



Development the Module of Mathematics Statistics 1 by using the Model of Dick and Carey Design

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Abstract

This research is a development of teaching materials formed the module of mathematics statistics 1. The stage of development in this research used the Dick and Carey instructional system design. The stage of the Dick and Carey development consisted of identifying the learning objectives, analysis of learning, analysis of learners and environment, formulating the specific goals, developing the instruments of assessment, developing the learning strategies, developing and selecting the learning materials, designing and conducting the formative evaluation, and revising the learning materials. Based on the results of descriptive analysis of the students' responses about the module of maths statistics1, it was obtained that 81.8% of the students stated well. Students found that the modules were good to be used in maths statistics 1. Displaying aspect indicated very good 83%, aspect of material presentation was easier to understand 80.6% and advantages aspect also showed very good 82%. Therefore, the module of mathematics statistics 1 was stated valid and feasible for used.

Keywords: Development of teaching materials; dick and carey model; module; random variable.

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1. Introduction

Statistics of mathematics 1 is one of the compulsory subject in mathematics education department of FKIP UMSU. Based on the researcher's experience and observation to the various problems faced by the students of FKIP UMSU in learning maths statistics 1, one of them was the lacking of students' understanding about the material of opportunities and sets, students were still not capable to master full of the material which was taught in calculus subject and differential equations on derivatives and integrals, because the key of maths statistics 1 is derivatives and integrals. In this case, the lecturer would be required to be more creative in developing innovative teaching materials, varied teaching materials, exciting teaching materials, and contextual teaching materials. It had to be appropriate on the level of the students' necessary [1]. Hence, it needed to develop a learning module.

In addition, that causing the students felt difficult in learning statistics of mathematics 1 were limited learning materials and limited resources. The students only had learning resources that given by the lecturer without looking for the material references from other sources. Statistics books were difficult to be understood by students because the language was unfamiliar, and the statistics mathematical books used English, that's why the students did not really know what the definition and concepts understanding of the book. Hence, the students needed to have learning materials and other resources as a guidance book that was easy to be understood.

According to [2] that teaching materials are materials that prepared by the teacher systematically to be used the learners (students) in the learning. The teaching materials that compiled in Educators' textbooks can be formed on textbooks, modules, handouts, worksheets, and it can also be packaged in other forms. Donnelly and Fitzmaurice [3] stated that *"In the process of devising a module. The key is to forge educationally sound and logical links between learner needs, aims, learning outcomes, resources, learning and teaching strategies and assessment criteria evaluation.* Reference [4] described that the module is a form of teaching material based on designed edition for studying independently by the learning participants, so that the modules are equipped with instructions for self-learning. Daryanto [5] also stated that the module serves as a learning tool independently, so that students can learn independently based on their own rapidity. The module serves as a learning tool independently. Therefore, students can learn at their own speed [6].

Reference [7] stated that an individual learning that can be used in the classroom is learning using modules, because by using the modules, students can determine the speed and the intensity of learning. Hence, individual learning module also used in training in Germany [8]. Hamdani [9] module is a tool or a learning tool containing materials, methods, limitations of learning materials, instructions and learning activities, exercises, and how to evaluate which are designed to systematically and exciting to reach the expected competencies and can be used independently.

According to [10], the benefits of learning with the application of the module are as follows: 1) increase learners motivation, because every doing the learning task is clearly limited and based on their ability; 2) after evaluation, educators and learners know well, which modules the learners have been successful and unsuccessful; 3) learners achieve the results appropriate their ability; 4) the learning materials are provided more evenly in one semester; and 5) education is more efficient, because the materials are prepared based on

the academic. The development the module of mathematics statistics 1 by using Dick and Carey design, where Dick and Carey [11] noticed that the learning design as a system and considered the learning is a systematic process. Reference [12] stated Dick and Carey Model Proved more efficient than the traditional lecturer method is readily Adopted by most teachers at the higher institutions of learning.

In fact, this systematic work way is stated as a system approach model. The components and the stages system of Dick and Carey model are more complex than other learning models. Dick and Carey model component is influenced by the condition of learning, based on the results of Robert Gagne's research that was first published in 1965. The condition of this learning is based on the assumption behavioral psychology, cognitive psychology, and constructive psychology that applied electricity [11], with the learning module, that is easy to be understood and studied by the students of statistics mathematical 1 will greatly assist students and lecturers in learning and teaching mathematical statistics 1. Module of mathematical statistics 1 can facilitate the students, where the students will be faster and more familiar with self-learning or learn with friends.

2. Methods

This research aimed to develop the module of mathematical statistics 1 on the discussion of random variables. The research specifically was classified into developing of instruction program research. It was conducted at the University of North Sumatera Muhammadiyah, Captain Mukhtar Basri street No.3, Medan. The time of the research was done in the second week on December until at the second week on February 2015. The sample was 10 students, they were taken randomly in semester five (V) as a small group. The instruments of data collection used 1) the questionnaire of material expert and 2) the questionnaire of students' responses.

