Development of Flipped Classroom Combined Case Team-Based Project Learning to Improve Students' Academic Achievements In Higher Education

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Abstract **– This research focuses on developing a flipped classroom model that integrates with case-based learning and team projects. The importance of this research arises from the difference in the effectiveness of using the existing flipped classroom model. Through the R&D method, by adapting the Borg & Gall model, we carried out validation with focus group discussions with six experts, effectiveness tests through small and large-scale experiments, and practical evaluations based on input from lecturers and students. As a result, we successfully developed a new flipped classroom model called FCTBPjL, which includes seven foremost syntaxes and shows high validity (0.84), effectiveness (82.3), and practicality (82.16% and 90.36%). This research contributes to education by presenting a new flipped classroom learning model, which is adequate for project and case-based learning.**

Keywords **– Flipped classroom model, case-based, team-based, project-based learning.**

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1. Introduction

In the flipped classroom learning model, The educational process undergoes a transformation, where students are expected to learn learning materials at home first by using resources such as videos, readings, or interactive materials. This approach transfers the responsibility of learning to students so that class time can be used to apply that knowledge through more interactive activities such as discussions, projects, or case studies. By applying a case and project-based approach, students have the opportunity to be directly involved in learning, working on real projects or solving complex case study problems [1], [2], [3], [4]. This enhances their conceptual understanding and their ability to apply practical knowledge in real situations. The flipped classroom method significantly encourages cooperation among students through group activities, allowing them to share knowledge, hone social skills, and develop communication skills [5], [6], [7], [8]. Active participation of students in the learning process leads to more meaningful and immersive learning. In addition, lecturers in this model act more as mentors or facilitators who guide students in navigating learning materials and working on projects rather than just presenting the information. The active role of lecturers as facilitators helps students understand concepts better and encourages them to become more independent and critical learners. This flipped classroom approach makes learning more dynamic and interactive, equipping students with skills relevant to their future academic and professional success.

Students often face significant challenges in the flipped classroom learning model, especially when it comes to access to online materials at home [9], [10], [11], [12].

Limitations such as unstable Internet and lack of electronic devices can hinder their learning process. In addition, not all students have the same readiness or motivation to study independently at home [13], [14], [15]. These differences lead to variations in their engagement with the material and understanding of the concepts being taught, which, in turn, can affect overall learning outcomes. Group work, which is a crucial component of project-based learning in the flipped classroom model, also often presents challenges. Problems such as lack of good coordination between group members or imbalances in contributions can decrease the effectiveness of group learning and harm the student learning experience. In the face of these challenges, it is crucial to provide teaching materials specifically designed to support the flipped classroom learning model. These materials should be easily accessible, take into account the technological limitations students may face, and be designed to encourage student motivation and engagement. Materials should include a variety of formats that can suit different learning styles, such as videos, text, and interactive activities. In addition, approaches to improving group work should include strategies to facilitate better communication and a fairer distribution of tasks among group members. With suitable teaching materials and techniques that pay attention to the needs and limitations of students, the flipped classroom learning model can be more inclusive and effective and provide a more satisfying learning experience for all students [16], [17], [18].

Existing research shows that flipped classroom learning models have mixed effects. Some studies, such as those conducted by Listiqowati *et al*. [19], Ding *et al.* [20], Cai *et al*. [21] and Mubai *et al*.[22] found that this model was effective in improving student learning outcomes and skills, especially when combined with projects, case studies, or teamwork.

However, there are also studies, such as those reported by Cabi [23], which state there is no significant difference in learning outcomes between students who use the flipped classroom model and those who follow conventional learning approach. Rahman *et al*. [24] add that without proper guidance, project-based learning may not be practical, especially with the use of flipped classroom models. Based on these conditions, the author tries to develop and apply a flipped classroom model combined with projects, cases, and group work in multimedia learning to improve student learning outcomes and students' critical thinking, creativity, communication and collaboration skills.

