

The Development of Innovative Learning Resources with Multimedia to Support Online Learning in Teaching Industrial Management

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ABSTRACT

An online learning is the strategy of choice during the Covid-19 pandemic to break the transmission of the virus. This study aims to develop an innovative learning resource to support online learning to improve student competence in teaching of Automotive Industrial Management. The research was conducted through the analysis of learning resource, developing of an innovative multimedia-based learning resource packages, standardization, and implementation of learning to improve student competence. The results indicate that an innovative learning package based on multimedia technology has successfully been developed and used in the teaching of automotive industrial management according to the KKNI curriculum. The learning resource package contains complete teaching materials and multimedia, attractively designed, integrated with sample assignments, easy to learn and can facilitate students learning industrial management. The implementation of innovative learning packages has succeeded in facilitating online learning for students in achieving their competencies in the field of automotive industrial management. Student achievements obtained from the portfolio of assignments and scores on the learning evaluation are all high. Students enjoy online learning by using innovative learning resources in a situation during the Covid-19 pandemic. This learning strategy can also be applied to other teaching in mechanical engineering education.

Keywords: Innovative Learning Resources, Multimedia, Industrial Management.

1. INTRODUCTION

The global outbreak of the corona virus (Covid-19) has affected the learning system in Indonesia, including at Universitas Negeri Medan. Lectures must be conducted online to break the chain of virus transmission [1,2]. Lectures must be systematically designed to achieve the targeted competencies even though students study online from home. One of the subjects taught to undergraduate students is industrial management. The Automotive Industrial Management course is very important for students in the Mechanical Engineering department because through this course students will gain experience in the field of industrial management, which is one of the competencies that a mechanical engineering graduate must possess [3,4]. Industrial management is the ability of management in the development of the automotive industry by following management principles such as planning, organizing, actuating and controlling (POAC).

The problem faced by students is that it is difficult to study Automotive Industrial Management because of limitations in good and complete learning resources according to the college curriculum [5]. The various learning resources available in the form of textbooks are generally still generic, applicable to all fields of science, and are not yet in accordance with the needs of certain university students such as automotive engineering. Students need management examples that focus on the needs of automotive engineering to improve knowledge and skills in automotive industrial management. The most difficult factor and has influenced the order in learning is the spread of disease outbreaks caused by the spread of the corona virus (Covid-19) which is very dangerous to health, a situation that forces students to study from home online in an effort to break the transmission of the virus [6]. The facts mentioned above are obstacles that make it difficult for students to study

automotive industrial management. As a lecturer in industrial management courses, it is necessary to conduct research to make online lectures effective in increasing student competence in the field of industrial management. The tendency of students who are relatively using the latest information technology becomes an opportunity in learning and can be used for adaptation to online lectures. Thus, it is necessary to improve learning through the use of innovative learning resources to facilitate active learning for students in achieving their competencies [7-9].

Learning strategies to teach industrial management have been carried out with the aim of providing knowledge and skills in the field of industrial management, thus management theory can be applied in practice [10]. Learning innovation in the field of management is very relevant to do in order to create a conducive and interesting learning atmosphere, making learning more fun for students, thus the impression of learning will be remembered longer by students [11-13]. The provision of innovative learning resources in teaching has been proven to improve learning outcomes [14,15], and this strategy is considered relevant to be implemented in industrial management teaching with the main target of facilitating students to learn actively in achieving their competencies in the automotive industrial management field [16]. It is believed that innovative learning resources can be implemented to support online learning carried out during the Covid-19 pandemic for teaching Automotive Industrial Management. Through the provision of innovative learning resources, students can learn optimally, and knowledge in the field of management is obtained to be used as capital in developing their careers through building adequate knowledge in organizational systems. Thus, students have management experience as production supervisors, operations analysts, strategic resource analysts, business analysts, and so on [17,18]. His knowledge and skills in industrial management enrich students' repertoire to face the world of work. The purpose of this research is to develop innovative learning resources to support online learning in an effort to improve student competence. Learning resources are systematically arranged, integrated with multimedia and assignments according to the characteristics of the university curriculum, and become the main reference in online learning during the Covid-19 pandemic to increase competence in the field of industrial management.

