

# Development of Engineering Mechanics Module as Student's Learning Material in Google Classroom

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**Abstract :** In the Mechanical Engineering subject the teacher has compiled a module but the module has not been developed properly, the content of the module only contains a collection of learning materials that do not meet the basic competency standards that must be mastered by students in the syllabus. Weaknesses in the previous module were not equipped with instructions for using the module, learning evaluation, answer keys and bibliography which were made in a systematic and structured manner as the module should be. So that if the engineering mechanics module has been developed, it can be used as a good teaching material used by students both during face-to-face and online learning. Especially for online learning, modules that have been developed are needed to be used as teaching materials for students in Google Classroom so that students can access them at any time and learn independently. The module development research procedure uses a modified 4-D models development model. The development model consists of four stages, namely Define (defining), Design (design), Develop (development) and Disseminate (dissemination) but at the disseminate stage (dissemination) is carried out in a limited way, namely only to class X students, Department of Design, Modeling and Building Information at SMK N 1 Padang which is the subject of product trials. The results obtained from this development research are as follows: (1) Engineering Mechanics learning module, (2) The validity of the learning module is declared valid on the content aspect with a value of  $0.93 > 0.67$ , the format aspect is obtained a value of  $0.85 > 0.67$ , (3) The practicality of the learning module, based on the teacher's response, was stated to be very practical with an average value of 92.30 and based on 36 student responses stated to be practical, an average value of 76.50 was obtained, (4) The engineering mechanics learning module, was declared effective. improving aspects of student knowledge can be seen from improving student learning outcomes and effectively improving aspects of student skills seen from the results of the resulting picture assignments. Based on the results of this study, it can be concluded that the Engineering Mechanics learning module has been valid, practical and effective as a learning resource in Engineering Mechanics subjects..

**Keywords :** Learning Module, R&D, Mechanical Engineering

## INTRODUCTION

Vocational education (SMK) has an important role in preparing and equipping students with competence, science and technology as well as vocational skills in the profession according to the needs of the community. Therefore, each educational unit must have complete facilities and infrastructure such as buildings, furniture, educational equipment, educational media, books and other learning resources that support an orderly and continuous learning process<sup>1</sup>.

SMK Negeri 1 Padang is one of the schools in the city of Padang that produces skilled graduates to go directly to work in accordance with the majors they have. SMK Negeri 1 Padang has a vision to produce graduates who are smart, competitive, and have noble character. With this vision, the graduates produced are expected to be able to meet the challenges of competition in the world of work and industry.

Each department must be able to develop students' skills in order to produce competent graduates. All aspects must be taken seriously to make it happen, one of which is that the subjects taught must be in accordance with the curriculum and industry needs. The Department of Modeling and Building Information Design (DPIB) aims to prepare students to<sup>2</sup>:

1. Able to master the science of Engineering Drawing
2. Able to master the knowledge of Mechanical Engineering
3. Able to master the basics of building construction and land surveying techniques
4. Able to master the knowledge of Software Applications and Building Interior Design
5. Able to master the science of Road and Bridge Construction
6. Able to master the science of Construction Cost Estimation
7. Able to master the science of Construction Utility Buildings
8. Able to master the science of Creative Products and Entrepreneurship.

Results of analysis and interviews conducted at SMK Negeri 1 Padang, majoring in Modeling Design and Building Information (DPIB) class X in the Engineering Mechanics subject, obtained information about data on student semester exam scores of more than 50% have not reached the Minimum Completeness Criteria (KKM). With the results of the semester exam students below the KKM more than 50%, it means that the learning objectives in the Mechanical Engineering subject have not been achieved optimally. Data on student scores in the first and second semester examinations of Mechanical Mechanics Subjects for the 2020/2021 Academic Year.

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<sup>1</sup> Dede Rusmana, "PENGARUH KETERAMPILAN DIGITAL ABAD 21 PADA PENDIDIKAN KEWIRAUSAHAAN UNTUK MENINGKATKAN KOMPETENSI KEWIRAUSAHAAN PESERTA DIDIK SMK," *JURNAL EKONOMI PENDIDIKAN DAN KEWIRAUSAHAAN* (2020).

