

DEVELOPMENT OF INTEGRATED CURRICULUM-BASED MATHEMATICS TEACHING MATERIALS TO EFFECTIVELY TEACH 21ST CENTURY CAPABILITIES

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Abstract

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The purpose of this research is to produce valid, effective, and practical textbooks. In the short term, it aims to produce valid and practical teaching materials for linear algebra courses. Validity based on the relevance of the expected competencies i.e. 21st century competencies. Practicality is measured by the use of teaching materials in classroom learning. This study used a development research design, followed by four steps: 1) initial research, 2) prototyping, 3) summative evaluation, 4) reflection and documentation. In our initial research, we analyzed the need for teaching materials for the Information Systems study program, the reason being that students really needed linear algebra teaching materials that had applied concepts that were described visually that were easy to understand by students. In the prototyping stage, we write teaching materials according to the needs analysis. The prototype was discussed with experts, revised after summative evaluation and implemented during lecture meetings. The result is the final product in the form of teaching materials used during reflection. Our systemic documentation was written according to the established research framework. Finally, a valid, practical linear algebra teaching material has been produced.

Keywords: development design, Mathematics Teaching Materials, effectively Teach 21st Century Capabilities

1. INTRODUCTION

There are 13 life skills that need to be mastered, namely: 1) life planning, 2) adaptability; 3) initiative and self-management, 4) entrepreneurship; 5) social and cultural interaction; 6) productivity and accountability; 7) leadership; 8) critical thinking; 9) problem solving; 10) communication; 11) collaboration and teamwork; 12) life learning; and digital literacy [1]. These skills must be mastered by students in order to undergo the industrial era 4.0. Therefore, institutions and teachers must have standards in making teaching materials [2], [3]. The curriculum that meets 21st century skills is an integrated curriculum known as an integrated curriculum.

Integrated curriculum is an integrated curriculum in which education is organized in such a way that it crosses subject boundaries, combines various aspects of the curriculum into meaningful associations, to be focused more broadly [4], [5]. This curriculum views learning and teaching holistically and reflects the real interactive world. In practice, according to Palmer, an integrated curriculum includes: 1) developing cross-curriculum sub-goals in the existing curriculum guide, 2) developing a learning model that includes cross-curriculum activities and assessments, 3) developing enrichment and increasing activities with a cross-curriculum focus that includes suggested cross-curriculum contacts in each objective, 4) developed cross-curriculum assessment activities, including sample planning in all curriculum guides. This means that the existing curriculum is developed, and one of the tasks of the teacher in this integrated curriculum is to develop teaching materials.

Developing linear algebra teaching materials in mathematics learning has the aim of making students absorb concepts and understand and solve linear algebra problems easily and 21st century abilities can be fulfilled as much as possible, which is a very important thing [5]. To achieve a higher level of 21st century skills as described above, lecturers must be able to develop teaching materials that will be presented to students with an integrated curriculum which is expected to meet the



demands of 21st century skills, one of which is by developing teaching materials according to visual concepts [5], [6]. things that are adapted to the environment and the needs of the 4.0 industrial era that is currently being carried out. The visual concept of linear algebra material is about finding the rank matrix.

Looking for a rank matrix on linear algebra material given to Informatics A Malam students at the Main Potential University which includes an indicator of 21st century ability is that problem solving has many problems , especially in online learning where lecturers cannot explain the problem solving process directly to students so that lecturers must can provide teaching materials that are developed and easily understood by students, where previously the lecturer only provided teaching materials in the form of files that were expected to be read by students, but after being given practice questions with the same concept as the teaching materials sent to e-learning, it turned out that students did not solve the problem. properly and correctly. This means that the response and motivation of students are not very good with the teaching materials that the lecturer provides. So it is very necessary to develop teaching materials that motivate students to solve these problems, meaning that students may not understand the steps for solving problems in the teaching materials. The steps for solving problems in the teaching materials that we design or develop should be visually understandable by students and can be used as student capital to solve the problems that the lecturer gives. The development of linear algebra teaching materials for the topic of finding rank matrices in this study is by providing learning videos on how to process the problem solving and commenting on the video directly via zoom meetings and observing student responses to the topics discussed so that learning via zoom becomes more interesting and students get motivated and invite them to ask questions they don't know . The linear algebra teaching materials that have not been developed and those that have been developed are as follows:

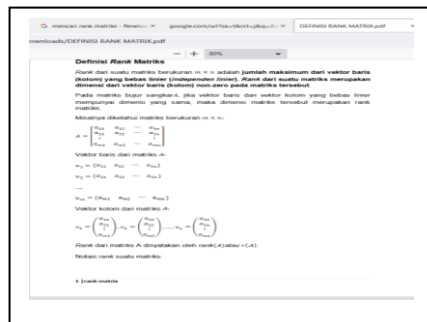


Figure 1 Undeveloped Teaching Materials (source:[7])

Based on Figure 1 above, it can be explained that by only providing teaching materials as above, students will never read them and solve problems such as the directions in the teaching materials. However, students will be more interested if we visually provide the teaching materials by providing direct tutorials such as videos that we show during online learning via zoom meetings while commenting on the videos presented. The tutorial is as presented in Figure 2 below,

