students' basic abilities before starting the learning process.

Phase 2: After the students have finished the pretest, the system will open so that the student can download the learning module in LMS. The learning module consists of several learning activities and is designed to meet the needs of offline and online learning. In every learning activity, there is an "understanding," where this section contains ten examples of questions with easy–to–understand and

follow–through stages for solving them. In this phase, the lecturers explain each step using the formula and its implementation. Ten structured assignments must be submitted before the next lesson begins.

Phase 3: At the end of the learning activity, as feedback, there are five conditional multiple–choice posttest questions available in LMS. The purpose of the conditional posttest is to achieve a minimum score of eighty (80). If the posttest score does not reach 80, students can repeat the posttest until the minimum score is reached. Indeed, the answers to the posttest are randomized so that students not only guessthe correct answer but also have to study them. The posttest is to determine the level of students' mastery after the learning processes are complete. If the posttest scores have been met, the system will open so that students can continue the learning process, as shown in Fig. 2.

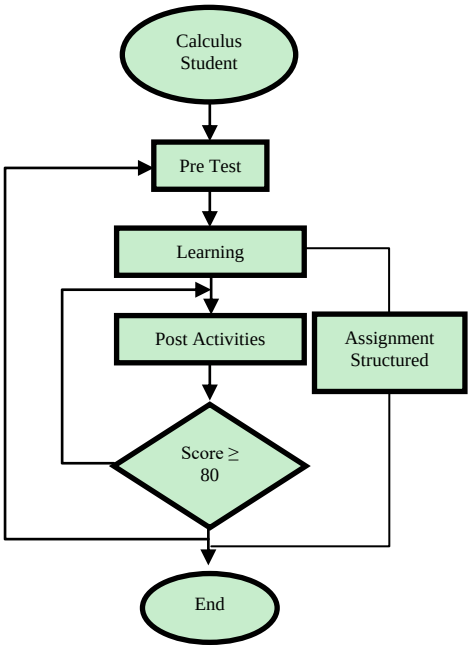

Fig. 2. *Students Activity Diagram.*

Phase 4: In each learning activity, there are ten structured assignments to fulfill independent learning activities and discussions with anyone who becomes their study partner. Structured assignments must be submitted to LMS before the next meeting starts.

Phase 5: In this phase, the lecturers play a role in checking students' abilities and explaining the stages of sequentially completing structured assignments.

Phase 6: Evaluation. Learning outcomes are based on the score of structured assignments submitted by each study activity, mid–semester test scores, and final semester test scores, all three of which must be completed. These three components will give the student's final score, and the level of mastery can be seen in the Table I.

TABLE I: MASTERY LEVEL

Achievement Grades	Weight Value	Range/Scores
A	4	80 – 100
A–	3.67	76 – 79.99
B+	3.33	72 – 75.99
B	3	68 – 71.99
B–	2.67	64 – 67.99
C+	2.33	60 – 63.99
C	2	56 – 59.99
D	1	45 – 55.99
E	0	0 – 44.99

C. Formative Evaluation Instrument

Modules prepared for offline and online learning(blended) have undergone formative evaluation using validator–validated instruments. The implementation of formative assessment to test the feasibility of products validated by experts is divided into four stages:

Stage 1: evaluation and validation by instructional design experts, material experts, and linguists
Stage 2:: one–to–one evaluation carried out by three students
Stage 3: small groups conducted by 11 students
Stage 4: field trials conducted by 30 students

The instrument used in the formative evaluation is a questionnaire with a Likert scale of 1–5 [37]. Then, the quality of the developed model with the criteria of very good, good, sufficient, poor, and very poor is carried out based on the assessment criteria using evaluation standards, as shown in Table II.

TABLE II: ASSESSMENT CRITERIA

Average Score	Classification
> 4.0	Very Good
> 3.4 – 4.0	Good
> 2.6 – 3.4	Enough
> 1.8 – 2.6	Not Enough
< 1.8	Very Less

The average value of the calculus module feasibility test by experts can be seen in Table III below:

TABLE III. AVERAGE FEASIBILITY TEST RESULTS

Formative Evaluation	Average Value	Description
Instructional Design Expert	4.53	Very Good
Material Expert	4.42	Very Good
Media Expert	4.47	Very Good
Linguist	4.20	Very Good
One–To–One	4.75	Very Good
Small Group	4.63	Very Good
Field Trial	4.26	Very Good

Based on the feasibility test results in Table II, the calculus course module is considered very satisfactory or suitable for use.

