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Developing teaching material for second ordered differential equation using Ispring Pro

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Abstract
This research developed teaching material for second ordered differential equation using Ispring Pro. It is a valid, practical, and effective Ispring Pro research. The stage of research procedure used development research of Borg and Gall. They are preliminary study, production of teaching material, validation of teaching material, trial of teaching material, data collecting, data analysis, and drawing conclusion. Data collection method used in this research were validation, students' response questionnaire, and test of teaching material. According to the tests, the teaching material were valid, practical, and effective. Thus, the teaching material of differential equation is ready to be used.

1. Introduction

Differential equation is equation which involves a function searched and its derivative [1]. Differential equation is a must subject in mathematics study program in 6^{th} semester. The next prerequisite of differential equation subject is calculus. Based on the list of final score in even semester in academic year 2017/2018, there were 11 of 22 students who took differential equation subject in mathematics study program got score C. Related to the final score, the cause of problem was most of students got difficulty in using concept. The concept achievement becomes important because it is proportional with students' learning achievement [2].

The cause of difficulty using concept in differential equation subject is lack of basic concept in differential equation that is calculus. It is because there is significant contribution of differential calculus ability and integral calculus toward students' learning achievement in differential equation subject [3]. Therefore, it needs much learning time in differential equation to remind again about relation concept in calculus to be used in differential equation. Beside, students got difficulty if they faced different types of questions. For instance, when the equation used was either linear equation or simple algebra quadrate was changed into trigonometry equation.

According to students' response about teaching material in differential equation was less interesting, the reason was there were not variety of diverse example questions and less detail in material questions explanation in the teaching material used. Beside, lack of differential equation reference in library caused the students looked for the information on online which sometimes it misled. Misleading means that each blog, journal and online book has own mathematics principle in its writing, although it has same meaning but sometimes the students are flamed and difficult in understanding differential equation material.

The students have used video in learning time in the college but it was considered less interesting and interactive. Ispring Pro can be integrated with power point in flash feature that contains picture, presentation, animation, audio or video that can be alternative which can help students in understanding differential equation material. Then, Ispring Pro can be maximized by using web. Therefore, students can access wherever and whenever.

2. Method

Research and development is a research method which can be used to produce a certain product, and test the effectiveness of the product [4]. The stage of Research and Development (R&D) is necessity analysis that aims to increase learning process through development of available teaching material that is tested the effectiveness until it is valid.
These are the research stages of Research and Development (R&D) procedure of Born and Gall that is developed by the researcher:

2.1 Preliminary study

The research was begun with preface study to find out problem in learning process and necessity analysis of kinds of product to be used, teaching material became product to be developed in this research. Next was literature observation be knowledge part determiner to apply teaching material developed.

2.2 Teaching material production

The plans of teaching material production were designing draft and designing systematic of teaching material draft. Then teaching material production was continued with reference assessment.

2.3 Teaching material validity

Teaching material validity was to assess early teaching material design. Validator of teaching material were material expert, language expert and media expert. Material expert assessed, gave suggestion and opinion that teaching material was suitable in scientific field that is mathematics. Then language expert assessed the efficiency of teaching material, communicative, suitability with students' development, and suitability with rule of Bahasa Indonesia. Then media expert assessed Ispring Pro.

2.4 Trial of teaching material

Trial stage or teaching material application in learning process of differential equation of order 2 used students of 6^{th} semester of mathematics education study program in STKIP Muhammadiyah Kotabumi academic year 2018/2019 that involved 16 students. Teaching material application was to find out advisability of teaching material developed that was observed by students' response. Then it was revised and the teaching material was ready to be used.

2.5 Data collecting

Data in this research was expert team assessment or validator and students' response assessment through giving questionnaire. The questionnaire delivered qualitative assessment that would be converted into quantitative data used likert scale with classification and different

meaning between expert team assessment and validator and students' response assessment. Besides, the test result of teaching material mastery was one of research data collected. Data of expert team assessment was to test validity criteria. Then, observation result and students' response questionnaire were used to test practical criteria. Meanwhile the test result of teaching material mastery was to test effective criteria.

2.6 Data analysis

These are the stages of data analysis of teaching material validation result used Ispring Pro: (1) changing qualitative assessment into quantitative, (2) counting average score of assessment result, (3) changing score into criteria, and (4) counting percentage of teaching material ideality. Then researcher analyzed data of students' response, before analyzed instrument in validity and reliability test. After the data was said valid and reliable, then it was analyzed in quantitative descriptive used formula of students' response score toward teaching material using ispring pro equals to score gotten and divided by maximum score from expected aspect then multiply 100. Then, the calculation result was categorized based on score interval of data analysis. Result data of teaching material mastery was analyzed with formula

$$N = \frac{f}{n} \times 100$$

with N=score, f = total score, and n = maximum score [5].

