Innovation Development of Microeconomics E-Module Based on Discovery Learning on Utility Functions

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ABSTRACT
The purpose of this research are (1) to produce innovation products for digital economic modules based on discovery learning on the subject of utility functions and (2) to know the level of feasibility of digital economic module innovation products based on discovery learning on the subject of utility functions. The development of this learning media is based on the importance of this problem is that with this discovery learning-based digital module innovation, students can be motivated to learn and prepare themselves before learning begins in the classroom, can help students better understand learning materials independently, ease the burden on students because the module does not need purchased in print. The ADDIE model is used in the development of this digital module, which consists of five stages, namely analysis, design, development, implementation and evaluation. From the results of the research that has been done, it turns out that the innovation of the digital microeconomic module based on discovery learning on the subject of utility functions that have been developed has been successfully applied and is feasible to be determined in the learning process.

Keywords: *E-module based, Microeconomics, Learning, Utility functions.*

1. INTRODUCTION

In microeconomic theory, Jehle, Geoffrey; Reny, Philipp [1] stated that the problem of utility maximization is a problem faced by consumers: "how should I spend my money to maximize my utility?" This is an optimal type of decision problem. It consists of choosing how much of each good or service is available for consumption, taking into account the limits on total spending as well as the price of the goods.

Based on the curriculum, economic theory courses are given as many as 3 credits and quite basic subjects need to be understood related to the concept of utility and have a minimum study time allocation of 3 hours per week. This time allocation must be used effectively, so an approach that can help students understand the concepts being taught is needed. Based on Law Number 20 of 2003, learning physics as a science must be student centered (active learning) and learning must be related to the opportunities given to students to construct knowledge in their cognitive processes. Students are encouraged to discover and transform complex information for themselves, check new information with what is already in memory, and develop it into information or abilities that are appropriate to the environment and times. This context is by one of the learning models that uses a scientific approach, namely discovery learning. Discovery learning or discovery learning is an inquiry-based learning technique and is considered a constructivist-based educational approach. It is also referred to as problem-based learning, experiential learning and 21st century learning [2]

In this paper, two main things are studied, namely as follows: (1) How is the quality of discovery learning-based digital economics module innovation as digital literacy material on the subject of utility functions for Economics Department students in terms of content feasibility, language feasibility, presentation feasibility, graphic feasibility, and suitability with utility function learning characteristics? And (2) How is the effectiveness of using discovery learning-based digital economics module innovations as digital literacy material on the subject of utility functions for Economics Department students in terms of content feasibility, language feasibility, presentation feasibility, graphic feasibility, and suitability with the learning characteristics of utility functions.

2. LITERATURE REVIEWS

The development of the virtual world (cyberspace) provides major changes in the world of education. Barnett Berry, identified the current emerging reality as the impact of advances in digital technology that must be faced. Digital technology has been proven to make the transfer of information more efficient. Learning materials are expected to create an interesting and conducive learning atmosphere and can be used independently by students, namely by using multimedia [3].

According to Sugianto states that the development of information and communication technology also affects the progress of education, especially in terms of learning media innovation because this virtual or digital module has an attractive appearance, is easy to understand, and is easy to use. The presence of multimedia in the learning process is very useful. One of the learning media that can be combined into one between learning models, print technology teaching materials, and the use of computer technology, namely digital modules. Digital modules can also be used anywhere, making it more practical to carry anywhere [4].

Digital modules or often also referred to as electronic modules are learning tools or facilities that contain materials, methods, limitations, and ways of evaluating that are designed systematically and attractively to achieve the expected competencies. One form of presenting learning materials in digital or electronic formats is e-books. An electronic book or e-book is an electronic version of a printed book, read using electronic devices and special software.

Digital module is a module in digital form which is built using a computer program. Several electronic/digital tools that can be combined to build electronic modules are (1) Microsoft Office PowerPoint, (2) Microsoft Office Word, and (3) Authorware. Microsoft Office PowerPoint can be used as the main page of the Electronic Module [5] and the development of digital module innovation is a process of designing independent teaching materials that are systematically arranged in electronic format to achieve certain learning objectives. The development model used for development is quite diverse and one of them is the development model developed by Dick and Carry, namely the ADDIE development model which includes five stages, namely Analysis (needs analysis), Design (planning), Development (development), Implementation (implementation), and Evaluation (evaluation) [6].