D. Effectiveness Test

The effectiveness test results of each learning activity of the developed calculus course module are as follows: the average pretest score was 67.34, and the average posttest score was 87.76. The results of the pretest and posttest of 30 students during the field trial are shown in Table IV.

TABLE IV: STUDENT PRETEST AND POSTTEST RESULTS SCORE

Respondent	Pretest	Result	Posttest	Result
Student–1	70	Finish	80	Finish
Student–2	70	Finish	100	Finish
Student–3	60	Finish	90	Finish
Student–4	70	Finish	80	Finish
Student–5	70	Finish	100	Finish
Student–6	70	Finish	0	Not Finish
Student–7	80	Finish	100	Finish
Student–8	70	Finish	90	Finish
Student–9	70	Finish	90	Finish

Student–10	60	Finish	90	Finish
Student–11	80	Finish	100	Finish
Student–12	70	Finish	100	Finish
Student–13	40	Not Finish	80	Finish
Student–14	70	Finish	90	Finish
Student–15	60	Finish	100	Finish
Student–16	70	Finish	90	Finish
Student–17	60	Finish	90	Finish
Student–18	70	Finish	100	Finish
Student–19	70	Finish	80	Finish
Student–20	60	Finish	90	Finish
Student–21	50	Not Finish	90	Finish
Student–22	70	Finish	80	Finish
Student–23	80	Finish	90	Finish
Student–24	70	Finish	100	Finish
Student–25	80	Finish	90	Finish
Student–26	60	Finish	90	Finish
Student–27	70	Finish	100	Finish
Student–28	80	Finish	80	Finish
Student–29	50	Not Finish	90	Finish
Student–30	70	Finish	80	Finish
Quantity	2020		2630	
Average	**67.33333**		**87.666667**	
Value Increase	**20.333**			

Table IV shows that students 13, 21, and 29 have incomplete notes. This is because the three students were late for the pretest, while during the posttest, there was one student, student 6, whose result was 0 because the student did not take the posttest for some reason. An analysis of the increase in the scores of the pretest and posttest was 20.33%. In finding out the significant difference between the average pretest and posttest, it is necessary to hold a t–test with the SPSS application. The result shows a significant difference in table V. It can be seen from the t–count value of –4.0239 or 4.0239, greater than the t–table (2.042) with a significance of 0.001. Thus, the t–count < 0.05, meaning there is a significant difference in learning outcomes before and after using the module. From these results, it can be concluded that the learning module is effective.

TABLE V: PRETEST AND POSTTEST ANALYSIS

Model	Paired Differences					t	df	Sig. (2–tailed)
	Mean	Std. Deviation	Std. ErrorMean	95% ConfidenceInterval of the Difference				
				Lower	Upper			
Pair 1 Pretest – Posttest	–20.333	20.254	3.698	–27.896	–12.770	–5.499	29	0.000

VI. CONCLUSION

Structured assignment method–based modules have been tested for their effectiveness in improving calculus learning outcomes with blended learning supported by LMS. The calculus module developed is written in simple language, with examples of questions that are discussed in sequential and structured stages to be easily understood and can be a guide should students want to learn independently. Printed modules are prepared for offline learning and can be accessed in LMS for online learning, equipped with structured assignments for discussion among friends and groups. This structured assignment, which is always given in every learning activity and must be submitted before the next lesson begins, accustoms students to complete their assignments independently and in group discussions. The pretest is prepared before distributing the material, and feedback is provided directly at the end of each learning activity.

From the lecturer's side, all materials can be adequately completed in fourteen meetings (offline and online)—no more complaints about lack of time in teaching. Lecturers can also more easily monitor the activities of their students. Research on the development of the structured assignment method–based calculus module with blended learning that has been tested for validity, feasibility, and effectiveness has not been carried out by many other researchers. In contrast, no studies discuss calculus learningmodules using structured assignment method–based modules. In addition, simple and easy–to– understand Indonesian language modules are not yet available.

This research method can also be applied to other courses with a support system that can be developed with a web–based or fun mobile–based system. Unfortunately, many researchers have not researched how to improve calculus learning outcomes using structured assignment method–based modules. However, some of the studies they found stated that the ability of students could be enhanced, increasing their final scores and understanding, as well as online learning video links to explore unlimited learning resources anywhere and anytime.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Based on personal experience, the primary author proposes the idea of a calculus learning model to improve student learning outcomes. Mr. Nurdin Ibrahim contributed to blended learning, which an ICT–based LMS supported, while Mr. Rusmono contributed to learning based on the structured assignment method. All authors have also approved the final version of this article.

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