2. METHOD

2.1. Research Method

The research development design in this study follows the ADDIE (Analysis-Design-Development-Implementation-Evaluation) model. The research step was carried out through an analysis of learning resource

needs for the automotive engineering education undergraduate program according to the curriculum oriented to the Indonesian National Qualifications Framework (Kerangka Kualifikasi Nasional Indonesia, KKNI) [19]. The development and packaging of innovative learning resources is carried out based on multimedia that is adaptive to online learning. Learning resources resulting from development are then standardized using experts to assess the feasibility of learning resources following the criteria for teaching materials set by the National Education Standards Agency (Badan Standar Nasional Pendidikan, BSNP). The final stage of the research is to implement learning to improve student competence in the field of automotive industrial management.

2.2. Population and Samples

The population in this study were all students of the Automotive Engineering Education Study Program, Faculty of Engineering, Universitas Negeri Medan (Unimed). The sample used includes 64 students who are enrolled in the Automotive Industrial Management course for the 2020-2021 academic year. The research protocol following the code of ethics for research in the field of social science (Education) that applies at the Universitas Negeri Medan has been carried out in the implementation of this research. Student consent to participate in research activities is carried out first, and students are given the freedom to withdraw from research activities at any time if deemed necessary.

2.3. Research Procedures

Analysis of learning resource needs has been carried out for the needs of undergraduate education programs according to the KKNI curriculum, followed by standardization, and implementation of learning resources for teaching Automotive Industrial Management. The Automotive Industrial Management textbook available online is used as the basis for compiling the teaching materials in this study. The draft learning resources are then packaged in hard copy and soft copy to be continued at the standardization stage. The learning resources developed were further standardized using experts following the criteria of the National Education Standards Agency (BSNP) following the previous research procedures [20]. Innovative learning resources that are standard and complete are well packaged according to the needs of students in online learning. Lectures are conducted online using the University Networked Learning System (Sistem Pembelajaran Dalam Jaringan Universitas, SIPDA) and via google meet and google classroom to provide information and stages of lecture implementation. The technique of collecting assignments, administering exams, and scoring rubrics is explained in SIPDA.

Student mastery of the Automotive Industrial Management material is measured through online evaluation of learning outcomes.

Innovative learning resources resulting from development are then implemented for the teaching of Automotive Industrial Management through online learning to improve student competence in the field of industrial management. The initial ability of students in the material to be taught is considered low because they have never studied industrial management before, and this is the reason that in this study there was no pretest. The SIPDA facilities provided by the university are used to upload learning resource packages, deliver announcements, conduct online lectures, assign assignments, collect assignments, and carry out formative exams. Lectures are conducted online using SIPDA, and for variations in lecture delivery to avoid the boredom of students studying online, online teaching using Google Meet and Google Classroom is also carried out alternately as needed. The facilities available at SIPDA are used for teaching and learning activities such as displaying learning materials, discussing, asking for teaching assistance, collecting assignments, assessment results and comments. Announcements such as the deadline for submitting assignments, and an assignment assessment rubric are also provided at SIPDA. Evaluation of final learning outcomes is carried out at the end of learning through SIPDA. Student responses to the implementation of online lectures were also collected using a questionnaire, with the aim of providing feedback and improving learning resources that will be used in the next online lecture.

2.4. Data Analysis

In this study, the result data consisted of respondents' opinions, subjective assessments of assignments, and objective assessments of learning evaluations. A standard questionnaire was used to collect respondents' opinions on the feasibility of innovative learning resources, using a Likert scale with a scale of assessment criteria from the highest to the lowest, then used as a decision on the opinion of the respondents. Student assignments uploaded to SIPDA are assessed subjectively using the assignment assessment rubric, and scores are converted to scores on a scale of 0-100. Evaluation of learning outcomes is assessed objectively based on the ability of students to answer questions, then the score is converted to a value on a scale of 0-100.

