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Development of The Project-Based Learning Model In Making Teaching Modules for Courses Multimedia Technology and Animation

Muhammad Sabir Ramadhan[1)] *, Harmayani [2)a]
Informatics Engineering Study Programme, Asahan University
[1)]ramasabir@gmail.com , [2)]baakamik@yahoo.co.id

ABSTRACT

The discovery of errors in the delivery of Multimedia Technology and Animation course material *is* indirectly caused by the implementation of lectures for the course, which should be given for 2 semesters compressed into 1 semester only. The limited learning time prevents some course material from being delivered to students. This limitation was also triggered by the absence of teaching modules that support condensed learning due to the implementation of lectures for 1 semester. Seeing these problems makes the development of a teaching module in the Multimedia and Animation Technology course with Project-Based Learning *to* support the implementation of lectures a solution that can be done to overcome existing problems. The feasibility test results show that the teaching module is valid. In contrast, the results of the feasibility test by media experts show that 95.14% of the module is very valid, and seen from the results of the feasibility test by material experts show that 97.14% of the module is very valid for use in learning for 1 semester. In the trial involving students, it shows that through the results of individual trials, it can be seen that 94.17% of the teaching modules developed are very feasible to use in the learning process. In addition, through the results of the small group trial, it can be seen that the teaching module is 85.18% very feasible to use, as well as the results of the usage trial show that the teaching module is 87.45% very feasible to use in learning. Based on the data obtained, it can be concluded that the Multimedia and Animation Technology module with Project-Based Learning *is* very feasible to be used as a reference and in the learning process of Multimedia and Animation Technology courses.

Keywords: Multimedia and Animation Technology Module, Project Based Learning

INTRODUCTION

The implementation of education in Indonesia, especially in higher education institutions, always contains learning that follows the development of human resource needs. Multimedia is one of the expert competencies in the higher education curriculum structure that can hone the ability to think creatively, productively, innovatively, proactively, and effectively. (Mastur, 2017) in mastering competencies that follow the objectives of higher education in Indonesia (Hoesny & Darmayanti, 2021) with the character of the scientific approach and authentic assessment owned by the Merdeka Curriculum (Pujiarti et al., 2023), thus supporting an increase in the balance of knowledge, skills, and attitudes competencies (Kurniati et al., 2019). One of the courses taught in this expertise competence is Multimedia and Animation Technology. When looking at the implementation of learning in the Informatics Engineering Study Programme, Asahan University found several things that are

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still a problem in the implementation of Multimedia and Animation Technology learning in the classroom. This is indirectly related to the compaction of the learning process in the study programme. The main problem found is that there is an error in providing learning material on the topic of *Stop Motion* Animation learning and even found that there are some other materials that cannot be conveyed to students. In addition, it was also found that the implementation of learning was dominated by providing material verbally by giving daily tests and assignments. It's the effect of compressed learning. This is also triggered by the absence of appropriate teaching materials or learning media to be used as a reference in a compressed learning process. The existence of these findings has an impact on student understanding of the material studied where 70% of students have not mastered the material studied, as evidenced by the responses of students who are confused when working on questions given to students related to Multimedia Technology and Animation learning material so that it can be seen that the implementation of learning in the course is still not optimal.

