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Calculus Module for Derivative Application Materials with an Islamic Contextual Teaching and Learning Approach

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Abstract. Available teaching materials have not been able to meet the needs of students, so innovation is needed. This is the background of this research. The purpose of this study was to determine the development and feasibility of the modules produced, namely the basic calculus module of derivative applications with the approach of contextual teaching and learning with the nuances of Islamic religious values. The method used by Research and Development (R & D) with a 4D model by Thiagarajan with four stages, namely Define (Defining), Design (Design), Development (Development), and Dissemination (Spread). Expert judgment and product trials are conducted to determine the level of product worthiness and attractiveness. Based on the expert's assessment, the following results were obtained: 1) material experts obtained a final average value of 3.90 with the criteria of "very feasible", 2) Islamic scholars obtained the final average score of 3.88 with the criteria "very feasible", and 3) media experts obtain the final average score of 3.96 with the criteria "very feasible". Meanwhile, a limited trial to find out the level of product attractiveness obtained a final average value of 3.35 with the criteria of "very interesting". After the product is said to be feasible and attractive, the product is distributed through the website at www.pspm.tarbiyah.radenintan.ac.id.

1. Introduction

The learning process in the classroom is generally directed at the ability of children to memorize information, the brain of students is forced to remember and hoard a variety of information without being required to understand the information they remember and relate it to everyday life. Schools actually encourage students to give correct answers rather than encourage them to come up with new ideas or rethink existing conclusions. As a result, many schools pass students who think superficially, only standing on the surface of the problem, not students who are able to think deeply [1]. The independence of students depends on the information provider or educator. The Word of Allah SWT in QS. An-Najm verses 39-40,

Artinya: (39) *and that a man has no gain other than what he has cultivated, (40) and that it will be seen (to him).* (QS. An-Najm: 39-40)

he verse explains that the results that have been achieved by humans are the fruit of the effort he has done. The saying also says that the processor business will not betray the results. Not unlike the learning process, the results obtained by students also depend only on what is given by the educator if the learning process is only focused on the educator. Students get limited information.

The steps to understanding and solving a problem contained in a book will greatly help students in doing independent learning as found in the module [2]. The use of modules must be accompanied by the selection of the right learning approach so that the objectives are achieved, for example, the approach of contextual teaching and learning. Approach to contextual teaching and learning, students are required to be more active and independent in finding their own mathematical concepts. Students are guided to construct their own knowledge based on factual experiences that have been obtained in



everyday life [3]. The use of modules is not limited to school only, but also in higher education with the same goal but different goals, namely students.

Calculus is a course that underlies several other subjects such as differential equations and initial values of boundary conditions and several others. Based on the place where the researchers conducted the research, namely the Islamic-inspired UIN Raden Intan Lampung university, it has great potential to develop modules that have Islamic nuances with quotes from the verses of the Qur'an.

The researcher conducted a preliminary study with a needs analysis in the form of 40 copies of questionnaires with 6 question numbers spread over three universities namely UNILA, UIN, and UTI. The results of the questionnaire analysis state that UIN is 100%, Unila 70%, and UTI 50% of students expect the development of a learning module that contains steps to solve problems and can bring them closer to everyday life. Questionnaire preliminary study explains that educators (lecturers) are still focused on one book that is not equipped with problem-solving steps so that learning is still focused on educators. The book used does not associate with everyday life, and there is no quotation of the verses of the Qur'an in the book used but occasionally the lecturer inserts the value of life in learning directly.

Several previous studies that developed learning modules with the final results of products developed with valid, practical, effective, and feasible criteria were used [4-9]. Based on these problems, researchers will conduct research on the development of calculus modules on the subject of derivative applications with the approach of contextual teaching and learning with the nuances of Islamic religious values. The purpose of this study is to produce products in accordance with student expectations and feasible to be used in learning.

2. Research Method

In this study using the type of research and development (Research and Development) [10]. The research method used is a 4D development model pioneered by Thiagarajan with four steps namely Define, Design, Development, and Dissemination [11]. Several previous studies also used the 4D development model proposed by Thiagarajan [12-15]. The following are the steps of the 4D development model by Thiagarajan.