3. RESULT AND DISCUSSION

3.1. Innovative Learning Resources with Multimedia

Innovative learning resource packages with multimedia for Automotive Industrial Management teaching have been developed according to student needs for online learning during the Covid-19 pandemic. Learning resources have been packaged in such a complete manner according to the KKNI curriculum, are interesting, informative, adaptive to online teaching, and are available to students at SIPDA. Learning resources have been designed to help students learn actively, as a supplement to online lectures. Descriptions of learning resources for teaching Automotive Industrial Management along with their completeness are summarized in Table 1.

Table 1. Innovative learning resources with assignments equipped with multimedia tools for teaching Automotive Industrial Management.

No	Sub Topic	Description of Innovation on Learning Resources	Supplements
1	Introduction to Management	Teaching materials on Introduction to Industrial Management are prepared in accordance with the IQF curriculum for undergraduate students of mechanical engineering education, equipped with media in the form of PowerPoint	e-book, articles from journals
2	Organizational Fundamentals	Teaching materials on Organizational Fundamentals are prepared in full with an emphasis on organization in terms of industrial management for mechanical engineering graduates, equipped with media in the form of PowerPoint	e-book, articles from journals
3	Industrial Management and Introduction to Automotive Industrial Management	Teaching materials on Industrial Management and Introduction to Automotive Industrial Management are arranged systematically and completely, in depth, equipped with hyperlinks to electronic books and articles from reputable journals, multimedia, relevant videos adopted from YouTube, and equipped with assignments that will be carried out by students	e-book, articles from journals, multimedia, video, and tasks
4	Production Planning and Control	Preparation and packaging of teaching materials on the subject of Production Planning and Control to make it easier for students to learn topics in accordance with competency targets. This learning resource is equipped with PowerPoint learning media	e-book, articles from journals, multimedia, video, and tasks

5	Location Strategy and Layout Strategy	Learning resources in the form of special topics are systematically made to provide reinforcement in the Location Strategy and Layout Strategy, equipped with examples of assignments, journal hyperlinks, multimedia, and assignments	e-book, articles from journals, multimedia, video, and tasks
6	Product and Service Design	Learning resources to learn Product and Service Design are arranged systematically, equipped with examples of assignments, materials for discussion, and PowerPoint media	e-book, articles from journals, Live chat, multimedia, and tasks
7	Machine maintenance	Machine Maintenance teaching is packaged as an interactive learning resource in the form of machine maintenance demonstrations that can help students maintain machines. Learning materials are equipped with multimedia and assignments	e-book, articles from journals, multimedia, video, and tasks
8	Human Resources and Work Design	Teaching materials are well packaged, equipped with examples of assignments to make it easier to study Human Resources and Work Design. Teaching materials are equipped with multimedia facilities and project assignment templates	e-book, articles from journals, multimedia, video, and tasks

The learning package has been equipped with examples of correct task execution and task templates with the aim of training students to work independently in studying industrial management. Students can work on their own projects (assignments) correctly after seeing examples of project assignments that are already available.

Assignments are designed to implement the theory that has been learned, lived and remembered for a long time. Students have succeeded in choosing and doing assignments well in accordance with the current conditions experienced directly in the field. Brief descriptions of the tasks are summarized in Table 2.

Table 2. Examples of assignment packages and assignments for teaching Automotive Industrial Management.