The research questions are:

1. How has the flipped classroom combined team-based project model been developed?
2. How is the validity of the developed model?
3. How effective is the model developed?
4. How practical is the developed model?

2. Research Method

This research method uses development procedures that have been formulated by Borg & Gall, as developed and adapted by the Center for Policy and Innovation Research (Puslitjaknov) in 2008 [25]. This approach includes a series of structured steps designed to ensure that the learning models developed are not only innovative but also relevant and effective in meeting current learning needs. The Borg & Gall development model used in this study is divided into five main stages, each of which has specific objectives and activities, as illustrated in the flow chart presented in Figure 1.

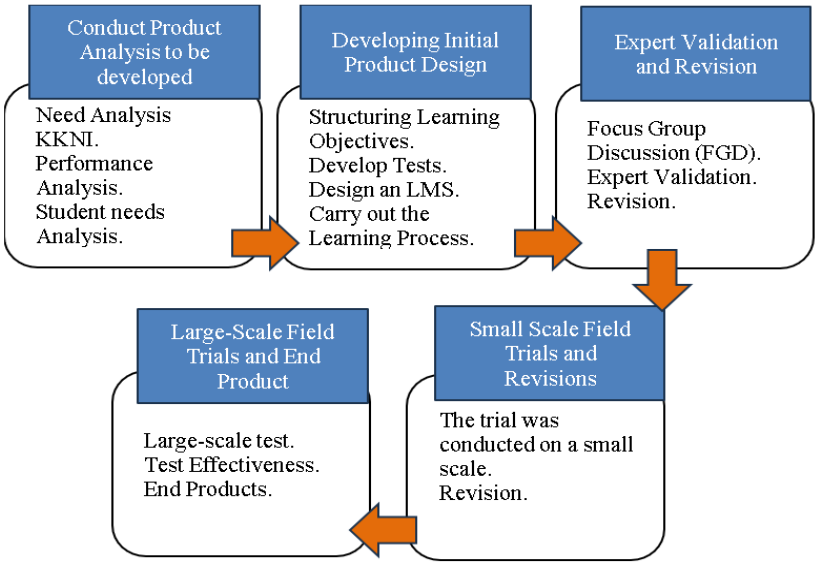

Figure 1. Model Borg & Gall and Puslitjaknov

The stages of development based on Figure 1 are as follows: 1) the "Conducting Analysis of the Product to be Developed" stage focuses on identifying existing learning problems and specific needs for new learning models. It involves extensive data collection and in-depth analysis to understand the context and challenges faced by students and lecturers. 2) The "Developing Initial Product Design" stage is the stage where the initial concept of the learning model is created. At this stage, innovative ideas are realised in initial designs, which are then prepared for validation through focus group discussion (FGD) activities involving various stakeholders who are experts in the field of learning models and languages. 3) In the "Expert Validation and Revision" stage, the model that has been designed undergoes a validation test process by a number of experts in the field of learning and language models. In particular, six experts were involved to assess and provide input on the model design, which was then used as the basis for revision and refinement. 4) The "Small-Scale Field Trial and Revision" stage was carried out by involving a small number of users, in this case, three students and one lecturer from the informatics study program, to test the application of the model on a more limited scale. The feedback gleaned from these trials is then used to make further revisions. 5) The last stage of "Large-Scale Field Trials and Final Products" expanded the scope of application of the model to a larger scale, involving 26 students and four lecturers from the informatics study program. This trial aims to validate the final learning model, with the results and feedback obtained at this stage determining the final version of the learning product developed.

3. Results

This section presents significant findings from developing and implementing the Flipped Classroom Combinate Case Team-based Project Learning (FCTBPjL) model within higher education. This approach is part of a broader initiative to revamp educational strategies, enhancing the academic environment's dynamic nature to meet contemporary needs better. The inclusion of case-solving methods and project-based learning aligns with the Ministry of Education and Culture's directives, aiming to cultivate a learning process that is more interactive, collaborative, and practical, thereby equipping students with the essential 21st-century skills of critical thinking, creativity, communication, and collaboration. This section outlines the outcomes of these educational reforms and their strategic implications for developing and validating this innovative educational model.