Figure 1 The Steps for Research and Development According to Thiagarajan

The procedure of research and development is explained in the scheme in Figure 2. The types of data used are quantitative data and qualitative data. Data collection techniques using a questionnaire (questionnaire). The instrument of data collection uses three steps namely preliminary study, expert validation, and product testing. The following is a detailed explanation of the research and development procedures.

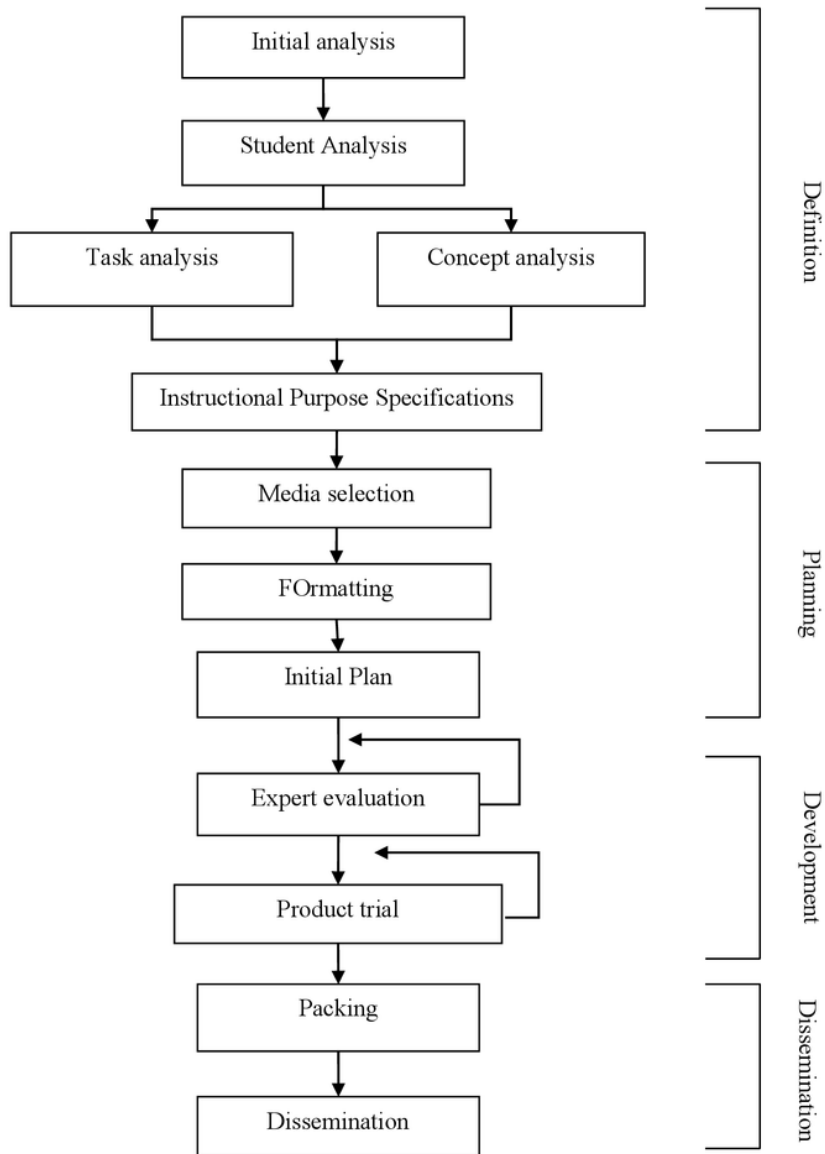


Figure 2 Research and Development Procedures

The data analysis technique in this study uses two objects as data analysis, namely experts and students. The total scoring score in the data analysis is searched by the following formula.

with

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

$$x_i = \frac{N}{S} \times 4$$

Description: \bar{x} = final average; x_i = the value of the operational test of the questionnaire of each respondent n = number of respondents; N = number of scores; S = total scores.