As one of the learning tools in the implementation of teaching and learning activities, teaching materials are an essential factor in improving the quality of learning and student abilities. (Suprihatin & Manik, 2020). In addition, teaching materials can improve student learning outcomes (I Gede Nurjaya & I Gusti Ayu Agung Manik Wulandari, 2023). Both from the aspect of knowledge (Pattaufi et al., 2023) and skills and ability to improve students' ability to think critically (Rohani et al., 2020) in representing knowledge. Teaching materials in development consist of various types, including printed and non-printed teaching materials (Magdalena et al., 2020); one of them is a module. The application of modules in learning can make the learning process well-planned, independent, and complete and have precise results and objectives if learning with modules follows the rules of the implementation instructions. Therefore, the use of modules in the learning process can be used to support student-independent learning to achieve the competencies that must be mastered. (Fitrotun Nisa et al., 2022).. *Project-based learning* is a learner-centred learning model, using research activities carried out with guidance and direction from the supervisor (teacher) to build collaboration according to the abilities and capacities of each individual as a whole. (Halimatusyadiyah et al., 2022).. Through Project-Based Learning, students obtain a concept and learning experience by themselves. (Sutrisna et al., 2020). Modules that integrate with project-based learning have characteristics that can be seen from the following, among others: (1) They contain questions that guide students to learn. (Sari, 2018)(2) some problems must be solved by students (as users) so that they can motivate and encourage students to dare to deal with the main concepts and principles of the knowledge being learned. (Jääskä et al., 2022). (3) the material contained in the module must have a clear, structured, and directed sequence. (Kemdikbud, 2024)(4) contains the most crucial point in the Project-Based Learning module, namely, using projects as a medium. In general, this research aims to develop teaching material as a Multimedia and Animation Technology learning module containing a Project-Based Learning model to improve student learning activities and outcomes. (Antari et al., 2023) The use of printed models helps improve students' understanding of learning materials (Muldiyana et al., 2018), so it has a positive impact on

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student learning achievement (Kustandi et al., 2021) and student learning completeness. This is also a solution to overcoming the various findings of the problems underlying this research.

METHODS

This research was conducted by applying the steps in the research and development method with Sugiyono's model as follows: 1) Potential and problems, at this stage, data are obtained that explain the fundamental issues in this study. In addition, through this stage the needs related to the research are known, primarily related to teaching materials that can support the implementation of lectures for 1 semester; 2) Data collection, through this second stage, various information is obtained through unstructured interviews that have been conducted, including data on the learning characteristics of 6th semester students of the Informatics Engineering Study Programme and their learning material needs; 3) Product design, through this stage the Project-Based Learning module activity design, material design, and module physical design are produced; 4) Design validation, this stage is carried out to obtain the validity level of the module that has been designed by material experts and media experts; 5) Design revision, revision or improvement of the module carried out at this stage is based on the results obtained from the previous stage based on suggestions and criticisms given by material experts and media experts; 6) Product trial, at this stage a series of trials of learning modules that have been developed are carried out, namely conducting individual trials and small group trials to get student responses and comments on the products set; 7) Product revision, revision carried out at this stage is carried out. Product revision: the revision carried out at this stage is to re-improve the developed module following the suggestions and results of the product trial; 8) Usage trial: the trial stage carried out at this stage is carried out by involving a large group of students to get student responses and comments on the developed product; 9) Product revision, product revision at this stage is carried out to improve and perfect the learning module based on the results of the usage trial that has been carried out; 10) Mass production, mass production, namely printing and binding of learning modules and the use of modules in the teaching and learning process is carried out at the end of the research and development stage.

The explanation of the trial implementation in the research and development of this learning module consists of 3 (three) stages, namely (1) individual tests involving material experts and media experts as well as 3 students of class 6A of the Informatics Engineering Study Programme; (2) small group tests involving 7 students, and (3) large group tests or field tests involving 23 students. The test aims to determine the level of validity (feasibility) of teaching materials in the form of 2D animation printed modules with project-based learning. The research instrument in the form of a questionnaire consists of (1) a material expert validation questionnaire consisting of 35 items, (2) a media expert validation questionnaire consisting of, and (3) a trial questionnaire for students.

The assessment contained in the questionnaire in this study uses a *Likert* scale consisting of 4 scores. The data that has been obtained from this research will be analysed using quantitative descriptive analysis techniques by looking at the percentage of research results against the validity criteria used in research data analysis and qualitative by looking at the criticisms and suggestions that have been given. The decision-making guidelines used

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to analyse the validity level of the module, which is based on a qualification scale as a decision maker, can be seen in Table 1.