3.1. Conducting Product Analysis to be Developed

This phase marks an essential step in efforts to review and strategically update the goals of higher education development in Indonesia. Where this effort aims to create an academic environment that is more dynamic and responsive to the needs of the times by focusing on three key areas: First, increasing learning standards and sharpening the relevance of higher education to ensure that the curriculum and teaching methods used are not only up-to-date but also able to prepare students with the competencies needed in the global job market. Second, developing the quality of lecturers and education staff is a crucial step to ensure that faculty and staff have the necessary expertise, knowledge, and skills to support effective teaching and learning processes and create a conducive and inclusive learning environment. Third, the implementation of efficient quality management, under the direct supervision of the Director General of Higher Education, is expected to improve the overall governance of the university, from academic administration to internal and external policies that support innovation and sustainability of higher education institutions. All of these efforts are designed to ensure that universities in Indonesia can compete at national and international levels while continuing to encourage the development of science, technology, and innovation for the welfare of society. [26]. Higher education institutions are expected to actualise these three goals by expanding capacity and raising the standards of the educational process and the management they manage. This includes improving learning facilities, developing more innovative teaching methods, and optimising an efficient and effective education management system so as to create a conducive academic environment for student growth and learning.

In accordance with the Ministry of Education and Culture Number 3/M/2021 [27], there is a strong encouragement for educational institutions to implement case-solving learning methods ('case method') and project-based group approaches ('team-based project learning') as an effort to create a more interactive, collaborative, and applicable learning process. The case-solving method encourages students to engage in the analysis of complex situations, stimulates critical and strategic thinking, and facilitates rich group discussions. Meanwhile, the project-based group approach emphasizes results-oriented learning experiences, honing teamwork, communication, project management, and theory application skills into practice through project development and completion.

This initiative is expected to change the academic environment to be more conducive to active learning, where students actively participate in the search for knowledge and development of relevant skills to support the vision of education that is adaptive, innovative, and in accordance with the needs of the times so that student competence can increase and support 21st-century learning known as the 4Cs of critical thinking, creativity, communication, and collaboration.

3.2. Developing the Initial Product Design

An in-depth study of educational needs emphasizes the importance of developing innovative learning models, especially for students of the informatics study program, with the main aim of improving their essential competencies. In the process of designing this learning model, an in-depth literature analysis is carried out not only to understand the existing theoretical framework but also to integrate case methods and project-based learning as the primary foundation.

The proposed model aims not only to enrich academic knowledge but also to hone five critical competency skills needed in the world of work such as problem-solving, critical thinking, teamwork, creativity, and adaptability.

This flipped classroom learning model is a combination of case methods and project-based learning, or what is called the flipped classroom model based on case team-based project learning (FCTBPjL), which can be seen in Figure 2. This model is designed to adjust the needs and characteristics of informatics students by changing conventional learning methods to be more interactive and student-centred. In the context of learning in multimedia courses, this becomes very important, where students are given the opportunity to first explore the material independently through digital or online resources and then apply it in real situations through class discussions and group projects. This approach ensures that learning does not only stop at mastering theory but also includes applying concepts in real-world scenarios, preparing students for their future professional challenges and needs more effectively and relevantly.