Data analysis of experts and students as product trials using Likert scale [16] with assessment scores and the following criteria,

Table 1 Expert Validation Assessment Score (modification)

Options	Score
Totally Agree	4
Agree	3
Less Agree	1
Disagree	1

Table 2 Expert Validation Assessment Score (modification)

Quality	Feasibility Interpretation Criteria
$3,26 < \bar{x} \leq 4,00$	Very good
$2,51 < \bar{x} \leq 3,26$	Good
$1,76 < \bar{x} \leq 2,51$	poor
$1,00 \leq \bar{x} \leq 1,76$	Very poor

Expert judgment in the form of a score of 1 to 4, then calculated using the available formula above to determine the feasibility level of the product being developed. Likewise with product testing. The following is a table of assessment scores and attractiveness criteria of product trials.

Table 3 Trial Assessment Score (modification)

Option	Score
Very interesting	4
Interesting	3
Less interesting	2
Not interesting	1

Table 4 Criteria for Victory Test (modification) [17]

Quality Score	Feasibility Interpretation Criteria
$3,26 < \bar{x} \leq 4,00$	Very interesting
$2,51 < \bar{x} \leq 3,26$	Interesting
$1,76 < \bar{x} \leq 2,51$	Less interesting
$1,00 \leq \bar{x} \leq 1,76$	Not interesting

3. Results And Discussions

The research and development that carried out resulted in a product in the form of a basic calculus module for derivative applications with a contextual teaching and learning approach with nuances of Islamic religious values. The success in this development is inseparable from the background of the problem described in the introduction and regularity in the research procedure. The following is an explanation of each research and development procedure to the point of producing a feasible and attractive product.

1. *Define*

At the defining stage, initial analysis, student analysis, task analysis, concept analysis, and specification of instructional objectives are carried out. In the initial analysis data obtained from student responses related to distributed questionnaires. Questionnaire answer number 1 with the question "have lecturers already used special teaching materials to learn the concept (eg modules, teaching aids, etc.)?" Resulted in 65% of students answering "no". Questionnaire response number 2 with the question "do you experience difficulties in understanding the material through the

teaching material and the method applied?" Resulted in 60% of students answering "yes". Meanwhile, responses to questionnaires number 3 and 4 with successive questions "are there other obstacles that were obtained during the lecture in understanding calculus course material (for example due to the completeness of the material, explanatory techniques, etc.)?" And "what is the book what is currently used is interesting and contains the steps that work must be done by the students and the tasks that must be done?" resulting in 55% answering "yes" and 65% answering "no". The results of the No. 6 questionnaire response with the question "does the book contain excerpts from the verses of the Qur'an relating to any material or learning activities of the lecturer linking the material to the verses of the Qur'an and the nuances of the values of Islam?" get 85% of students answer "no". Based on the results of the questionnaire response that the teaching materials used are still far from the needs of students, so the need to develop new teaching materials such as modules.

Student analysis was conducted to find out expectations regarding teaching materials that must be developed. Questionnaire preliminary study No. 6 provides an overview of researchers regarding student expectations for desired learning resources. On average students expect innovation in learning resources that are easier to understand, detail, attractive design, book size is not too thick, contains steps to solve problems, is associated with the application of daily life, and contains verses from the Qur'an.

Task analysis is done by identifying the main material that needs to be taught, collecting and selecting relevant material. The material presented is derivative applications with sub-material including maximum and minimum values, monotonicity and sunken, local extreme values and extreme values at open intervals, drawing sophisticated graphics, average value theorems for derivatives, and applying derivative concepts in economic problems.

Concept analysis depends on the references used. In this development using references include the books Dale Verberg, Edwin J. Purcell and Steven E. Rigdon, Calculus (Ed. 9, Volume 1). Jakarta: Erlangga, 2008; Leithold, L. and E. Hutahaean. Calculus and Analytical Science in the Fifth Edition of Volume 1. Jakarta: Erlangga, 1986; Martono, K. Calculus. Jakarta: Erlangga, 1999; Purcell, Edwin J. Dan D. Verberg. Calculus and Analytical Geometry Fifth Edition Volume 1. Jakarta: Erlangga, 1987; Stewart, James. Calculus Issue 4: Volume 1. Jakarta: Erlangga, 2002; and the book Dale Verberg, Edwin J. Purcell and Steven E. Rigdon, Calculus Eighth Edition Volume 1. Jakarta: Erlangga, 2004. Other sources of support are books written by Ar-Rifa'i, Muhammad N. Ease from Allah summary of Tafsir Ibn Kathir Volume 2. Jakarta: Gema Insani, 1999; the success of the Research and Development Al-Qur'an Mushaf and the Ministry of Religion Ministry of Religion. Brief Interpretation of Al-Karim Volume 1 and Volume 2. East Jakarta: Lajah Pentashihan Mushaf Al-Qur'an, 2016.