<sup>2</sup> Niam Wahzudik, "Kendala Dan Rekomendasi Perbaikan Pengembangan Kurikulum Di Sekolah Menengah Kejuruan," *Indonesian Journal of Curriculum and Educational Technology Studies* (2018); Gita Mahardika Pamuji and Asep Herry Hernawan, "Analisis Kebutuhan Pengembangan Kurikulum Pelatihan Kompetensi MICE Bagi Guru SMK Usaha Perjalanan Wisata," *Jurnal Penelitian Ilmu Pendidikan* (2019).

At this time at SMKN 1 Padang due to the pandemic, the learning system is implemented in 2 ways, the first is face-to-face (Offline) and the second is online (on the network) which is connected through the Google Classroom application. In the face-to-face learning process in Mechanical Engineering subjects, teachers generally use a teaching method, namely Teacher Centered Learning, where learning is still teacher-centered. The teacher provides learning materials and then students pay attention, listen and take notes on the material from the blackboard the material explained by the teacher. Student activity becomes hampered because students only learn to take notes on the lessons taught by the teacher, so they are not trained to think creatively.

Other factors identified that caused the lack of achievement of the learning process for Mechanical Engineering material were the inappropriate schedule of the material provided by the teacher and the amount of time wasted because what should have been included in the advanced material but the teacher repeated the teaching material at the previous meeting.

Researchers see that teachers in teaching mechanics subjects generally use teaching materials such as guidebooks or material summaries that are distributed to students during learning<sup>3</sup>. Actually, the guidebook functions to train students' independence to actively think critically during the teaching and learning process. Students will be ready to receive the subject matter because they have studied first using a guide book. However, there are some students who are given a guide book, they are lazy to read the book because the contents of the book are too theoretical and dense. So that students do not understand the subject matter they are studying, especially the subject of engineering mechanics.

Less practical teaching materials and students' laziness to read are the causes of students being less active in critical thinking. With these problems, a treatment is needed to overcome these learning difficulties by selecting appropriate and effective teaching materials, one of which is by using learning modules. The Ministry of National Education<sup>4</sup> states that a module is a set of independent teaching materials that are presented systematically. According to Prastowo<sup>5</sup> explaining a good learning module is that it can function as teaching materials for independent learning without depending on the presence of teachers or

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<sup>3</sup> Purwosiwi Pandansari and Abdul Gafur, "PENGEMBANGAN MULTIMEDIA INTERAKTIF UNTUK PEMBELAJARAN DESAIN BUSANA DI SMK," *Jurnal Inovasi Teknologi Pendidikan* (2016); Ajeng Maulina, "Pembelajaran Desain Grafis Pada Mata Pelajaran Multimedia Di Smk Negeri 02 Adiwerna Tegal," *Eduarts: Journal of Visual Arts* (2014); "Pengembangan Media Edukatif Berbasis Augmented Reality Untuk Desain Interior Dan Eksterior," *Innovative Journal of Curriculum and Educational Technology* (2017).

<sup>4</sup> R I Undang-Undang, "Nomor 20 Tahun 2003 Tentang Sisdiknas Dan Peraturan Pemerintah RI Nomor 47 Tahun 2008 Tentang Wajib Belajar," *Bandung: Citra Umbara* (2008).

<sup>5</sup> Uzlifatul Jannah, Sri Handono Budi Prastowo, and Subiki, "Analisis Keterampilan Proses Sains Terintegrasi Dalam Pembelajaran Fisika Pada Siswa SMK Negeri 5 Jember Kelas X Materi Suhu Dan Kalor," *Jurnal Pembelajaran Fisika* (2018).

educators. Meanwhile, according to Anwar <sup>6</sup>, learning modules must be arranged systematically and attractively including material content, methods, and evaluations and these compiled modules will be used as teaching materials in online learning so that students can use them independently to achieve the expected competencies.