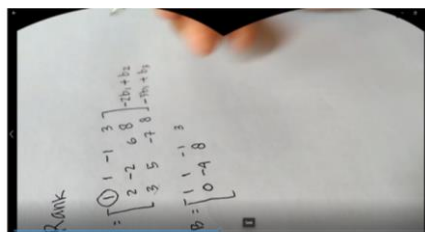
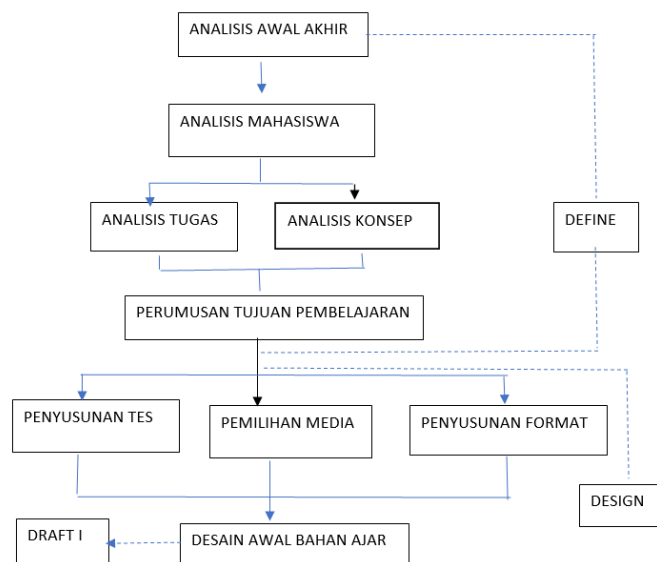


Figure 2 Teaching Materials that have been developed (source: research documentation)

Based on Figure 2 above, it can be explained that it is one example of teaching materials that have been developed. The teaching materials are made or packaged in video tutorials on how to find the rank matrix by giving examples and showing them at the zoom meeting. Based on observations and interviews of lecturers with students that students feel more understanding so that when they are given assignments they can complete them.

2. METHOD

This research is a development research that produces a product. The resulting product is the development of teaching materials for linear algebra students, the topic developed is an easy way to find Rank Matrix. This research was conducted at the Potential Utama university in Class IF A Evening. Learning is carried out using the Blended Learning method during the New Normal period [8]. This development research refers to the Thiagarajan 4-D model. According to [9], [10], [11] this development model consists of 4 stages of development, namely: the defining stage, the design stage, the development stage (develop), and the disseminate stage.



Modified Figure 3 Designe 4-D (source : [12])

Based on Figure 3, it can be explained which is a modified 4-D development design where in this journal it is only shown to be limited to designing teaching materials (Draft I) that meet 21st century ability indicators such as 13 life skills that need to be mastered, namely: 1) life planning, 2) adaptability; 3) initiative and self-management, 4) entrepreneurship; 5) social and cultural interaction; 6) productivity and accountability; 7) leadership; 8) critical thinking; 9) problem solving; 10) communication; 11) collaboration and teamwork; 12) life learning [13],[14], [15]. Initial evidence of the application of a lecturer in implementing an integrated curriculum is by developing teaching materials that are in accordance with the demands of the 21st century and young and efficient to be accepted and studied and easily implemented by supervisors or lecturers of courses, especially linear algebra courses, which in online learning It is very demanding of lecturers' skills in developing teaching materials that will be given so that they are easily understood by students because they are constrained during face-to-face meetings [5].

3. RESULTS AND DISCUSSION

Based on the things that have been described above, it can describe the results of a temporary trial or readability test of teaching materials that have been developed to meet an integrated curriculum and 21st century competence. After an evaluation by giving tests around the topic of

looking for a rank matrix where a video has previously been shown tutorial how to easily find the rank matrix then the student test results get as follows,

3.1 Student Test Completeness Data before and After being given a tutorial on how to easily find the rank matrix

Based on the results of the evaluation in the class before the reading test of teaching materials designed from 30 students of IF A Malam at the Utama Potential University, only 24% were completed (7.2 or 7 students) and 76% were incomplete (23 students). . The completeness data can be seen in Table 1 below

Table 1 Student Test Completeness Data

	Pre Test	Post Test
Finish	24	88
Not Finish	76	12

Based on Table 1 above, it can also be seen that the comparison of the percentage of students' completeness, which is 24% to 88%, means that more than 50% have completed. This means that classically there has been a significant change in student learning outcomes for the rank matrix topic in the Linear Algebra course. Of course, student test results will be better if each topic is given a working tutorial so that it is easy to understand and understand, meaning that the problem of learning mathematics online can be overcome even though it is not 100% successful. This depends on how the lecturer develops the material [16].

3.2. Student Motivation Data when listening to Video Tutorials during Zoom Meet.

Based on the results of observations and observations through zoom media based on the responses of students asking questions from Chat Whatsapp about the material presented with video tutorials, it can be seen in table 2 below,

Table 2 Student Motivation Data

	Pre Test	Post Test
Motivated	10	93
Not motivated	90	7

Based on Table 2 above, namely student motivation data based on their responses on WhatsApp or in the chat column at the time of zoom before learning via zoom with the usual teaching materials is 10% who are motivated and 90% are not motivated, a very large number, sometimes the lecturer repeats the question when the new zoom is responded by the student. However, after the video tutorial was shown, the students asked more questions. This shows that the response of students with integrated curriculum learning to improve 21st century skills has a very significant positive response [17], [18],

4. CONCLUSIONS

Based on the data described above and the discussion, it can be concluded from the development of an integrated curriculum to improve 21st century skills in the first stage or draft or the readability test of the teaching materials that have been developed as follows,

1. Teaching materials developed are efficient and effective,
2. The result of the readability test is very significant.
3. Motivation and Student Responses have a significant positive response.

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