Table 1. Eligibility Criteria

No.	Eligibility Criteria	Eligibility Level
1	85,01%-100,00%	Very Valid (can be used without revision)
2	70,01%-85,00%	Fairly Valid (can be used but needs minor revisions)
3	50,01%-70,00%	Less Valid (recommended not to be used because it needs major revisions)
4	01,00%-50,00%	Invalid (should not be used)

RESULTS

Product Design Results

Through the product design stage in a series of research and development stages, a teaching module activity design containing *project-based learning*, material design, and module physical design consisting of the module design of the initial, core, and closing parts. The division of the module material consists of 6 (six) each, namely (1) Creating Simple 2D *Animation* Objects and Moving them; (2) *Character* Animation; (3) *Stop Motion Animation;* (4) Applying 2D Animation Production Techniques; (5) Creating Storyboards; and (6) Creating Simple 2D Animation Films with learning activities according to the project-based learning activity design in Table 2.

Module Design with Project-Based Learning

No.	Activities	Description
1	Providing directed questions	It is represented in the form of exams or tests that can shape students' understanding of knowledge.
2	Providing basic concepts and principles of learning	It involves presenting an extract of information to students in writing in a section of the module about things that students should know.
3	Providing exercises with structured steps	It is translated into providing structured practical steps that students can follow to produce a product.
4	Providing a problem to be solved	The problems raised in the module include simple problems to complex problems that have been adjusted to the needs of a student learning activity.
5	Project delivery	The projects given are directed projects with case studies that exist around students.
6	Submission of student work	It is a form of activity that encourages students' courage to convey things found in the learning process that has been carried out.

Product Development Results

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The teaching material developed is a printed module containing learning materials in the Multimedia and Animation Technology course. This module is used to support the learning of Multimedia Technology and Animation in semester 6 of the Informatics Engineering Study Programme, which is condensed into 1 semester so that this module can be used to support the implementation of the 1-semester lecture. The module has chapters called learning activities, as many as 6 learning activities consisting of: (1) Creating Simple 2D *Animation* Objects and Moving them; (2) *Character* Animation; (3) *Stop Motion Animation;* (4) Applying 2D Animation Production Techniques; (5) 2D Animation Objects; and (6) Simple 2D Animation Production. The teaching module display is depicted in Figure 1.

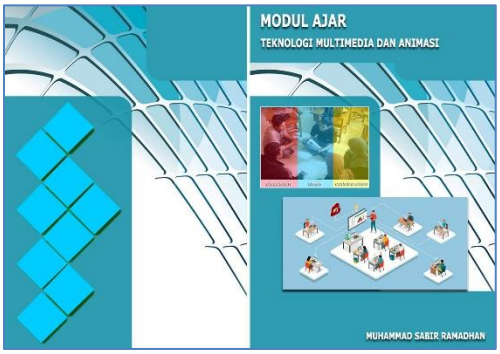

Figure 1: Cover Page of Multimedia and Animation Technology Teaching Module

The learning presented in this module itself consists of providing explanations of 2D animation theories embodied in the material section as well as providing practices embodied in the provision of exercises and projects. The presentation of the module material is complemented by the provision of illustrations and images that are adjusted to the explanation discussed. It is also done in exercises where almost every step is accompanied by a picture to clarify the instructions given and in the provision of projects where pictures accompany some of the instructions to clarify the instructions given, as in Figure 2.

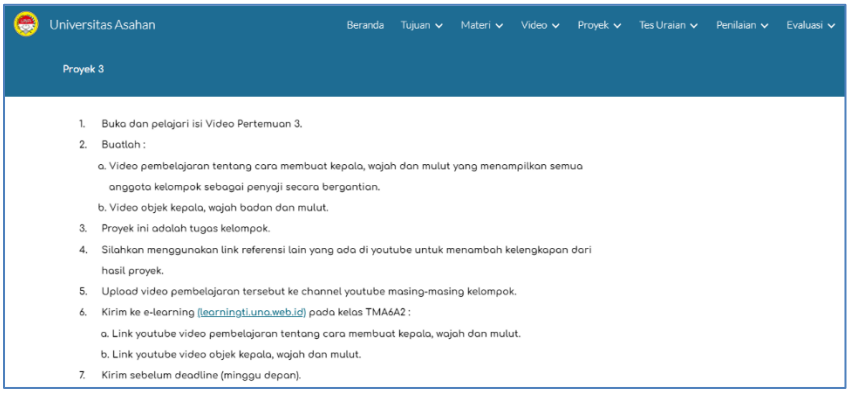

Figure 2: Example of Providing Illustrations on the Module

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As a module that has a condensed learning concept, each Learning Activity in this module includes an allocation of time or the length of time learning in one Learning Activity can be carried out. An example of time allocation can be seen in Figure 3.

