

Development of Digital Hypercontent Teaching Material to Improve Students' Understanding of Pedagogical Concept

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Abstract. This study aims to develop teaching materials based on digital hyper-content to improve prospective teacher-student's understanding of pedagogic concepts. The type of research is Research and Development (R&D) with the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). The test subjects of this development product were 40 students who took the learning strategy course. The product feasibility test was obtained from teaching materials experts and content experts' validation. The results of this study indicate that the product, based on the validation of teaching materials experts, got a score of 87% and content experts a score of 84.5%; both are in the very feasible category. In addition to teaching materials and content experts, the teaching materials developed were tested on students getting a percentage of 85% with information on teaching materials that are easy to use, easy to understand, and engaging. Besides being easy and straightforward, teaching materials are also considered effective in increasing student understanding of pedagogic concepts.

Keywords: Teaching Material, Digital Hypercontent, Pedagogical Concept

1. Introduction

The development of technology is very rapid, having a significant influence on the world of education. The involvement of technology in education is an innovation that contributes greatly to the progress of the learning process. Through the facilities provided, making technology in learning is the right, effective and efficient solution in supporting education so that learning can be carried out independently, even without having to meet face to face.

Learning in higher education that emphasizes product or outcome-based learning processes, with the implementation of project-based learning models, is an effort to create graduates who can meet the needs of the industrial work through various competencies and skills implemented in the learning process. This is a demand for 21st-century skills, namely critical thinking, creative thinking, communication, and collaboration.

The learning process must be able to produce learning products or outcomes according to the achievement of course competencies. One of the ways to fulfill these competencies is by using teaching materials that stimulate critical thinking, creative thinking, communication, and student collaboration. The use of teaching materials in learning needs to be adapted to the characteristics of project-based learning models to support the realization of independent and collaborative learning with references from adequate and comprehensive teaching materials.

In this era, students in higher education are the digital generation, better known as digital natives, who are accustomed to and very familiar with using digital devices and spending more time with technology or digital devices they have. Learning can be effective if the teaching materials used can adapt to these conditions [1]. The teaching materials should be developed in a form that is easy, interactive, not boring, and rich in content. The attractive design of teaching materials will make it easier for students to understand the material and motivate them to learn so that learning objectives can be achieved [2].

However, so far, the teaching materials used by students, in general, are still in print or have been digital, but they have not been interesting and make students happy to use and read them. The teaching materials should allow students to understand the material quickly, appear more motivated to learn, and reflect well.

Likewise, in learning strategy courses, the available teaching materials are still conventional, with more texts that are less interesting and minimal use of examples or the application of learning strategies that can be done in class. This makes students' understanding of the concept of learning strategies imperfect due to the absence of additional, more concrete explanations of the material as a form of deepening the application of examples. There are also no instructions for implementing project assignments. Even though this is important considering that students are prospective teachers who need to know, compare, and apply appropriate learning strategies to their students in learning.

Therefore, using digital hyper-content teaching materials can positively impact the independent learning process and create open-minded students who are also currently carrying out blended learning. Hyper-content material will provide continued access to other website pages through Youtube video channels and other open resource pages (icons/tools, cloud computing, QR codes, or hypertext). So that students are not fixated only on the text in the book.

Hypercontent can be understood as a concept interweaving one material and another simultaneously in a particular digital technology program. The logic is not far from hypertext, i.e., one text contains many other connected texts. Its simple form is to display menus on website pages; if clicked, it will take the user (user) to one material and another. In other words, a text accommodates and connects with other texts [3].

On the other hand, developing digital hyper-content teaching materials in the project-based learning model can also support the implementation of the Outcome-Based Education (OBE) approach in universities because project-based learning makes a product of the output of the learning model. In addition, it is one of the strategic efforts to achieve the main performance indicators of higher education. This research aims to develop teaching materials for digital hyper-content learning strategies to improve students' understanding of pedagogic concepts.

Teaching materials are a set of learning materials arranged systematically, displaying a complete figure of competencies that will be mastered by students in learning activities [4]. Types of teaching materials include learning instructions (student/teacher instructions), competencies to be achieved, the content of learning materials, supporting information, exercises, work instructions, evaluations, and responses or feedback on evaluation results.