Specific instructional objectives, students can determine the maximum and minimum values, determine the value of monotony and sunken, determine extreme local values and extreme values at open intervals, draw sophisticated graphics, understand the average value theorem for derivatives, and students can apply the concept of derivatives in economic problems.

2. Design

The design phase is done by media selection, format selection, and initial design. The researcher used Microsoft Word 2007 in making modules, Geogebra application for drawing curve images, Equation and symbols to write mathematical formulas, and using Corel Draw X4 for making covers.

The format selection in the preparation of modules is adjusted to the material sub-section, using B5 paper, top margin 2.54; left 4; bottom 2.54; and right 2.54, space scale 1.15. Fonts used are

Times New Roman, Matura MT Script Capitals, Monotype Corsiva, and Traditional Arabic and use 14 font sizes for sub-tab titles, 12 for material content, and 14 for Arabic writing. The verses of Al-Qur'an are included through the available Add-Ins program.

The initial product design consists of the front cover and back cover, the module developer team page, introduction, and table of contents. In the module consists of an introduction, learning objectives, activity instructions, learning activities, inventors, calculus. The learning activities in the module contain the steps of learning contextual teaching and learning namely constructivism, questioning, inquiry, learning community, modeling, reflection, and authentic assessment; problem exercises, answer keys, and bibliography. Modules developed contain verses of the Qur'an relating to derivative applications in daily life and stories of Muslim scientific figures and Muslim inspirational figures in modeling as user motivation.

3. *Development*

The development stage is in the form of appraisal of experts with improvements given and product trials to determine the level of product attractiveness. The expert assessment was carried out on three fields, namely material experts with 2 validators, religious experts with 2 validators, and media experts with 1 validator. The criteria in determining the validator are adjusted with experience in their field. The assessment phase is carried out to find out success in product development and for better module repairs. The results of the assessment of experts in stage 1 are presented in Table 5 as follows,

Table 5 Expert Validation Result at Stage 1

Experts	Score	Criteria
Material Expert	3,53	Highly Feasible
Religious Expert	3,30	Highly Feasible
Media Expert	3,88	Highly Feasible

Based on the results of the assessment the experts in Table 5 state that the products developed have been in the very feasible category but some of the improvements provided by experts. The researcher fixes the module in accordance with the suggestions and input provided by experts to produce better products. The results of the assessment after repairs are shown in Table 6 as follows,

Table 6 Experts Validation Result at Stage 2

Experts	Score	Criteria
Material Expert	3,90	Highly Feasible
Religious Expert	3,88	Highly Feasible
Media Expert	3,96	Highly Feasible

The results of the assessment in stage 2 are better than in stage 1 as evidenced by the score increasing in stage 2. In stage 2 there has been no rediscovery of the improvement notes from the validators, so the expert assessment stage stops at stage 2 and the developed module is appropriate for use.

Advice from experts is followed up by the researcher as a form of improvement on the product being developed. Following are the improvements made by the researcher regarding the suggestions/inputs provided by the material experts.



Figure 3 Improvements in Scientific Status

Figure 3 shows an improvement in the status of scientists from calculus inventors to being inventors of derivative concepts. Repairs carried out by researchers at the suggestion of material experts on aspects of the quality of content.