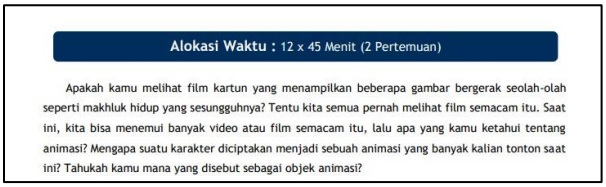

Figure 3: Allocation of time

This Multimedia and Animation Technology print module product was developed with a Project-Based Learning model. Six activities are integrated with the stages and characteristics of the Project-Based Learning model, among others: (1) Providing directed questions manifested by providing basic questions at the beginning of each Learning Activity; (2) Providing basic concepts and main principles of learning manifested in the provision of basic materials and learning objectives; (3) Providing exercises with structured steps based on case studies that are often encountered around students; (4) Providing problems that must be solved given in exercises and projects; (5) Providing individual and group projects which are the core activities of Project Based Learning. (Rati et al., 2017); (6) Provision of individual and group projects, which is the core activity of project-based learning; and (7) Submission of student work results facilitated by the existence of student worksheets after giving projects. The teaching module is also equipped with a concept map in each Learning Activity to improve students' understanding of the material studied. (Febriana & Sakti, 2021). In addition, to further highlight the concept of Project-Based Learning in the module, the initial part of the module added a check of students' initial abilities as a *pretest* representation of student skills. The module is also equipped with *self-evaluation* (for students) in the form of a *checklist* to evaluate the projects undertaken by students, as shown in Figure 4.

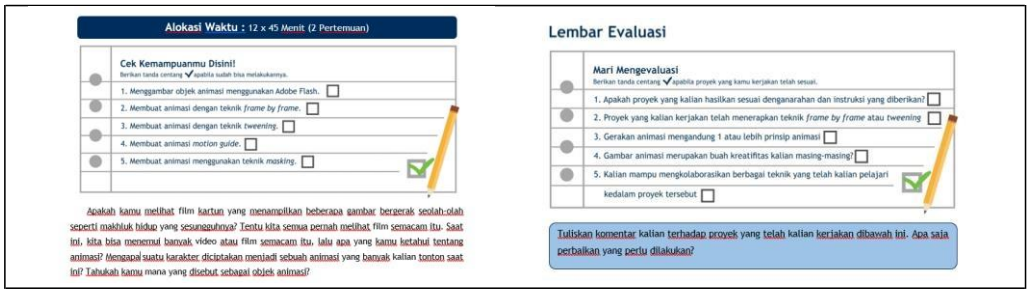

Figure 4: Self-Evaluation Page

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Trial Results

The equation for processing validation data for material experts and media experts uses equation 1, and for processing trial data, using equation 2.

$$Va = \frac{TSe}{TSh} \times 100\% \quad \text{.....} \quad \text{equation 1}$$

$$Vp = \frac{TSe}{TSh} \times 100\% \quad \text{.....} \quad \text{equation 2}$$

Description:
- *Va*: Expert Validation
- VP: User Validation
- TSe: Total score (the result of respondents' answers as a whole)
- TSh: Total expected score (the sum of the overall maximum score)

Validation by media experts includes an assessment of the linguistic and graphical aspects. The percentage value obtained in each element consists of the linguistic aspect, which obtained a percentage value of 89.29%, and the graphic aspect, which obtained a percentage of 98.86%. The results of the validation of the Multimedia and Animation Technology teaching module from media experts obtained a percentage value of 95.14%. The results of media validation are presented in Table 3.