Some things that must be considered in making teaching materials that can motivate students to learn independently and obtain mastery in the learning process are:

1. Provide interesting examples to support the presentation of learning materials

2. Provide the possibility for students to provide feedback or measure their mastery of the material by providing practice questions, assignments, and the like
3. Contextual, namely, the material presented, is related to the atmosphere or context of the task and the environment of students.
4. The materials used are quite simple because students only deal with teaching materials when studying independently.

Teaching materials have several characteristics: self-instructional, self-contained, stand-alone, adaptive, and user-friendly [5]. First is independent learning, namely teaching materials that can make students able to learn themselves with the developed teaching materials. Teaching materials must have formulated goals, both final and intermediate goals. In addition, teaching materials make it easier for students to learn thoroughly by providing learning materials packaged in more specific units or activities. Second, independent, namely all learning materials from one competency unit or sub-competency studied in one complete learning material. So a material must contain all its parts in one book to make it easier for readers to study these materials.

Third, standard teaching materials developed do not depend on other teaching materials or do not have to be used with other teaching materials. This means that teaching material can be used alone without depending on other teaching materials. Fourth, adaptive learning materials have a high adaptive power to develop science and technology. Teaching materials must contain material that can add readers related to the times, specifically the development of science and technology.

The criteria for developing teaching materials are:

1. Teaching materials must be relevant to the learning objectives.
2. Teaching materials must be by the level of development of students.
3. Good teaching materials are useful for students both in developing their knowledge and the need for future assignments in the field.
4. The material must be interesting and stimulate student activity.
5. The material must be arranged systematically, gradually, and tiered manner.
6. Materials that are conveyed to students must be thorough, complete, and intact.

Hypercontent or hypertext is learning materials (learning objects) developed through information technology-based systems. Hypertext is learning content that is interconnected but contains only text, while hyper content is interconnected and combines various types of content. Hyper-content includes text and visualizations in images, animations, videos, and audio [6].

One way that can be used to connect learning content, both text content and integrated content, is with barcodes. Learning materials connected to barcodes are part of information technology-based learning, where students can access learning materials from inside and outside the classroom [7]. Learning materials that are accessed through barcodes are one of the actualizations of blended learning, which is understood as learning that combines face-to-face learning with non-face-to-face learning. The accessibility of learning materials linked to barcodes is one of the characteristics of online learning because it can be accessed via the internet and is network-based [8]. Learning materials linked to barcodes and stored in the cloud can be processed, downloaded for offline use, and shared within communication technology as a disseminator of information [9]. The pedagogical concept is divided into three basic concepts, and the teacher is expected to be able to:

1. Know the pedagogical concept so that, for example, they can distinguish instances on it;
2. Use the pedagogical concept for analyzing the topic and producing information about it that can be used in the planning process; and
3. Use the information produced with the pedagogical concept for making decisions in the planning process.

The three points above are categorized into theoretical, technical, and practical knowledge of the pedagogical concept [10].

The technical knowledge of pedagogical concepts is a type of practical knowledge that is oriented toward production, its program, and concept-specific. Analyzing a topic with a pedagogical concept requires putting its meaning into play to produce information that can be used in the planning process. It is necessary to operationalize the key ideas that characterize its meaning into techniques. Those techniques configure the technical knowledge of the pedagogical concept and should satisfy two conditions: (a) to be grounded on the meaning of the pedagogical concept and (b) to make it possible to produce information about the topic that can be used for planning purposes. Among all the techniques that satisfy these two conditions, educators propose and make explicit those that they consider most effective for planning purposes.

Pedagogy is a comprehensive, objective and firmly in order to develop the concept of human nature, substance the child, the substance of the child and the nature of the purpose of education itself.

2 Method

The research method used in this research is Research and Development (R&D). The R&D method is a research method used to produce certain products and test the effectiveness of these products [11]. The development model used is the ADDIE model development. In the ADDIE development model, five stages must be carried out: analysis, design, development, implementation, and evaluation.