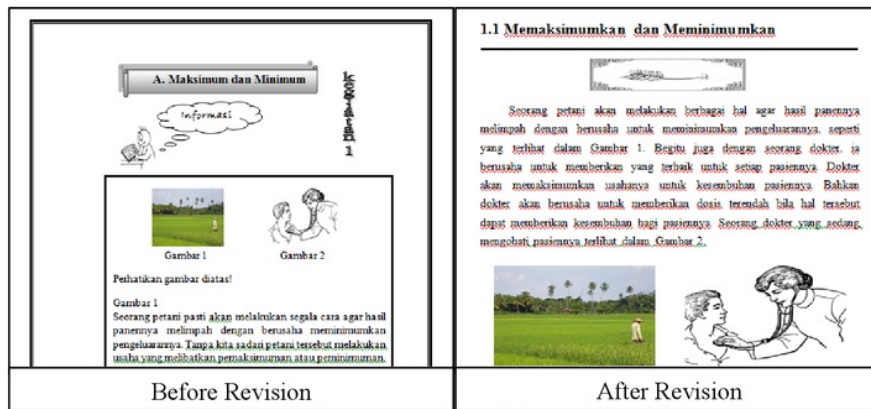


Figure 4 Improvements in the Presentation of Material

Based on Figure 4, improvements are made to the presentation of material. Improvements are made to facilitate the understanding and flow of the story more regularly. Repairs are carried out on the advice of material experts.

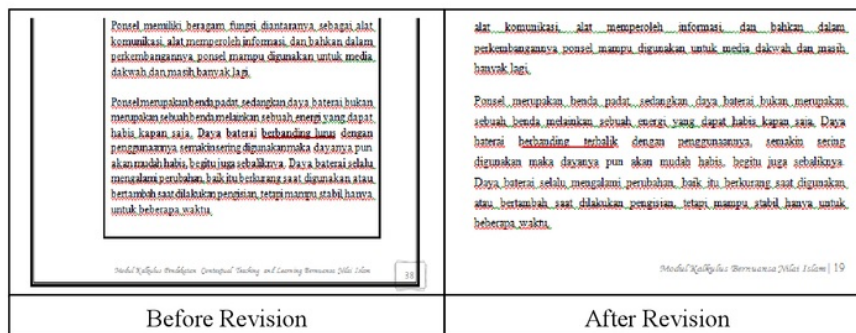


Figure 5 Improvements in the Reverse Material Concept

Based on Figure 5 shows an improvement in the inverse concept. The inverse concept is directly proportional to the revision, then changes to inversely after revision. Improvements were made to input from material experts.

<p>1. Fungsi Polinomial Polinomial derajat 1 atau 2 mudah untuk digambar grafiknya, yang berderajat 50 hampir mustahil. Jika derajatnya sedang, misalnya 2, sampai 6, kita dapat menggunakan alat-alat kalkulus dengan banyak kemungkinan.</p> <p>Contoh 1</p> <p>Sketsakan grafik $f(x) = \frac{3x^2 - 24x^2}{32}$</p> <p>Penyelesaian</p> <p>Karena $f(-x) = -f(x)$, maka f adalah fungsi ganjil. Oleh karena itu, grafiknya simetri terhadap titik asal. Dengan menetapkan $f(x) = 0$, kita temukan pepotongan sumbu-x adalah 0 dan</p>	<p>1.4.1 Fungsi Polinomial Polinomial derajat 1 atau 2 mudah untuk digambar grafiknya, yang berderajat 50 hampir mustahil. Jika derajatnya sedang, misalnya 3, sampai 6, kita dapat menggunakan alat-alat kalkulus dengan banyak kemungkinan.</p> <p>Contoh 1</p> <p>Sketsakan grafik $f(x) = 4x^3 - 8x^2 - 3x + 9$</p> <p>Penyelesaian</p> <p>Titik potong dengan sumbu Y, didapat jika $x = 0$, maka $f(0) = 4(0)^3 - 8(0)^2 - 3(0) + 9 = 9$ Jadi titik potong dengan sumbu Y adalah (0,9)</p>
Before Revision	After Revision

Figure 6 Improvements in Example

Figure 6 shows an improvement in the example of a change in function from the form of a fractional polynomial to an ordinary polynomial form. Improvements are made to make it easier for students to understand before completing the training given. Material expert suggestions or comments are a reference in these improvements.