No	Title of task	Brief description of the purpose of the assignment
1	Task 1: Type of production process	Students can analyze and identify the types of production processes and types of production flows, know the advantages and disadvantages of certain types of production processes, and know the factors that influence decision making in management.
2	Task 2: Locational Cost Volume Profit Analysis	Students can calculate and determine the most profitable company location through a Locational Cost Volume Profit Analysis, knowing the types, characteristics, and uses of certain material handling used in the production process.
3	Task 3: Types of machine maintenance	Students can identify the type of machine maintenance according to the type of machine, based on its characteristics and objectives.
4	Task 4: Textbook analysis	Students can study, criticize, and compare the contents of the main book and comparison books, and identify parts of the book that can enrich knowledge in the field of industrial management.
5	Task 5: Scientific Journal Analysis	Students can study, criticize several scientific articles from reputable journals, and compare methods that can be used to solve problems related to industrial management.
6	Task 6: Special projects	Students can know the general description of the company (including small and medium enterprises), such as history, location, marketing area, and socio-economic impact on the environment, identify the organization and management of the company, identify and analyze technology (production processes, machinery and equipment, safety and occupational health, waste treatment, and machine maintenance), describe the layout of the company, identify the type of layout and the type of flow of the production process, and provide advice related to management aspects within a company.

3.2. Standardization of Innovative Learning Resources and Multimedia Packages

Innovative learning resources as a result of development have been equipped with comprehensive and in-depth teaching materials, management tasks, relevant multimedia, and tools. All of these learning

resource packages have been standardized using the learning resource eligibility criteria set by BSNP as summarized in Table 3. Expert respondents have given a good assessment of the learning resource packages ($M=3.50\pm0.52$). This package is believed to be suitable to support online learning for teaching automotive industrial management during the Covid-19 pandemic.

Table 3. Assessment of expert respondents on the feasibility of innovative learning resources and types of tasks integrated for teaching Automotive Industrial Management.

No	Description of the assessment of learning resource components	Respondents opinion ($M\pm SDv$, $n=5$) ^a
1	Content Components: In accordance with the IQF curriculum, the accuracy of the content of teaching materials with the desired competency targets in the teaching of automotive industrial management	3.60 ± 0.55
2	Extension section: Integration of sample assignments and templates, Automotive Industrial Management learning multimedia, and assignment assessment rubrics	3.40 ± 0.55
3	Appropriateness and depth: The suitability and depth of learning resources for undergraduate students of automotive engineering education, and the accuracy of hyperlinks of supporting learning resources (textbooks and scientific journals)	3.40 ± 0.55
4	Design Quality: Design from learning and multimedia resources, complete sample assignments, illustrations, visualization quality, narrative text, and voice clarity	3.80 ± 0.45
5	Language: Simplicity of presentation, easy to read and understand, good learning messages and long-lasting learning impressions	3.40 ± 0.55
Average		3.50 ± 0.52

^aAssessment criteria: (1) Poor, (2) Enough, (3) Good, (4) Very good.

3.3. Implementation of Innovative Learning Resources For Online Learning

Automotive Industrial Management teaching has been conducted online using innovative learning resources. These results believe that the innovative learning resources available at SIPDA have helped students learn to achieve their competencies. The results showed that students were very enthusiastic about using the learning resources provided at SIPDA. This learning resource package is effective in facilitating students to learn actively for the enrichment of knowledge from online learning. The availability of sample assignments in the learning resources makes it easier for students to complete the tasks given according to the topic being taught. The targeted competence in the field of industrial management has been achieved, which is indicated by the students' mastery in completing assignments and answering the evaluation of learning outcomes correctly. The value of the portfolio of assignments uploaded by students is summarized in Table 4. Students have been able to do all the assignments given well. The student achievements obtained from the assignment portfolio scores and scores on the learning evaluation were all

classified as good on all components, with an average of $M=76.14\pm16.99$. These results give confidence that the innovative learning resources available at SIPDA are very helpful for students in learning as well as completing the tasks that have been given to achieve their competencies.

As a result of implementing innovative learning resources for teaching industrial management, it can be seen from student learning outcomes in Table 5. These results prove that available innovative learning resources have been proven to be effective in facilitating active learning activities, strengthening online teaching, making lecture materials well understood, assignments can be made done properly. Students who have difficulty in learning are also facilitated by online discussions at SIPDA. Student learning outcomes based on assignments and learning evaluations were classified as good ($M=80.02\pm12.42$). Student competence in the field of industrial management and maintenance has been achieved. Students enjoy online learning by using innovative learning resources in a situation during the Covid-19 pandemic. This learning strategy is considered suitable for teaching Automotive Industrial Management.