Table 3. Media Expert Validation Results

No.	Aspects	TSe	TSh	Va	Criteria
1	Linguistics	50	56	89,29%	Very Valid
2	Graphics	87	88	98,86%	Very Valid
Total		137	144		
Average				95,14%	Very Valid

Validation by material experts includes an assessment of the aspects of content feasibility and feasibility of presenting module material. The percentage value obtained in each element consists of the content feasibility aspect, which obtained a percentage value of 96.3%, and the presentation feasibility aspect, which obtained a percentage of 98.21%. The results of the validation of 2D animation learning modules from material experts obtained a percentage value of 97.14%. Media validation results are presented in Table 4.

Table 4. Material Expert Validation Results

No.	Aspects	*TSe*	*TSh*	*Va*	Criteria
1	Content Appropriateness	81	84	96,43%	Very Valid
2	Presentation Feasibility	55	56	98,21%	Very Valid
Total		136	140		
Average				97,14%	Very Valid

The individual trial involved 3 students from class 6A of the Informatics Engineering Study Programme. In each aspect assessed or given responses by students, including the

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material aspect, the percentage obtained was 93.06%, the language aspect was 94.44%, and from the aspect of student interest, a percentage of 96.67% was obtained. The results of individual trials with a percentage of student responses were 94.17%. The results of the individual trial are presented in Table 5.

Table 5. Individual Trial Results

No.	Aspects	*TSe*	*TSh*	*Vp*	Criteria
1	Material	134	144	93,06%	Very Valid
2	Language	34	36	94,44%	Very Valid
3	Student Interest	58	60	96,67%	Very Valid
Total		226	240		
Average				94,17%	Very Valid

Table 6: Small Group Trial Results

No.	Aspects	*TSe*	*TSh*	*Vp*	Criteria
1	Material	134	144	93,06%	Very Valid
2	Language	34		94,44%	Very Valid
3	Student Interest	58	60	96,67%	Very Valid
Total		226	240		
Average				94,17%	Very Valid

The small group trial involved 7 students from class 6A (semester 6 regular class A). The percentage obtained in each aspect includes the material aspect getting a percentage of 83.63%, the language aspect of 85.71%, and the aspect of student interest getting a percentage of 88.57%. The quantitative data obtained from this trial reached a percentage of 85.18%. The results of the small group trial are presented in Table 6.

Table 6: Small Group Trial Results

No.	Aspects	*TSe*	*TSh*	*Vp*	Criteria
1	Material	281	336	83,63%	Fairly Valid
2	Language	72	84	85,71%	Very Valid
3	Student Interest	124	140	88,57%	Very Valid
Total		477	560		
Average				85,18%	Very Valid

The usage trial involved respondents in a large group of 23 students. The percentage obtained in each aspect includes the material aspect getting a percentage of 87.05%, the language aspect of 90.94%, and the aspect of student interest getting a percentage of 86.30%. Quantitative data obtained from the usage trial reached a percentage of 87.45%. The results of the usage trial are presented in Table 7.

Table 7. Usage Trial Results

No.	Aspects	*TSe*	*TSh*	*Vp*	Criteria
1	Material	961	1104	87,05	Very Valid
2	Language	251	276	90,94	Very Valid

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3	Student Interest	397	460	86,30	Very Valid
Total		1609	1840		
Average				887,45%	Very Valid

This study also described student learning outcomes through the implementation of learning carried out when carrying out the trial process involving some of the learning material contained in the module with student learning outcomes in Multimedia and Animation Technology learning before using the learning module. The learning implementation process, which is a series of trials, involves 33 students of class 6A (semester 6 regular class A), where the implementation is divided into 3 groups according to the trial stage with the provision of different module materials.

In the individual trial, students tried the learning activities contained in the Learning Activity 1 module entitled "Creating Simple 2D Animation Objects and Moving Them". The average score obtained by students was 82.67. In the small group trial, the respondents involved tried the learning activities containing material about 2D animation in Learning Activity 5, entitled "2D Animation Objects". The average score obtained by students is 87.14. In the implementation of this usage trial, students as respondents tried learning activities in Learning Activity 3, which discussed digital puppeteer animation. The average score obtained by students is 84.83. The average coherent student learning outcomes in each group, starting from group 1 in the implementation of learning in the individual trial to group 3 in the implementation of learning in the usage trial, are presented in Table 8.