The process of development the module learning component used steps on the model stage of the [13] The steps of the Dick and Carey model consisted of: identifying the learning objectives, analysis of learning, analysis of the learners and the environment, formulating specific goals, developing the assessment instruments, developing the learning strategies, developing and selecting the learning materials, designing and conducting the formative evaluation, and revising the learning materials. According to Semiawan [14], Research and Development (R&D) is the border of qualitative and quantitative approaches, especially to bridge the gap between research and practice of education. Thus, R and D is a process to develop and product. 1) Testing the validation expert of the educational content and learning media; 2) Testing the learning design experts; 3) testing the students individually; 4) Testing the students of small groups; and 4) testing the field. But, in this research, it only reached in the testing phase of students in small groups.

3. Results and Discussions

3.1. Results

The stages of the module development:

- a. Identifying the learning objectives

Students required a guidance book (module) to facilitate them in learning mathematical statistics 1 of random

variables material. In this point, it could be seen the existing of learning objectives. The learning objectives was outlined in the teaching basic time line of Program Strata-1 in Mathematics Education Department of UMSU.

b. Analyzing of learning

Learning analysis was performed to obtain the skills that must be mastered by the students to achieve basic capabilities on the basic competence. Basic competence in the random variable understood some random variables that had the density function of discrete corrector and continuous random variables. To understand the students' random variables were expected to have understood the opportunities, derivatives and integrals material.

c. Analyzing the learners and the environments (preparing the students)

The students who used by the researcher to see whether the using of the module was valid or invalid, they were the students of mathematics education department of UMSU FKIP in the fifth semester (V). They were encouraged to think critically and abstractly because the module was developed abstractly.

d. Formulating the specific goal and developing the assessment instruments

The specific learning goal was the students could use the material as a random variable as an approach to solve the problem, it could be a problem in mathematics and in daily life. After following the course, the students were expected to be able:

1. Explaining the variable random
1. Explaining the discrete variable random
2. Calculating the value of the discrete variable random
3. Explaining the continuous variable random
4. Calculating the value of the continuous variable random

e. Developing the learning strategies

Within the module that has been made, there were:

1. A beginning defenition about the variable random material.
2. The students' participation that was contained in the module formed derivations exercises and the usage of basic opportunities material.
3. Capability test, it contained some questions that were used to measure the achievement of the specific objectives of learning/indicator.
4. Follow-up, it consisted of the provision of a test answer key from the capability test.

f. Developing and selecting the learning material

The material that would be developed was random variable.

g. Developing the assessment criteria

This research used the questionnaire instrument, so to calculate the average of each indicator were as follows:

$$\bar{X} = \frac{\sum i}{n} \quad (\text{Arikunto}) [15]$$

Where:

\bar{X} = The average score of each indicator

$\sum i$ = Total number of the answers scores of the respondents

n = Number of respondents

In this research, the scale used 1 to 5 where 1 being a the lowest score and 5 being a the highest score. The criteria of the average analysis validation that was used, it could be seen in the following table:

Table 1: The Criteria of the Average Analysis Validation Every Indicators

The average	Validation criterias
$4.21 \leq \bar{X} \leq 5.00$	Very valid
$3.41 \leq \bar{X} \leq 4.20$	Valid / no revision
$2.61 \leq \bar{X} \leq 3.40$	Enough valid (average)/ no revision
$1.80 \leq \bar{X} \leq 2.60$	Less valid/ partial revision
$1.00 \leq \bar{X} \leq 1.80$	Invalid/ total revision

h. Designing and implementing the formative evaluation

Each module of mathematical statistics 1 of random variable material contained lots of examples related to concepts and also exercises that was expected to be done by students individually or in groups. The prototype of the module by using the design of Dick and Carey was validated by material experts that consisted of two material experts. Reference [16] validation is a process or endorsement to the suitability of the module to the needs. Further Daryanto [17] said that validation can be done in a way ask for help masterful experts competencies learned

After the module was declared validly, the next stage, it was evaluated to the students in the form of a questionnaire to know the students' responses, which consisted of 10 students by selecting randomly in semester five (V), the next stage was validation test to see the disadvantages of the module in mathematical

statistics1 of random variable material both in terms of content, appearance and language.

Table2: Validation of Material Experts

No	Indicator	Indikator Items	The Result Of Material		The Everage
			Experts Validation		
			I	II	
1	Aspect of the content feasibility	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19	3.63	3.68	3.66
2	Aspect of the presentation feasibility	20,21,22,23,24,25,26,27,28,29,30,31,32	3.69	3.85	3.77
3	Language assessment	33,34,35,36,37,38,39,40,41,42,43,44,45,	3,76	4.00	3.88
Total of the group everage					3.77

Based on the above table, it couldbe concluded that; from the aspect of the content feasibility, the module was stated valid with an everage 3.66. From the aspect of the presentation, it was also declared valid by the everage3.77.

And based on the language assessment aspect, it was also declaredvalid by the everage 3.88. The general conclusion wasthe module of mathematics statistics1 of random variable material by using the design of Dick and Carey was declared valid and reasonable to be used in the field with the existing of revision.