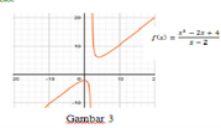
<p>$f(x) = \frac{x^2 - 2x + 4}{x - 2} = x + \frac{4}{x - 2}$</p> <p>grafik $y = f(x)$ makin lama semakin dekat ke garis $y = x$ ketika x menjadi semakin besar. Kita sebut garis ini asimtot miring untuk grafik f.</p> <p>3. Fungsi yang Melibatkan Akar</p> <p>Terdapat beraneka ragam fungsi yang melibatkan akar. Berikut salah satu contohnya.</p>	<p>$f(x) = \frac{x^2 - 2x + 4}{x - 2} = x + \frac{4}{x - 2}$</p> <p>grafik $y = f(x)$ makin lama semakin dekat ke garis $y = x$ ketika x menjadi semakin besar. Kita sebut garis ini asimtot miring untuk grafik f.</p> <p>Dengan demikian, sketsa grafik fungsi dari $f(x) = \frac{x^2 - 2x + 4}{x - 2}$ ditunjukkan dalam Gambar 3.</p> 
Before Revision	After Revision

Figure 7 Improvements in Unclear Concepts

Based on Figure 7, there is an unclear improvement in the concept so that an explanation is needed. Improvement notes from material experts before the revision is done, namely the unanswered example of the questions given, namely in the form of graphic images, then the researcher makes improvements by adding graphic images according to the functions given in the example.

Based on Figure 10, additional hadiths were performed at the end of each sub-section before the exercise was given. The addition of hadiths was done to add to the nuances of Islam and the addition of hadiths in order to motivate users who in this case were students. Improvements were made on the advice and input of Islamic scholars.

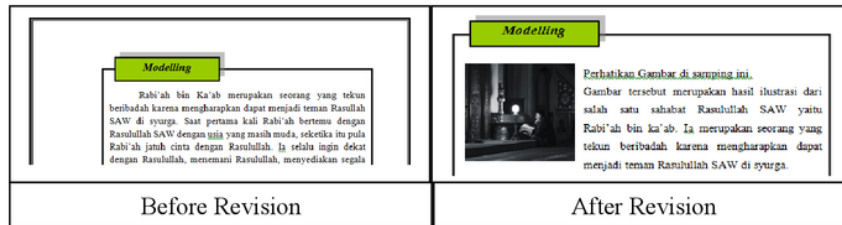


Figure 11 Improvements with Addition of Images

Figure 11 shows the modules before and after revision in the modeling phase. The improvements made in this modeling phase are the addition of images that are nuanced to add to the attractiveness of users. Repairs are carried out with the advice of Islamic scholars.



Figure 12 Font Size Revision

Figure 12 shows an improvement in font size. Improvements are made by changing the font size from 12 before revision to 18 after revision and the bold command given in verses of Al-Qur'an and hadith. Improvements were also made on the advice of Islamic scholars.

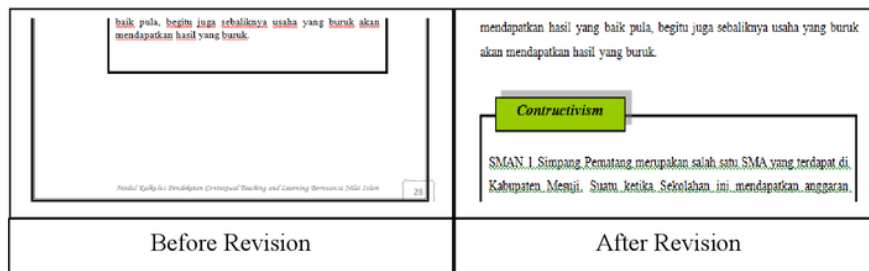


Figure 13 Improvements in Empty Space

Figure 13 shows an improvement in empty space. Improvements are made by adding sentences or adjusting the layout of the writing so that no free space is available again. This improvement is on the advice of Islamic scholars.