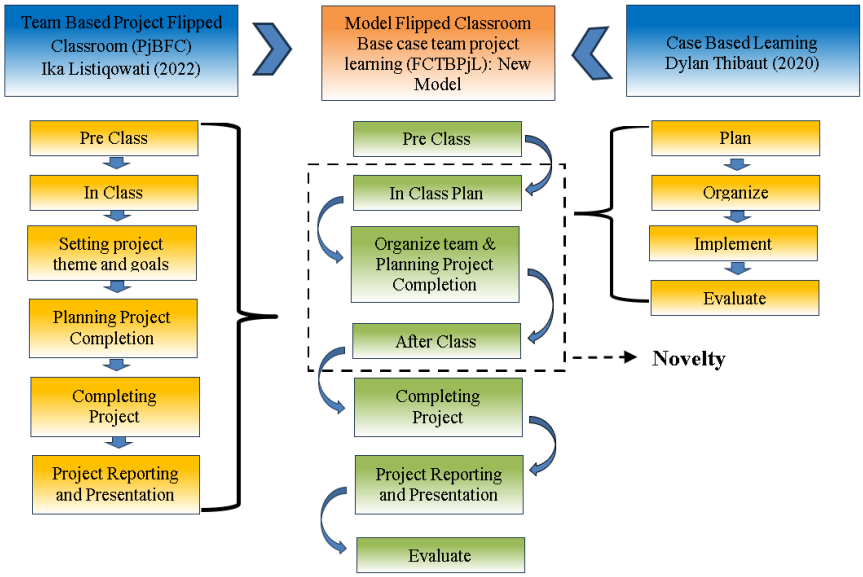

Figure 2. Syntax model flipped classroom combinate case team-based project

3.3. Expert Validation and Revision

a. Focus Group Discussion (FGD)

Before implementing the FCTBPjL learning model, a focus group discussion (FGD) was conducted with the presence of six experts or validators who have expertise in relevant fields (Table 1). The results of this FGD obtained various inputs and suggestions related to the FCTBPjL model that is being developed, and they also show the need for improvements to the products that have been produced.

Table 1. Validators and their areas of expertise in FGD activities

No	Name	Areas of Expertise
1	Validator 1	Evaluation
2	Validator 2	Learning Model
3	Validator 3	Language
4	Validator 4	Multimedia
5	Validator 5	Flipped Classroom
6	Validator 6	Multimedia

b. Expert validation

Before being used to measure the validity of research products, validation must be carried out on research instruments. The validation of this instrument is carried out by six experts who will also provide an assessment of the validation of research products. The results of the validator assessment of research instrument validation are presented in Table 2.

Table 2. Results of recapitulation of research instrument validation

No	Research Instruments	Average	Category
1	Model Book	0,83	Valid
2	Module Book	0,85	Valid
3	Job Sheet Book	0,83	Valid
4	Lecturer Teaching Handbook	0,84	Valid
5	Student Handbook	0,85	Valid
6	Product Validation Instruments	0,86	Valid
7	Product Practicality Validation	0,84	Valid
8	Syntax Validation	0,84	Valid

c. Syntax Validation

Syntax validation assessment is also carried out by six validators against syntax validation, which covers several aspects as presented in Table 3 below:

Table 3. Syntax validation

No	Aspek	Aiken'sV	Keterangan
1	Pre-Class	0,83	Valid
2	In-Class Plan	0,83	Valid
3	Organise team & Planning Project Completion	0,87	Valid
4	Completing Project	0,82	Valid
5	Project Reporting and Presentation	0,85	Valid
6	After Class	0,84	Valid
Average Validator Value		0,84	Valid

3.4. Small-Scale Field Trials and Revisions

After the FGD activities and revisions to the model and product are declared valid, the next stage is to test the model and product. This trial was conducted on a limited scale with a small group involving three students and one lecturer.

3.5. Large-Scale Field Trials and End Products

The results of the development of the FCTBPjL learning model have been validated and revised, and then a large-scale field test is carried out, consisting of testing the effectiveness of the model. These data were obtained through pretest and posttest tests on two classes of students in multimedia courses, namely classes using the FCTBPjL learning model with as many as 14 students and classes using the Conventional learning model with as many as 12 students. The results of the effectiveness test can be seen in Figure 3.