Based on the experts’ notes,it has been revised in the following table:

Table 3:The Revision of Learning Material

Before Revision	After Revision
<ul style="list-style-type: none"> It has not been listed the distribution of negative binomialyet. 	<ul style="list-style-type: none"> It has been added to negative binomial distribution.
<ul style="list-style-type: none"> It has been listed the learning objectives. 	<ul style="list-style-type: none"> It did not need to be listed the learning material.
<ul style="list-style-type: none"> Example of question each material was only one. 	<ul style="list-style-type: none"> Addition of examples in every material.
<ul style="list-style-type: none"> Writing flats. 	<ul style="list-style-type: none"> It was replaced with expectations
<ul style="list-style-type: none"> There was a distribution of chi-quadrante material. 	<ul style="list-style-type: none"> It did not have to be put the material of chi-square distribution.

Table 4: The Result of the Students' questionnaire Responses

No	Indicator	Indicator Items	Value										Percent age (%)
			I	II	III	IV	V	VI	VI I	VI II	IX	X	
1	Displaying aspect	1,2,3,4,5,6	83.	80	90	80	83.	86.	83.	80	80	83.	83%
2	Presentation aspect	7,8,9,10,11,12,13,14,15,16,17,18,19	81.	78.	72.	81.	78.	81.	84.	84.	81.	81.	80.6%
3	Advantage aspect	20,21,22,23,24	80	76	92	76	92	76	92	80	80	80	82%
Total of the group percentage												81.8%	

Based on the students' questionnaire response was presented in table 4, it could be obtained by the following analysis

Table 5: Percentage the Result of the Students' Questionnaire Responses

No	Students' responses of the module	Responses	Range	Everage
1	Displaying aspect	Good	80%-90%	83%
2	Material presentation aspect	Good	80%-90%	80,6%
3	Advantage aspect	Good	80%-90%	82%

1. Percentage of the displaying aspect was 83%, it showed good.
2. Percentage of the material presentation aspect was 80.6%, it showed good.
3. Percentage of the advantage aspect was 82%, it showed good.
4. Percentage of group everage was 81.8% which indicated that the module was good to be used.

i. Revising the learning material (revising the module)

This module still needed an improvement, because in this research only used a small scale, which only used a sample of 10 students, so that it needed to be tested on a large scale in order that the results were more maximal/total.

3.2. Discussions

The discussion was focused on the presentation and analysis of the data and the revisions were made to the development product. Based on the input of the contents experts, There were some revisions that made to the module of mathematics statistical1, they were: 1) in terms of content, it would be better if it was included the distribution of negative binomial; 2) the members of the sample questions on each material was more than one and it did not have to include the material of the chi-square. Based on the validation of material experts showed that there were not any constraints in material terms for the module of mathematical statistics 1 of random variables material. Overall, the module was declared valid and reasonable to be used in the field with the group average of validation results by the material experts was 3.77. Then, the test on a small group (10 students) was done to see the students' responses. The students' responses stated that the module of mathematical statistics 1 of random variables material by using the Dick and Carey design was used well. If it was noticed based on the students' appearance aspect expressed good (83%) the presentation aspect stated good (80.6%) and the advantages aspect stated good (82%) the students showed good for this module. This research related with the research that conducted by Sica Septyenthi and his colleagues [18], it showed that the hypothesis test results of teachers and students' responses could be concluded that the modules received a great response, interesting and appropriate to the students' necessary. Then, the module material could help to grow the students' skills to be entrepreneurs. With this module, the students could learn independently or in groups, so that they could think critically and self-learning in statistics of mathematical 1. The research results were related with the research of Heru Kurniawan E and his colleagues [19] which show the success of the students' learning process by using the module based-problem that has been developed by his, it was indicated with the average achievement of before and after the learning. Likewise, with the research of Satinem and his colleagues [20], it could be stated that the teaching and learning model which was developed could increase the third-grade of students' achievement at elementary school in Indonesia by using teaching and learning with the source of regional literature.

4. Conclusions

The conclusions of the research are:

1. Prototype of result in the development the modules of mathematics statistics 1 on variable random material by using the Dick and Carey design for mathematics education department of FKIP UMSU was declared valid and eligible for used in the mathematical statistics 1 subject.
2. Based on the result of descriptive analysis about students' responses on the module of mathematics statistics 1 was obtained that 81.8% of the students stated well. The Students found both modules were used in statistics of mathematical 1. The displaying aspect indicated very good (83%), the presentation aspect was easier to understand (80.6%), and the advantage aspect also showed very good (82%).

5. Suggestions

Because the hypothesis test only used small groups, that was 10 students as the samples, so the information that obtained for the module of mathematics statistics 1 of random variables material that developed still need to be

tested again with a large group that had more samples so these modules will be better. In addition, as for the advice of this research is:

1. For Lecturers, hopefully the results of modules developed by researchers can be used in teaching and learning process
2. For students, this module can be used as a handbook / supplementary in studying mathematics statistics

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