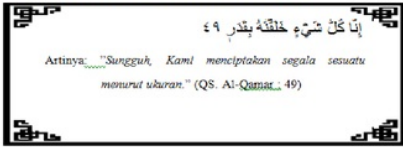



<p>membedakan. Selain itu, dari masing-masing neraca atau timbangan memiliki skala ketelitian dan kemampuan yang berbeda-beda. Hal tersebut sesuai dengan firman Allah SWT yang menerangkan bahwa Allah telah menetapkan segala sesuatu berdasarkan ukurannya masing-masing, yaitu sebagai berikut</p> <p>إِنَّا كُلَّ شَيْءٍ خَلَقْنَاهُ بِقَدَرٍ ۙ</p> <p>Artinya: "Sungguh, Kami menciptakan segala sesuatu menurut ukuran." (QS. Al-Qamar: 49)</p>	<p>berdasarkan ukurannya masing-masing, yaitu sebagai berikut</p> 
<p>Before Revision</p>	<p>After Revision</p>
<p>C. Ekstrim Lokal dan Ekstrim pada Interval Terbuka</p> 	<p>1.3 Nilai Ekstrim Lokal dan Nilai Ekstrim pada Interval Terbuka</p> 
<p>Before Revision</p>	<p>After Revision</p>
<p>10. Sebuah tangga panjangnya 5 meter bersandar pada dinding tegak, ujung atasnya bersandar pada dinding dan ujung bawahnya terletak pada lantai mendatar. Jika pada saat 3 meter dari lantai kecepatan meluncur ujung atasnya adalah 1 meter/detik, tentukan kecepatan meluncur tangga di lantai pada saat itu.</p>	<p>10. Sebuah tangga panjangnya 5 meter bersandar pada dinding tegak, ujung atasnya bersandar pada dinding dan ujung bawahnya terletak pada lantai mendatar. Jika pada saat 3 meter dari lantai kecepatan meluncur ujung atasnya adalah 1 meter/detik, tentukan kecepatan meluncur tangga di lantai pada saat itu.</p> 
<p>Before Revision</p>	<p>After Revision</p>

Figure 14 Improvements by Emerging Islamic Nuances

Based on Figure 14, improvements were made to aspects of material emphasis. Researchers distinguish writing for verses of the Qur'an with ordinary material by adding a frame that has the impression of Islam in the verse Al-Qur'an is ordinary material without frames. The researcher also made improvements by raising the nuances of the Islamic religion from the basmallah and hamdallah readings at the beginning and end of the section. Improvements were made to suggestions/input from Islamic scholars.

The following are improvements made by researchers regarding suggestions/input provided by media experts.

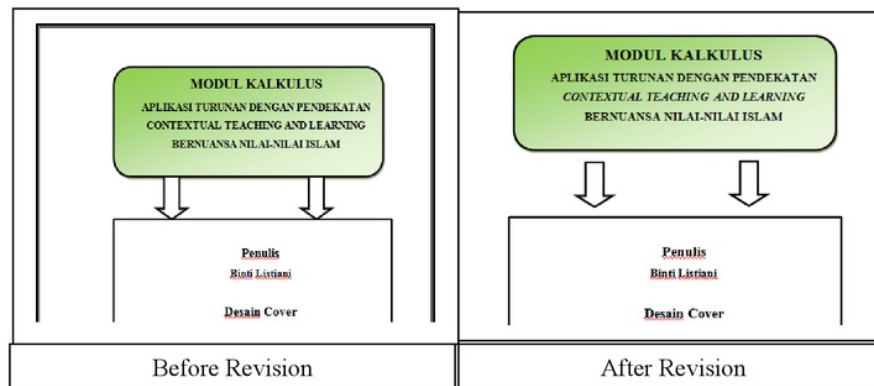


Figure 15 Improved Writing Consistencies

Figure 15 shows the improvements made by researchers on the advice of media experts on the aspect of the design of the module skin (cover). The image shows the cover in before and after revision. Improvements were made to giving italic commands in contextual teaching and learning according to the procedures for writing foreign languages and for consistency with the outer cover.

Improvements are not only given to the skin design aspects of the module (cover) but also given to aspects of the module's contents. This improvement is based on suggestions/input from media experts for a better product. Improvements in aspects of module content design are shown in Figure 16.