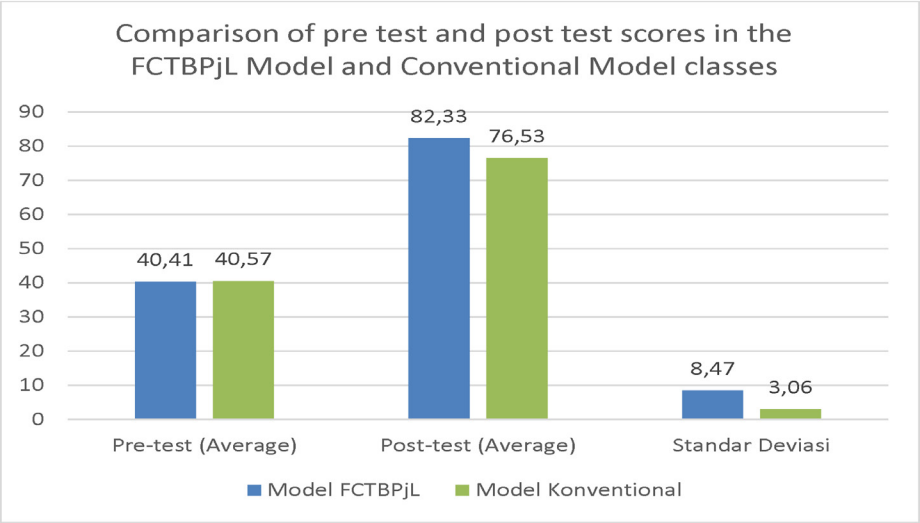

Figure 3. Comparison of FCTBPjL model and conventional model effectiveness test results

a. Practicality by Lecturers

After large-scale trials were carried out, then a practicality test was carried out by giving practicality questionnaires to 4 lecturers as validators to test the practicality of the FCTBPjL model.

Based on the lecturers' assessment of the FCTBPjL model in the multimedia course, explained in Figure 4.

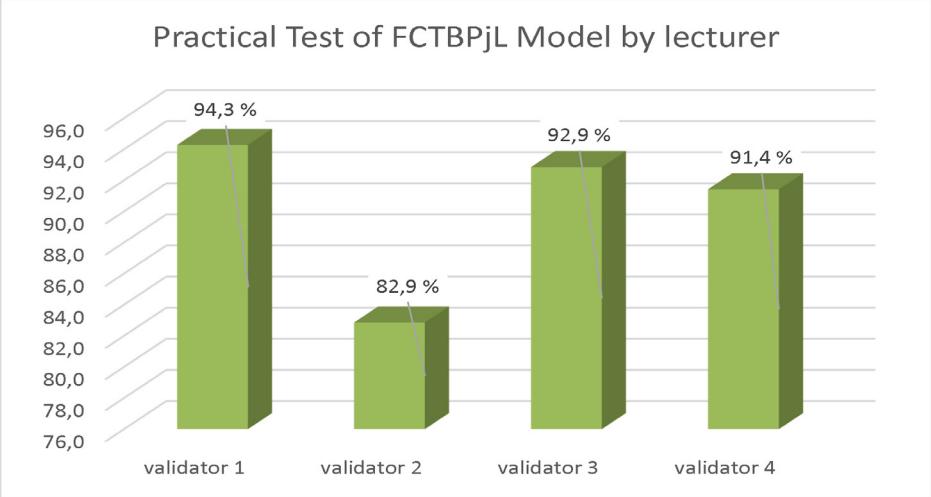

Figure 4. Practical Assessment of FCTBPjL Model by 4 Lecturers

b. Practicality by students

The practicality questionnaire was given to a large group of students who had learned through the FCTBPjL model, consisting of 14 students as validators.

Practicality tests on students include testing the practicality of the FCTBPjL learning model, Module Book, Job Sheet Book, and Student Guidebook. Based on student assessment of the FCTBPjL learning model, Module Books, Job Sheet Books and Student Guidebooks in Multimedia courses can be described in Figure 5.