Table 4. Student achievements based on the portfolio of assignment scores uploaded to SIPDA.

No	Tasks	Assessment components				Average
		Contents	Systematics	Discussion	Finding	
1	Task 1 Production process	70.19±22.66	71.37±15.11	70.45±19.95	71.05±20.85	70.77±19.64
2	Task 2 Locational Cost Volume Profit Analysis	72.74±17.86	70.21±18.33	71.53±20.11	70.43±22.67	71.23±19.74
3	Task 3 Machine maintenance	84.75±16.50	80.35±20.42	80.00±18.07	80.03±18.25	81.28±18.31
4	Task 4 Textbook analysis	80.21±9.14	80.03±15.33	80.55±8.71	80.20±11.29	80.25±11.12
5	Task 5 Analysis of journal articles	72.34±24.82	75.81±18.51	71.01±23.89	71.29±14.05	72.63±20.32
6	Task 6 Special projects	80.84±12.75	78.19±15.70	81.25±11.82	82.64±10.96	80.73±12.81
Average		76.85±17.29	75.99±17.23	75.80±17.09	75.94±16.35	76.14±16.99

Table 5. Student learning outcomes based on assignment scores and learning evaluation.

No	Assessment of learning outcomes	Student achievement (n=64)
1	Tasks ^b	76.14±16.90
2	Midtest	80.48±10.40
3	Posttest	83.43±9.87
Average		80.02±12.42

^bObtained from results in Table 4.

3.4. Discussion

The learning resource package has been prepared with an attractive appearance to support online learning. The learning resource package contains teaching materials complete with multimedia, attractive design, integrated with sample assignments, easy to learn, and facilitates students learning industrial management. Competence in industrial management is very much needed by automotive engineering students as a strategy to bridge knowledge with the world of work [21,22]. Learning during the corona virus outbreak is a big challenge for lecturers and students. Lecturers must make every effort so that learning is interesting which makes students learn optimally in achieving their competencies [23,24]. Developing innovative learning resources is the best choice because it can bridge the achievement of competencies desired by lecturers with the needs of students after completing their studies. The lessons designed in this study have proven to be effective in facilitating students to learn industrial management. The combination of teaching materials with multimedia available in the learning resources makes it easier for students to understand the concept of industrial management. Assignments that have been designed in

this lecture have enriched students with learning experiences, while increasing knowledge in the material being studied [25]. Examples of tasks that are integrated into learning resources have succeeded in making student learning activities more meaningful, motivating students to spend more time studying online [26,27].

The availability of the innovative learning resource package developed in this study has proven to be effective in facilitating students to study industrial management during the Covid-19 pandemic. Students are made to learn actively in doing their assignments well, as evidenced by the high value of assignments and evaluation of learning outcomes. The competencies required in this course are still achieved even though students do not attend lectures in class. Online learning in accordance with lecture recommendations during the Covid-19 pandemic is very appropriate for industrial management courses because through this learning all knowledge and skills can be fulfilled. All students managed to do the task well [28]. The innovative learning resources produced in this study are very suitable to be used for active learning, especially for online learning that is applied during the Covid-19 pandemic, so that the transmission of the corona virus can be contained without

losing the competency targets needed by students [29]. Development of innovative learning resources integrated with multimedia can be done for other courses in mechanical engineering.

4. CONCLUSION

Innovative learning resource packages with multimedia have been developed according to the IQF curriculum for teaching Automotive Industrial Management. Learning resources have been packaged attractively, equipped with multimedia, task templates, and supporting tools so that they are adaptive to support online learning in industrial management teaching. The facilities available in the learning resource package include complete teaching materials, interesting multimedia, and standard examples of assignments that can guide students in active learning to achieve competence in the field of industrial management. Student competence in the field of industrial management has been achieved as indicated by the portfolio of assignment scores and evaluation of learning outcomes that are classified as good. The design of innovative learning resources, the findings of this research can be used to improve student learning outcomes in other subjects during the Covid-19 Pandemic.

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