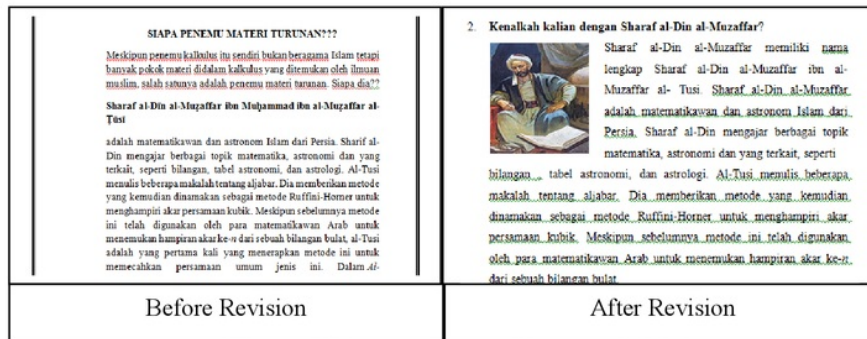


Figure 16 Improvements of Concept Additions

Figure 16 shows the addition of concepts to the module before revision by adding images of related scientists. Additions are made with the aim that the concept is presented in full and introduces Islamic scientific scientists and their stories to users. Improvements were made on the advice and input of media experts.


 <p style="text-align: center;">Kata Pengantar</p> <p>Segala puji bagi Allah SWT yang telah memberikan hidayah dan karunia-Nya kepada penulis sehingga penulis mampu menyelesaikan modul kalkulus aplikasi turunan dengan pendekatan <i>contextual teaching and learning</i> bernuansa nilai-nilai Islam yang disusun sebagai petunjuk kegiatan pembelajaran dengan baik dan lancar. Modul kalkulus aplikasi turunan dengan pendekatan <i>contextual teaching and learning</i> bernuansa nilai-nilai Islam dapat digunakan untuk pembelajaran, baik di dalam kelas maupun di luar kelas.</p>	<p style="text-align: center;">KATA PENGANTAR</p> <p>Segala puji bagi Allah SWT yang telah memberikan hidayah dan karunia-Nya kepada penulis sehingga penulis mampu menyelesaikan dengan baik modul kalkulus aplikasi turunan dengan pendekatan <i>contextual teaching and learning</i> bernuansa nilai-nilai Islam yang dapat digunakan sebagai petunjuk kegiatan pembelajaran, baik di dalam kelas maupun di luar kelas.</p>
<p>Before Revision</p>	<p>After Revision</p>

Figure 17 Improved Correct Sentence

Based on Figure 4.30, improvements to the correct sentences are made more solid and clear but do not change the meaning. These improvements are based on suggestions/input from media experts on the design aspects of the module contents. Improvements are made to products that are better and more feasible to use.

Product testing to determine the level of attractiveness is done after all suggestions/inputs from experts have been corrected until there are no more improvements. A limited trial was conducted for students with 15 students in the mathematics education department of UIN Raden Intan Lampung who had graduated or was taking calculus using a purposive sampling technique. The results of the student assessment responses related to the module developed obtained the final average score of 3.35 with the criteria "very interesting". This means that the module can be used as a tool for learning activities when viewed in terms of attractiveness.

4. Disseminate

Modules are said to be feasible and interesting based on the development stage, then continued at the final stage, namely the distribution stage. The module that has been developed has been carried out with dissemination through the website at www.pspm.tarbiyah.radenintan.ac.id.

Research and development carried out by previous researchers mentioned in the introduction produce products that are valid, practical, effective, and interesting. Likewise, the research conducted by researchers at this time is to produce a product in the form of a basic calculus module, a derivative application with a contextual teaching and learning approach with nuances of decent and attractive Islamic values. This study has differences with previous research, both from the Islamic religious values, the approach used, the subject matter discussed, and the products developed.

4. Conclusion

The research and development carried out resulted in a product in the form of a basic calculus module derived from the application of contextual teaching and learning with nuances of Islamic religious values using the 4D development model pioneered by Thiagarajan with four steps, namely define, design, development, dissemination. Based on the final assessment from experts and students that the module is feasible and interesting to use. This research needs to be resumed to find out the effectiveness of the modules developed in order to produce more qualified modules. Hopefully, this research can be useful and become a reference source for future research.

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