In developing this innovation, the digital economy module tries to be carried out interactively through a discovery learning approach or inquiry-based learning technique and is considered a constructivist-based educational approach. It is also referred to as problem-based learning, experiential learning and 21st century learning. According to Hosnan, discovery learning is a model for developing an active way of learning by finding it yourself, investigating it yourself, then the results obtained will be loyal and long-lasting in memory. Through discovery learning, students can also learn to think analytically and try to solve their problems.[3]

In microeconomic theory, the utility-maximizing problem is a consumer-facing problem: "how should I spend my money to maximize my utility?" This is the type of optimal decision problem in choosing how much of each good or service is available for consumption, taking into account the limits on total expenditure and the price of goods, becomes interesting to be studied in this discovery learning-based digital economic module innovation. Enumeration of all possible consumption bundles that can be selected if there is no budget constraint, has L commodities and is limited to the number of positive consumptions of each commodity. Let x be a vector $x = \{ x_i ; i = 1, ... L \}$ which contains the amount of each commodity; then .Suppose also that the price vector (p) of commodity L is positive, and consumer income I; then the set of budget sets, is where (p,x) is the product point of p and x , or the total cost of consuming x products at the price level, then the consumer wants to buy the best package of commodities at an affordable price, and it is assumed that the consumer has an ordinal utility function,, which is called u . This is a real-valued function with the domain being the set of all commodity bundles, or , Then the consumer's optimal choice x(p,I) is the utility that maximizes the bundle of all bundles in the budget set which is a utility maximization problem. If there is a unique maximizer for all values of the price and wealth parameters, then it is called a Marshaliian demand function; otherwise, a value is assigned and it is called a Marshallian demand correspondence [1]

3. METHODS

The development model used is the ADDIE development model. The selection of this model is based on several considerations. First, the ADDIE model is presented simply and systematically. The stages in this model are very simple when compared to other design models. It is simple and systematically structured nature makes the ADDIE model very easy to learn by developers. Second, the ADDIE model is relevant in the development of a module [7] The stages of research analysis are as follows shown in Figure 1.

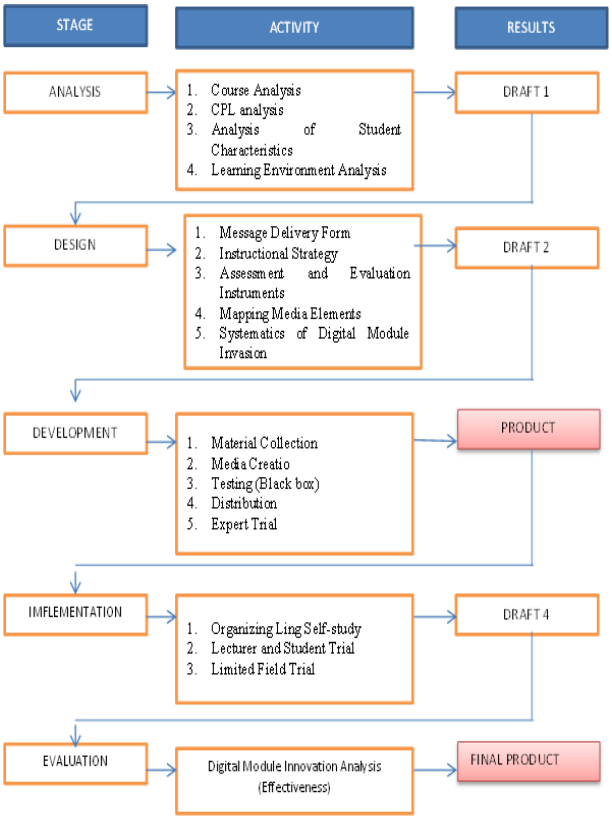

Figure 1 Stages of ADDIE Model Development.

The test subjects in this study were 10 students of the Department of Economics who took the theory of microeconomics and 1 lecturer of the microeconomic theory course, Department of Economics, Faculty of Economics, Unimed, individual test subjects, 6-8 students of the Department of Economics, the trial subject (large group), as many as 20 people, the validator subject consists of 4 people, including 1 lecturer for Microeconomic Theory course, 1 material expert, 1 media expert and 1 learning expert.

The type of data in this study is the feasibility of the module. The data was obtained from interviews with material, media and learning experts, and lecturers of the Microeconomic Theory course at the Department of Economics, Faculty of Economics, Unimed.