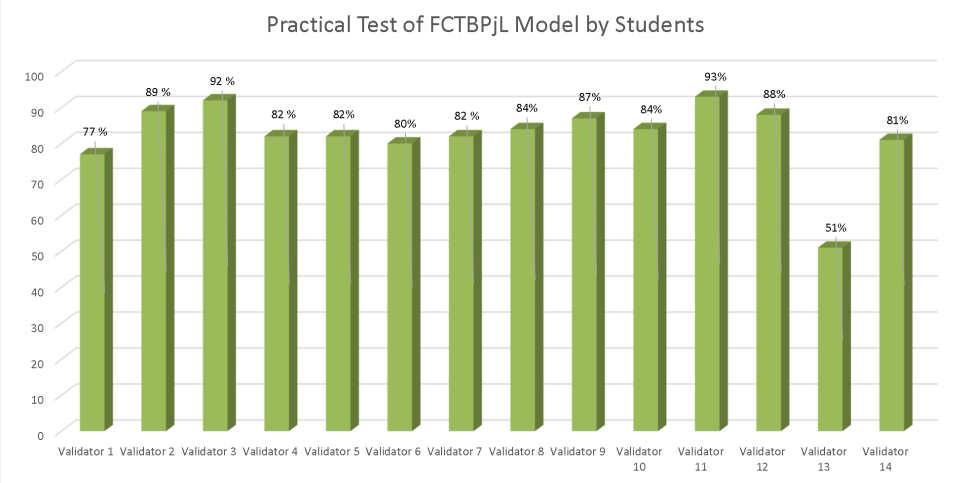

Figure 5. Practical assessment of FCTBPjL learning model by students

4. Discussion

In this study, a flipped classroom learning model has been developed by combining a team-based project model with a case-based learning model by adapting the Borg and Gall Model [28, p. 571] and Puslitjaknov [25, p. 11].

This research was conducted at Payakumbuh College of Technology and tested using this FCTBPjL model in experimental classes, both small groups and large groups, in multimedia courses.

In the process of analyzing learning products to be developed, the main focus is to identify existing problems.

The results of the needs analysis confirm the need to design a special learning model aimed at improving student competence [29], [30], [31]. This design process involves an intensive literature review to reinforce the concept of the flipped classroom learning model, which integrates case methods and project-based learning. The purpose of this model is to enrich the learning experience and effectively hone students' competency skills [32], [33], [34]. In the context of multimedia learning, this specially developed flipped classroom learning model is designed to meet the needs and characteristics of students to make them more relevant and practical.

The steps implemented in this development include: 1) Analysis of KKNI needs to determine the set of essential competencies, which include knowledge, skills, and attitudes that students must master; 2) Performance analysis, identifying problems through interviews with heads of informatics departments and lecturers; 3) Student needs analysis, which examines students' characteristics, prior knowledge, and skills. This process also establishes the required competencies, success indicators, and supporting conditions for competency achievement through the distribution of questionnaires to students. The findings from this analysis are used to develop learning support media, especially for multimedia courses in the informatics study program. Literature studies are also carried out to strengthen theoretical foundations, ensuring that learning products developed are based on solid and accountable theories.

Then in the initial product design development section, the model developed comes from the team-based project flipped learning model which is combined with the case base learning model by considering the advantages and disadvantages of each of these models so as to produce seven syntaxes in this FCTBPjL model (figure 2), namely: 1) Pre-class, in this syntax students do independent learning before class starts according to the direction of the lecturer using teaching modules, job sheet book, student manual, and FCTBPjL model book. 2) In class plan, in this syntax, learning activities are in the classroom, starting with the lecturer opening a lecture. The lecturer confirms the learning that has been done independently so that there is a dialogue between the lecturer and the student; if there are students who ask about the results of their independent learning, the lecturer can provide opportunities for other students to answer it so that there is a dialogue between students and students so that communication, critical thinking, student creativity can grow. 3).