In the Mechanical Engineering subject the teacher has compiled a module but the module has not been developed properly, the content of the module only contains a collection of learning materials that do not meet the basic competency standards that must be mastered by students in the syllabus. Weaknesses in the previous module were not equipped with instructions for using the module, learning evaluation, answer keys and bibliography which were made in a systematic and structured manner as the module should be. So that if the engineering mechanics module has been developed, it can be used as a good teaching material used by students both during face-to-face and online learning. Especially for online learning, modules that have been developed are needed to be used as teaching materials for students in Google Classroom so that they can access at any time and learn independently.

According to Purwanto (1986:106) states that the high or low value of learning outcomes achieved by students can come from "inside (internal factors) and from outside students (external factors)". Internal factors include maturity, intelligence, motivation, interests, and personal factors. External factors include social environmental factors and tools used in the learning process . The learning module is one of the external factors, in the form of tools or media that can affect the high and low value of student learning outcomes..

## METHODS

### A. Development style

The method used in this study using research and development methods ( *research and development* ) . According to Sukmadinata <sup>7</sup> research and development ( *Research and Development* ) is a process or steps to develop a new product or improve existing products, which can be accounted for. Sugiyono <sup>8</sup> states that *Research and Development* research which is usually abbreviated as *R&D* is included in the category of *need to do* research, namely research whose results are used to assist the implementation of work, so that the work is assisted by products produced from *R&D*, it will be more productive, effective and efficient. In this study, the resulting product was a learning module in the Mechanical Mechanics subject in class X of the Department of Modeling Design and Building Information at SMK N 1 Padang resulting from the development of existing modules .

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<sup>6</sup> Rengga Nofrianti and Muhammad Anwar Anwar, "PENGEMBANGAN MODUL BAGI SISWA TEKNIK KOMPUTER JARINGAN PADA MATA PELAJARAN PEMROGRAMAN DASAR," *Voteteknika (Vocational Teknik Elektronika dan Informatika)* (2019).

<sup>7</sup> Nana Syaodih Sukmadinata, *Metode Penelitian Pendidikan* (Program Pascasarjana Universitas Pendidikan Indonesia dengan PT Remaja Rosdakarya, 2005).

<sup>8</sup> Sugiyono, *Metode Penelitian Pendidikan* (Bandung: ALFABETA, 2016).

### Development Procedure

The module development research procedure uses a modified *4-D models* development model. The development model consists of four stages, namely *Define* (defining), *Design* (design), *Develop* (development) and *Disseminate* (dissemination) but in the *disseminate* stage (dissemination) is carried out in a limited manner, namely only to class X students, Department of Modeling and Building Information Design at SMK N 1 Padang which is the subject of product trials.

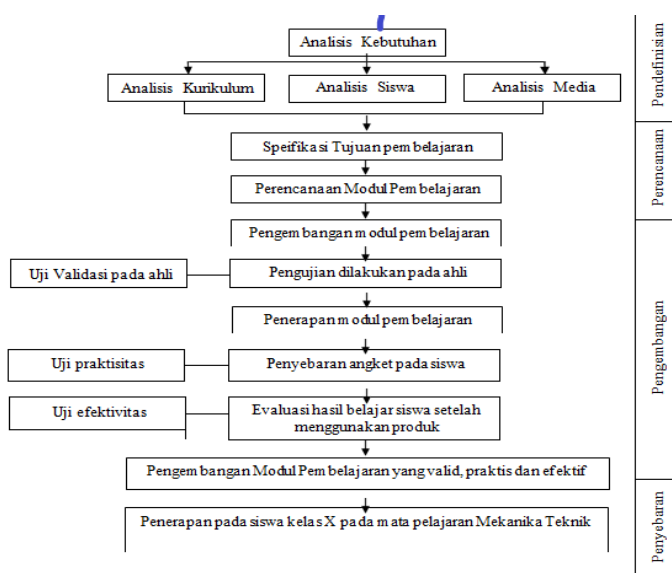


Figure 1. The 4-D Module Development Procedure Source: Trianto (2012:94)

#### 1. Defining Phase (*Define*)

At this definition stage, it aims to see and determine the basic problems faced in the learning process so that a development of teaching materials is needed. This stage is a needs analysis where an analysis of the learning conditions that occurred before the development was carried out so as to obtain solutions and the selection of the development of teaching materials that were in accordance with the needs in the learning process. With this analysis can determine and define the conditions needed in learning.