The type of data used is the level of effectiveness of the module obtained through the results of questionnaires, tests and observations on students of the Economics Department, Faculty of Economics, Unimed.

The data collection instrument used the Guttman scale with the answer choices YES or NO. Score 1 if you answer yes, score 0 if you answer no. The feasibility analysis of the digital module was carried out to material, media, and learning experts using the following formula:[8]

$$Vah = {}^{TSe}/_{TSh}\, x100\% \quad (1)$$

Next, analyze the feasibility of the digital module for individual, small and large group trials using the following formula:

$$Vau = {}^{TSe}/_{TSh}\, x100\% \quad (2)$$

Information:
Vah = Expert validation
Vau = Group validation
TSe = Total empirical score achieved
TSh = Total expected empirical score

Regarding the analysis of the data that has been obtained, the percentage results from the validators are interpreted using the percentage category, as can be seen from the following table

Table 1 Effectiveness.

Criteria for achieving grades	Level of effectiveness / validity
85,01% 100,00%	- Very valid, very effective, very thorough, can be used without repair
70,01% 85,00%	- Quite valid, quite effective, quite complete, usable but needs minor improvements
50,01% 70,00%	- Invalid, less effective, less thorough, need major improvement, it is recommended not to use
01,00% 50,00%	- Invalid, ineffective, incomplete, unusable

The results of the data obtained from this study are comparing the post-test scores of the experimental group using conventional media with the post-test scores of the control group using interactive digital modules. The design of this study used the Pretest-Posttes Control Group Design with the following details:

Table 2 Rresearch design.

Description	Pretest	Activity	Posttest
Random	experimental group	Treatment (treatment) . Using digital modules	experimental group
Random	control group	-	control group

If the results between the t table test and the calculated t test show a significant value in the experimental group, then the interactive digital module can be said to be effective. The following is the formula for independent sample t-test as follows:

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad (3)$$

Information:
X1 = sample mean 1
X2 = sample mean 2
n1 = number of samples before treatment
n2 = number of samples after treatment
S12 = sample variance 1
S22 = sample variance 2

4. RESULTS AND DISCUSSION

Discovery Learning-based E-Modul innovation in microeconomics courses which is specifically carried out for e_module development with the topic of utility functions is designed based on the results of the analysis, design, development, implementation and evaluation stages. This research and development of digital module innovation in discovery learning-based learning aims to determine the level of feasibility and performance of digital module innovation in microeconomics learning based on discovery learning. The feasibility of this digital module innovation is determined based on a predetermined method.

Based on the results of the study, the product was obtained in the form of a digital module of utility functions in the microeconomic theory course which was developed based on the ADDIE stage. The module design developed has been validated by material and media experts before being tested. The results of the validation of the digital module of microeconomic theory with the subject of utility functions according to material experts from the aspects of content feasibility, presentation feasibility, language assessment, and inquiry assessment in detail can be seen in Table 3.

Table 3 Digital module validation results according to material experts.

No	Aspect of Validation	V1(%)	V2(2)
1	Content Eligibility	90	90
2	Serving Eligibility	83	85
3	Language Assessment	96	95
4	Characteristic Rating	91	90
	Average (%)	90	90
	Criteria	Very Worthy	Very Worthy

Based on Table 3, it is known that the digital utility function module in the microeconomic theory course developed is generally considered feasible by material experts to be used in learning with an average assessment of the two validators of 90%.

Design improvements are made based on input in the form of comments and suggestions given by the validator who in this case is a material expert and media expert. Comments and suggestions from validators can be seen in Table 4.

Table 4 Comments and suggestions from validators regarding digital modules according to material and media experts.

No	Aspect of Validation	Comments and Suggestions
1	Accuracy of drawings, diagrams and illustrations	Add source to image
2	Cover and introduction section	There needs to be a back cover design that is in line with the front cover. Standards for Learning Outcomes and Learning Outcomes for Courses to be written down
3	Presentation	The description of the evaluation sheet does not match the evaluation sheet
4	Contents section	Consistency of spacing and spacing between paragraphs. Adding lines or dots to descriptions and conclusions to make it easier for students to fill out answers. The use of columns or lines to facilitate filling in the table of observations EYD consistency in using the word class/class/classis in questions

In accordance with the comments and suggestions, then the digital module was revised and the revised one was used in the next stage, namely product testing. The trial was carried out during microeconomic theory lectures. In addition to testing, an assessment of the digital module used was also carried out. The assessment is carried out using a user response questionnaire which in this case is a student. For more details on the assessment of the digital module display, as show in Table 5

Table 5 Student response to digital modules.