The product in this research is digital hyper-content teaching materials. The study was conducted at the State University of Jakarta. The population in this study were students of the education program, while the sample respondents in this study were students of the Faculty of Social Sciences, with a total of 40 respondents. The technique used is purposive sampling. The respondents chose based on the students who took the education strategy course and the level of students' good cognitive abilities. Assessment of the design of teaching materials using a media/product assessment questionnaire instrument. The purpose of this research is said to be achieved if it meets the indicators (1) product development/teaching materials get a very suitable category for use, (2) the effectiveness and efficiency of teaching materials to encourage the achievement of learning objectives.

Analysis of the results of the development using quantitative and qualitative data. Qualitative data is used to analyze the effectiveness of digital hyper-content teaching materials to increase students' understanding of pedagogic concepts.

3 Results and Discussion

3.1 Analysis Stage

In research using the ADDIE development model, the initial step that needs to be done is to conduct an analysis, namely an analysis of the needs, feasibility, and requirements for the availability of teaching materials. However, in this study, the analysis carried out was only an analysis of the needs and availability of teaching materials.

The stages of a needs analysis are adjusted to the material relevant to achieving the desired competencies related to what is mastered by students. In contrast, the availability analysis adjusts to the availability of teaching materials or intermediary media that students often encounter [12]. The teaching materials that will be designed and developed are to make students easier to use, related to learning outcome (LO), easy to understand, and equipped with additional materials from other sources, such as links and barcodes.

The analysis of student needs for teaching materials of the learning strategy course is to improve students' understanding of pedagogic concepts so that students can be good teacher candidates. It is because all pedagogic concepts have been understood in the learning process.

The analysis of teaching materials availability is based on the media that students use daily, namely smartphones, so teaching materials can be accessed more easily via smartphones.

The learning strategy teaching materials are in digital form. They are used via smartphones to make it easier for students to read and scan hyperlinks and barcodes as additional material deepening. The analysis results from this stage are further evaluations to improve the results. Evaluation based on the analysis results is then processed into several sets of data reduction.

3.2 Design Stage

The design stage is the stage for designing or planning the development of teaching materials. It is designed to make specifications regarding the product framework, style, appearance, and material/material requirements at this stage. In addition, researchers also developed research instruments.

This teaching material is designed with an attractive appearance so that students are interested and not bored in reading it. From that, students will be encouraged to carry out or understand more deeply pedagogic concepts as a basis that needs to be possessed by prospective teacher students.

In addition, the application display is also designed with an attractive appearance, with a barcode that can be scanned easily by students. The barcode contains video links and additional explanations from other sources related to the material.

At this stage, an assessment instrument was also designed for media/product experts, material/content experts, and small-group trial respondents. The assessment instrument for teaching materials consists of the suitability of teaching materials with the characteristics of the course, practicality and ease of use of teaching materials, and display of teaching materials. At the same time, the material instrument includes the suitability of teaching materials with CPMK and the depth of the material. As for the instrument for small group respondents, namely ease of use and appearance.

3.3 Development Stage

At the development stage, teaching materials are developed by applying the product designs made at the beginning. Includes activities to prepare software/applications and materials and design the appearance and content of teaching materials.

The initial development stage design is making factual samples for learning design and collecting various sources of relevant data for development [12]. In addition, it also develops column-by-section chapters in the application, as well as inserts scannable barcodes and practice questions.

The product design developed is assessed by media/product expert validators and material experts on the instruments that have been compiled. The assessment results of all aspects are measured by a Likert Scale [13]. The media/product expert validator is a lecturer in Educational Technology, while the material validator is a lecturer in Islamic religious education. The respondents for the small group trial were 40 students.

The validation test results from media/product experts are responses and assessments from media/product experts. The results of the data obtained are analyzed, and product revisions are made according to the advice given by media/product experts.

The answers to each item of the media/product expert and material expert assessment instrument are classified into scores ranging from 1-5 as follows:

Table 1. Categories Likert Scale

Score	Category
5	Very decent/very good
4	Decent/good
3	Less worthy/not good
2	Not worthy/not good
1	Very unworthy/very bad

The next step is to assess the feasibility of teaching materials to be implemented in the learning strategy course.