#### 2. Design Phase (*Design*)

The learning module that will be developed is carried out in class X in the subject of Engineering Mechanics, Department of Modeling Design and Building Information at SMK N 1 Padang. Design (*design*) this module develop existing modules by redesigning modules. The module design phase begins with compiling the components of the module framework based on basic competencies, indicators, learning materials and formative tests that exist in each learning material.

### 3. Development Stage (*Develop*)

At the development stage, there will be 3 actions, namely, the validation stage, the practicality and the effectiveness of the module.

#### a. Validity Test

Data can be said to be valid if it corresponds to the actual situation. The validity process consists of content validation and validation of the format of the Engineering Mechanics learning module. The validity process is accompanied by the provision of questionnaires and direct discussions with experts/experts and supervisors regarding improvements that must be made to design learning modules. Then the design is assessed by validators who have understood the principles of developing learning modules.

#### b. Practical Test

Practicality relates to the use of the Mechanical Engineering learning module in class X by teachers and students in class. A module can be said to have practicality if it is practical, easy to understand and easy to use. At the data collection stage, it was carried out with practicality questionnaires by teachers and students. Before giving a questionnaire regarding teacher and student responses, validation of the contents of the teacher and student response questionnaire instrument was carried out to 2 validators consisting of postgraduate lecturers from the Faculty of Engineering, UNP. Aspects assessed regarding the practicality of the contents of the teacher and student response instruments are aspects of content quality, content aspects, and language.

#### c. Effectiveness Test

The effectiveness test was conducted to determine whether the Mechanical Engineering learning module which was carried out in class X at SMK Negeri 1 Padang was effective in increasing student activity and learning outcomes. The effectiveness analysis was determined by looking at the comparison of the increase in student learning outcomes from the two groups, namely the experimental group and the control group. If in the experimental group there is an increase in student learning outcomes that is higher than the increase in student learning outcomes in the control group, it can be said to be effective.

#### d. Stage of Dissemination (*Disseminate*)

The function of the dissemination (*Disseminate*) of this module is to get input, criticism and suggestions for the development of the module to be better. The dissemination stage can be done by distributing the developed learning modules, dissemination (*Disseminate*) can be done in other classes with the aim of knowing the effectiveness in the learning process by using learning modules.

## RESULT AND DISCUSSION

### *A. Class X Engineering Mechanics Learning Module*

The advantage of the Engineering Mechanics subject module that was developed is that it is easily accessible independently in the form of files, besides that it can guide students to make mechanics assignments. The development of the Engineering Mechanics subject module is carried out by looking at the development of previous research modules. The development of this module is intended to be able to support efforts to fulfill learning resources for students so that it will improve the quality of learning for students.

### *B. Validity of Class X Engineering Mechanics Module Learning Module*

The Mechanical Mechanics subject module developed has fulfilled the Material Content aspect with Aiken's V value of 0.93 in the valid category. The format aspect of the Mechanical Mechanics subject module is Valid with Aiken's V value of 0.85. When these two aspects are added together, the score for the validity of all aspects is obtained by an average of 0.89, this value is in the valid category. Content validation is a requirement related to the process of finding the correct concepts and in accordance with the applicable curriculum. Valid validation results for content validation indicate that the Engineering Mechanics subject module developed is in accordance with the current curriculum. In the aspect of the module format, the validation value of the validator also obtained a valid value of 0.85 which is categorized as valid. The validity of the module format is the conformity of the module components with the elements that have been determined. Based on the validity of the value obtained from the validator it can be concluded that the module that was developed has been in accordance with the terms module to be used as a resource.