Table 8. Test Learning Outcomes

Student Group	Average Score Before Using Module	After Using
Group 1	67	82,67
Group 2	77,43	87,14
Group 3	67	84,83

DISCUSSION

Based on the assessment given by students during the pilot test it shows that students are still too fixated on the learning they have been doing when they are used to a competitive learning process. This is because they are not used to structured learning using a learning module with Project-Based Learning content in which there are exercises and group projects. Therefore, the application of the module in the classroom must always get direction so that students can accept and interpret the learning process carried out. In addition, improvements in the use of module editorials and briefings on the technical implementation of learning activities in the module itself in the learning process will continue to be adjusted so that a better teaching module is obtained.

Looking at students' responses and opinions on the learning module of Multimedia and Animation Technology with Project Based Learning, it can be seen that students are

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very interested in using this module in learning. This shows that students need this research and development module to meet their learning needs. This research can describe the learning outcomes of students who can pass the minimum completeness criteria value in the Informatics Engineering Study Programme at Asahan University, which is 75%, and also shows that the module can be used in learning. In addition, it can be seen that student learning outcomes after using modules tend to be higher than previous scores on the same activities and learning.

The making of teaching modules for Multimedia and Animation Technology courses using the Project-Based Learning (PjBL) model aims to make the learning stages in the module structured and directed. Following the stages of the research design used by Dick and Carey, the first stage is to determine the course that is the object of development, namely the Multimedia and Animation Technology course. The second stage is the analysis stage of the content of the needs, to analyse everything needed in the development, namely: (a) course objectives and course characteristics, (b) learning resources, and (c) student characteristics. The third stage is the process stage of developing the draft, including the preparation of the draft module and module design; at this stage, the Competency Standards, Basic Competencies, and Learning Indicators will be developed in the draft module. Module preparation activities include collecting materials, typing teaching materials, and compiling materials according to the expected competencies.

This teaching module prioritises group activities rather than individual activities. This is so that the learning provided provides opportunities for students to get used to thinking creatively and imaginatively, collaborate, communicate, solve problems and think critically, with consideration of many sources to be able to produce creative new work, and students will have the skills to work in a team which is the best provision for them when entering the world of work which prioritises teamwork to achieve goals.

However, there are previous research findings (Mita Gustamiyosi, 2015) that developed Project-Based Learning by prioritising individual activities because many students are less active in learning because there are no activities to explore and construct their knowledge. Also, usually, the end-of-semester exam is done independently, not in groups.

The difference between this research and the previous research is not fundamental because it is still developed as a project-based learning model that aims to improve student competence but is adjusted to the situation and conditions where the research is conducted.

CONCLUSIONS

Through the implementation of this research and development, a series of design and development processes can be carried out so that a printed module for *learning* Multimedia and Animation Technology with a Project-Based Learning model is produced. The module material contains 19 Learning Activities in the courses in the Merdeka Campus curriculum, which are condensed and arranged in such a way as to become 6 Learning Activities and contain learning activities in the Project-Based Learning model. Students of the Informatics Engineering Study Programme, semester 6A, can use this module. Based on the results of the teaching module trial, it is feasible and can be used to support the course of lecture activities for 1 semester as evidenced by the trial results obtained in this study, namely: (1)

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through the media expert validation stage obtained a percentage of 95.14%; (2) material experts obtained a percentage of 97.14%; (3) individual trials with a percentage of 94.17%; (4) small group trials with a percentage of 85.18%; and (5) usage trials reached a percentage of 87.45%. In addition, the module that has been feasible to use in learning is evidenced by the high average student learning outcomes where in this study, it is known that student learning outcomes in each group can reach 82, 67 for group 1, 87.14 for group 2, and 84, 83 for group 3. Therefore, it can be concluded that the development of modules with Project-Based Learning model content is possible, and the use of 2D animation print modules with *project-based* learning content in 2D animation *learning* can help students achieve learning objectives and competency achievements well.

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* Corresponding author