No	Assessment Aspect	Percentage
1	Overall module display compatibility	87.7
2	Ease of following the core material	81.5
3	Module interest	87.5
4	Material mastery	71.6
5	Image clarity	79.8
6	Conformity with theory	88.8
7	Clarity of economic mathematical model	71.3
8	Ease of drawing conclusions	83.2
	Average	80.67
	Criteria	Very good

Based on the discussion, it can be concluded that digital module innovation with a Discovery learning approach for the subject of utility functions for the microeconomic theory course with the ADDIE development model consisting of the analysis (analysis), design (design), development (development), implementation (implementation) and evaluation, the quality of the digital module is shown in Figure 2.

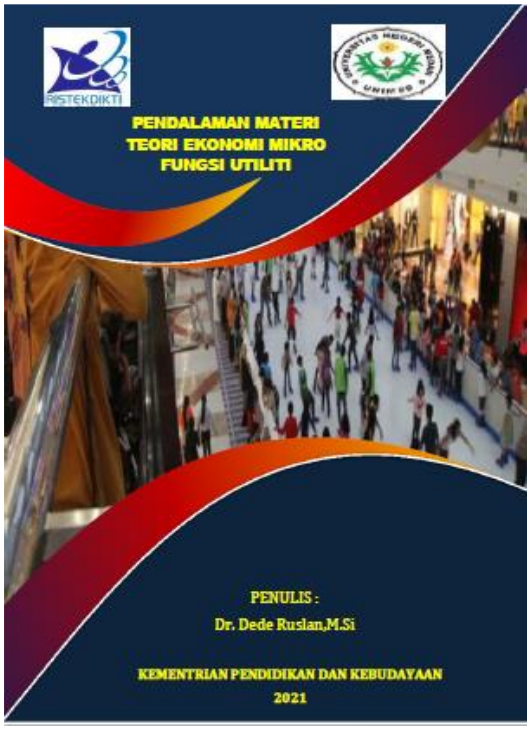

Figure 2 Digital module front page.

The first trial was an individual trial with 3 respondents with 1 student with high learning achievement, 1 student with moderate learning achievement, and 1 student with low academic achievement. From data analysis and analysis of comments given by respondents during individual trials, the percentage of students' answers to "Yes" answers for each component is 90% and is in very good qualification.

The second trial is a small group trial. Small group trials were conducted on 15 students of the Department of Economics with 5 students with high academic achievement, 5 students with moderate academic achievement and 5 students with low academic achievement.

From the data obtained, the percentage level of achievement of the utility function learning module during the small group trial was 89.4% and was in good qualification.

The last trial was a field trial which was given to 62 students majoring in economics. This digital utility function learning module was distributed directly to 62 students of the Department of Economics. Each student reads, observes and gives an assessment through the questionnaire that has been provided. From the data obtained, the percentage level of achievement of the utility function digital module during the field trial was 89.3% and was in good qualification.

The effectiveness of the development of the digital module. The utility function has been carried out using a test method. In this study, it was measured by providing an instrument in the form of multiple choice question sheets to 62 students of the Department of Economics through pretest and posttest. The average value of the pretest is 65.66 and the average value of the posttest is 83.63. After calculating with spss obtained t count of 15.6. The calculation results show that the value of t count is greater than the value of t table so that H0 is rejected and H1 is accepted. This means that there is a significant difference in student utility function learning outcomes between before and after using the utility function digital module.

5. CONCLUSION

In this paper, we have shown that development of a digital module with a discovery learning approach to the utility function material for students attending microeconomic theory courses at the Department of Economics, Faculty of Economics, Unimed, with the ADDIE development model consisting of the analysis, design, and development stages, implementation (implementation) and evaluation (evaluation). The quality of the modules on the utility function material for students who take microeconomic theory courses in the Economics Department of the Faculty of Economics that have been developed are : (a) the module developed with

the discovery learning approach is declared valid with an average score of 90 valid categories with very feasible criteria and (b) the module developed with the discovery learning approach is declared effective

Suggestions that can be given based on the research that has been done are as follows. (1) This digital module with a discovery learning approach has been tested for validity and effectiveness, so it is recommended for lecturers and students to use it as an alternative source of learning on the utility function material for microeconomic theory courses at the Economics Department, Faculty of Economics, Unimed.

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