### *C. Practicality of Learning Module for Class X Engineering Mechanics Module*

The results of the practicality test of the module by the teacher obtained an average percentage of 92.30 in the very practical category. These results indicate that the Learning Module The developed module makes it easier for teachers to help students learn independently and helps teachers provide concepts for learning materials to students. Practicality of the Learning Module The Mechanical Mechanics Module is based on student responses with an average score of 76.50 in the practical category. The results of this practicality test show that the module developed can make it easier for students to understand the material. Susilana and Riyana, (2008:03) revealed that "The good or bad of a learning is supported by learning media users". So it can be concluded that the Mechanical Engineering Learning Module is able to help teachers convey material concepts as effectively as possible and help students understand the material independently.

### *D. The Effectiveness of the Mechanical Engineering Subject Module*

The technique is carried out by conducting a *pretest* and *posttest* which is given to 2 different classes consisting of the control class, namely the class that does not receive the treatment of the Engineering Mechanics Module Learning Module with the experimental class, namely the class that can be treated in the form of the Engineering Mechanics Module Learning Module. The results of this test were then compared with the recap of students' scores between the control class and the experimental class.

To test the difference in the significance of the learning outcomes of the control class and the experimental class using the *Gain score* test . Based on these data, obtained by the value of the gain score of 0.5175 on the class experimental means to increase the results of classroom learning experiments classified was because  $0.7 > g \geq 0.3$ . In the control class , the gain was 0.254, meaning that the control class also experienced an increase in learning outcomes, but the increase was in the low category because  $G < 0.29$ .

The results of the analysis test show that the use of the Mechanical Engineering Learning Module Learning Module is very good for improving student learning outcomes in Engineering Mechanics subjects compared to student learning outcomes that do not use the Engineering Mechanics Module. So, it can be concluded that learning using the Mechanical Engineering Module can be said to be effective in improving student learning outcomes.

In addition to being effective in improving student learning outcomes, the Mechanics Engineering Learning Module is also effective in improving student skills. From the results of the drawing assignments that have been generated by students. This proves that the use of the Mechanical Engineering Module assistance can help students improve their *soft* skills (skills) in applying the learning concepts they understand.

## DISCUSSION

The results of this development research have proven that the Engineering Mechanics module is valid, practical and effective so that the developed module teaching materials can be used for students and teachers in understanding engineering mechanics lessons both at home and at school. Modules can also increase knowledge and skills in order to improve the quality of Engineering Mechanics learning .

The validity of the results of this research and development is that the Mechanical Engineering module has met the requirements of a good module and is suitable for use. The module can be used in the learning process of engineering mechanics in other schools .

The practicality of the results of this research and development is the practical Engineering Mechanics module to be used by teachers and students in learning Engineering Mechanics. The use of the Mechanical Engineering module directs students to be able to learn independently so that they can streamline study time.

The effectiveness of the results of this research and development is that the use of the developed module makes it easier for students to understand the material, so that student learning outcomes in terms of knowledge and skills increase. Significant learning outcomes between the control and experimental classes can indicate that the students ' use of the new module has different results and has positive developments.

## CONCLUSION

Based on the results of research on the development of learning modules that have been carried out, the following conclusions are obtained:

The development research resulted in a valid, practical and effective Engineering Mechanics Module at SMKN 1 Padang with the Four D development model .

The results of the research on the development of the Mechanical Mechanics Module revealed that the results of the validity test of the developed module had fulfilled the



content aspect with an average of 0.87 categorized as valid, and the format aspect obtained with an average of 0.83 categorized as valid. The conclusion obtained is that the Mechanical Engineering Module developed is valid to be used as a learning module in the learning process .

The results of the research on the development of the Mechanical Mechanics Module reveal the results of the practicality test. The module developed has met practicality. It can be seen from the results of the teacher's response that 92.30% was obtained in the very practical category and the student response results obtained an average of 76.50% in the practical category. The conclusion obtained is that the module is practical, easy to understand and easy to use.

The results of the research on the development of the Mechanical Mechanics Module revealed the results of the effectiveness of the developed module as seen from the learning outcomes of students who took the pretest before using the module and the posttest after using the module showed that there was an increase in learning outcomes in terms of knowledge and skills.

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