If average score from three validators is more than equal 60 so teaching material are in good category. Likewise, teaching material in practical category, when the average score is more than 60 so it can be said that learning activity is active and students' response toward learning is positive. Then if 60% shows teaching material mastery aimed by solving problem so teaching material is in effective criteria.

3. Results and discussion

One of the results in this research was product validity result that was teaching material of differential equation. Validators consist of material expert validator, language expert validator and media expert validator. Validators are mathematics lecturer as material expert, Bahasa Indonesia lecturer as language expert, and informatics engineering lecturer as media expert. Validation sheet contains of assessment indicator of teaching material that is adjusted with each expertise. First, teaching material advisability based on material expert assessment. The Table 1 is validity result of material expert after several revisions to be suitable with assessment indicator in validation sheet instrument.

Table 1. Validity result of teaching material according to material expert

Assessment Indicator	Average	Interpretation
1. Suitability of material with RPS	80	Excellent
2. Accuracy of material	78	Good
3. Finesse of material	78	Good
4. Encouraging curiosity	83	Excellent
5. Presentation technique	80	Excellent
6. Presentation completeness	77	Good
7. Learning presentation	79	Good
8. Series of though flow	80	Excellent
9. Evaluation system	78	Good
Average	79.22	

Next is Table 2, validity assessment of language expert that is suitable with assessment indicator in validation sheet.

Table 2. Validity result of teaching material according to language expert

Assessment Indicator	Average	Interpretation
1. Simple	80	Excellent
2. Communicative	78	Good
3. Dialogic and interactive	78	Good
4. Suitability with students' development	86	Excellent
5. Suitability with rule of Bahasa Indonesia	80	Excellent
Average	82.4	

Next is Table 3, validity assessment of media expert that is suitable with assessment indicator in validation sheet.

Table 3. Validity result of teaching material according to media expert

Assessment Indicator	Average	Interpretation
1. Size of teaching material	80	Excellent
2. Design of cover	78	Good
3. Design of teaching material content	80	Excellent
4. Media of *Ispring Presenter*	77	Good
Average	78.75	

According to validity results of material expert, language expert and media expert are gained validator assessment score toward teaching material of differential equation. Here is each assessment score in Table 4.

Table 4. Validator assessment score toward teaching material

Validator Assessment Score	Score	Teaching Material Category
Material expert	79.22	Good
Language Expert	82.4	Excellent
Media Expert	78.75	Good
Average	80.12	Good

Validity result of material expert, media expert and media expert are gained assessment average score 80.12. This result shows that teaching material is good and can be conducted trial to the field.

Next is research result from students' response questionnaire toward teaching material is practicality assessment of teaching material. The assessment is gained through students' response assessment questionnaire with 16 students. The result of students' response questionnaire is shown in Table 5 below.

Table 5. Result of students' response questionnaire toward teaching material

Score of Students' Response Questionnaire	Number of Student	Category
$80 \leq N \leq 100$	10	Very Positive
$60 \leq N < 80$	4	Positive
$40 \leq N < 60$	2	Positive Enough
Total	16	
Score Average of Students' Response Questionnaire		80.5

According to Table 5, result of students' response questionnaire shows that most of the students show positive attitude toward teaching material. It means that most of them agree the indicators of assessment. Indicators of students' response questionnaire consist of: display aspect, material presentation aspect, and use of teaching material aspect.

The effectiveness of teaching material is observed based on teaching material mastery used test that contains question from material has been taught for 16 times meeting. Here is test result of students teaching material mastery in Table 6.

Table 6. Test result of students teaching material mastery

Score of Students' Response Questionnaire	Number of Student	Predicate	Category
$81 \leq N \leq 100$	7	A	Excellent
$66 \leq N \leq 80$	5	B	Good
$56 \leq N \leq 65$	4	C	Enough
$46 \leq N \leq 55$	-	D	Less

Based on Table 6 is shown that 12 of 16 students who get predicate A and B. It means 75% of students can master teaching material of differential equation. In other word, they can solve problem of differential equation and understand the material that has been taught.

4. Conclusion

According to suitability tests are validity, practical and effective, the teaching material of differential equation is suitable to be used. The instruments are valid after validation from 3 validators they are media expert, material expert and language expert with good category and average assessment 80,12. Then it is practical based on result of students' response questionnaire, with the result most of students categorize the teaching material is positive. Then it is effective because 75% students master material that is contained in teaching material.

Teaching material is a set of material that is arranged systematically either written or not written which is used to help learning [6]. Teaching material of differential equation can be used as supporting in learning process. The teaching material has passed good suitability test. Besides that, designing of draft follows systematic guide in writing teaching material that is legalized by Ministry of Research Technology and Higher Education.

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