After the data is obtained, to see the weight of each response and calculate the average score, the following formula was used:

$$x = (\sum x) / n \dots (3)$$

Description:

x : average score

n : number of raters

$\sum x$: total score of each

And to assess the percentage of the results obtained using the following formula:

$$\text{Result} = \frac{\text{total score obtained}}{\text{maximum score}} \times 100$$

The categories of eligibility for teaching materials are based on the following criteria:

Table 2. Media Eligibility Criteria

No	Score in Percent (%)	Eligibility Category
1	< 21%	Very unworthy
2	21 – 40%	Not worthy
3	41 – 60%	Less worthy
4	61 – 80%	Decent
5	81 – 100%	Very decent

Source: [14]

Based on the percentage of eligibility from media/product experts, digital hyper-content teaching materials get a score of 87%, with a very decent category. In comparison, the percentage of the feasibility test from content experts is 84.5%, which is included in the very feasible category for use.

The trial results on small group respondents got a percentage of 85% with information on teaching materials that are easy to use, easy to understand instructions, and interesting. The final stage of development is a review of teaching materials based on evaluating results or suggestions from media/product experts and material/content experts.

3.4 Implementation Stage

The implementation stage is the implementation of the research plans and designs that have been prepared previously. The implementation stage needs to be carried out to determine the effectiveness, efficiency, and attractiveness of the developed teaching materials. From there, it can then be identified and evaluated things that need to be revised/improved teaching materials to be better and optimal.

The steps at this stage are preparing teaching materials, socializing them with students, and explaining their instructions. The results of the implementation phase become evaluation materials for developing teaching materials or products. Components that still have deficiencies will be optimized according to development needs

3.5 Evaluation Stage

The evaluation stage is the stage to analyze the assessment and prepare steps to improve the teaching materials that are being developed. The evaluation stage aims to ensure that the result of teaching materials can be used and applied properly in learning and achieving product development goals.

In addition, determining whether teaching materials effectively accommodate student needs is accompanied by identifying the advantages and disadvantages of hyper-content-based learning strategy teaching materials.

The evaluation results of a small group of students, media/product, and material/content experts concluded that teaching materials could be developed and implemented in large class research or field tests.

The development of teaching materials that are designed to be interactive, interesting, varied, and accommodate the needs of independent and collaborative learning needs to be done because it is a new thing and is a good step. The development of hyper-content teaching materials is enriched by being linked to the virtual world and utilizing cyberspace as an open resource for learning. Hypercontent is formed by using tools/icons, hypertext, quick response codes (QR code), YouTube video channels, and cloud computing to take advantage of various web pages and help students understand the material more effectively.

Learning strategy teaching materials developed with a digital hyper-content approach can solve the problem of students' difficulty understanding the concept of learning strategies and enrich students' understanding. The learning approach by emphasizing outcomes is very appropriate if the availability of varied teaching materials supports it, and group assignments for collaborative learning practices so that students can think critically and creatively and improve students understanding of pedagogic concepts.

Based on the questionnaire and interview data analysis results, students stated that the use of teaching materials was very effective and efficient because it contained an element of

simplicity or ease to use and could encourage students to explore and understand the understanding of pedagogic concepts.

In addition, these digital hyper-content teaching materials can help students become aware that, as prospective teachers, pedagogic concepts must be mastered, especially related to strategies, models, approaches, media, and learning methods.

Thus, at this stage, the teaching materials that have been designed can be the beginning of further development with a more modern form to complement the format that has been carried out so far.

4 Conclusion

Digital hyper-content teaching materials developed have high quality by three criteria: easy to use, easy-to-understand content, and interesting. The ease of use aspects are based on assessing media/product experts and content experts with suitable categories for use. In comparison, the elements of the content of teaching materials are easy to understand, and is based on student assessments, that digital hyper content-based teaching materials are easy to understand and use because the media can be installed on smartphones. The appearance is simple and attractive. The last is the effectiveness, based on the implementation in large classes, effective teaching materials for students to understand pedagogic concepts.

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