Organize team and planning project completion; in this syntax, lecturers form student groups to solve cases as projects in multimedia learning, and then students discuss and look for literature for solving the case so that at this stage, students' communication collaboration, creativity and critical thinking competencies grow. 4) After class and 5) Project completion; at this stage, students bring their project cases home for further discussion to find a resolution of their project cases in groups within a time limit of course the lecturer 6) Project reporting and presentation, at this stage students return to class and report the results of solving their project cases and presenting their project case solving reports. At this stage communication between students grows, criticism al thinking, collaboration, and student creativity. 7) Evaluate: At this stage, lecturers assess the results of student projects and provide feedback.

Furthermore, in the expert validation and revision section, in this section a focus group discussion activity was carried out with experts to obtain validation of research products attended by six experts from the field of expertise: learning models, flipped classrooms, evaluation, multimedia, and expertise in the field of language (Table 1). Based on Table 2, validation results were obtained from research products in the form of model books, module books, job sheet books, lecturer teaching guidebooks, student guidebooks, product validation instruments and product practicality validation in sequence, having an average validation value of 0.83, 0.85, 0.83, 0.84, 0.85 and 0.86 which were in the valid category then based on Table 3. It is known that the results of the validation assessment by six validators are valid. A validity test was carried out using Aiken's V formula. The calculation results obtained that the average value of Aiken's V = 0.84 is more significant than V = 0.6, so it can be concluded that validation of syntax validation is declared valid so that a valid syntax is obtained and worth testing.

After the model syntax was declared valid, then a limited-scale trial was carried out with a small group involving three students and one lecturer. The tests carried out at this stage are practical tests of module books, job sheet books, student manuals and lecturer manuals. This practicality test is carried out after the provision of learning materials. Instruments were given to 3 students, and a practical assessment was carried out. The results of the practicality assessment in the small group of module books are 76.97, the practicality of the job sheet book is 85.33, the practicality of the student manual is 82.67, and the practicality of the lecturer manual based on the lecturer's assessment is 94. Based on the practicality category, according to Purwanto [35], the range of 76-85 with practical categories and the range of 86-100 categories is very practical.

Based on these conclusions, the product is ready to be used for large-scale research (widespread testing).

Furthermore, the test was carried out to extend to students in multimedia courses consisting of two classes: 1 class was used as an experimental class by applying the FCTBPjL model to as many as 14 students, and 1 class was used as a control class by applying the conventional model as many as 12 students, at the beginning of the multimedia lecture a multimedia question was pretested to students in the FCTBPjL class and conventional classes so that pretest scores were obtained in the model class FCTBPjL with an average of 40.41 and the conventional model with an average of 40.57. Then, in the 15th lecture (last meeting), the post-test was carried out again so that the average value of the FCTBPjL model was 82.33. The conventional class was 76.53 (Figure 3), so based on these data, the achievement of multimedia learning with the application of the FCTBPjL model in trials was declared more statistically effective than using conventional models. In this extensive test research is in line with [36], [37], [38].

Next, after learning FCTBPjL was tested, a practicality test was carried out by giving a practicality questionnaire to 14 students who had experienced the implementation of the FCTBPjL model so that the highest practicality score was obtained, 93%. The lowest score was 51%, so the average practicality score of students was 82.16% who were in the practical category (Figure 5). Then, the practicality test was also carried out on four lecturers who taught multimedia courses with the highest score of 94.3% and obtained the lowest score of 82.9% so that the average value of practicality from lecturers was 90.36 in the very practical category (Figure 4).

5. Conclusion

This research succeeded in developing a flipped classroom model that is proven to improve student competence in multimedia courses, including academic competencies and 21st-century competencies such as communication, collaboration, creativity, and critical thinking. The model was successfully built and consisted of seven instructional stages: pre-class preparation, lesson plans in class, team building and planning, after-class activities, project completion, project reporting and presentation, and evaluation. This model has been validated by six experts with valid values and proven effective after being tested in small and large-scale classes.

Then, this model received positive assessments from both lecturers in the multimedia field and students who have participated in learning using this model, so in this case, this model is proven to be practical. These findings suggest the need for further research on the implementation of the results of developing this flipped classroom model that is integrated with various learning management systems (LMS) for deeper exploration in the future.

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