Development of Science Teaching Modules in Class IV Elementary School Independence Curriculum

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Abstract. Research on the development of science teaching modules and data processing is designed to be more practical, effective, and easy to understand for fourth grade elementary school students using the ADDIE model development method. The types of data in this study were: content validation, design validation, student and teacher response questionnaires, and written tests of learning outcomes. The analysis technique uses descriptive analysis then the data is processed by being converted using a predetermined formula. The results of content validation from experts after being converted to the achievement level table obtained 89.09%. The design validation results from experts after being converted with the achievement level table obtained 86.49%. The results of field trials after being converted with the achievement level table obtained 91.81%. While the written test results obtained completeness of 29 children with a percentage of 90.625% of 32 children. From the data and analysis that has been done, it can be concluded that the results of the development of the IPAS teaching module for grade IV Semester II Elementary Schools can be used as a teaching module.

Keywords: Teaching Module, Science, Independent Curriculum.

1. INTRODUCTION

The driving school program is carried out through the independent curriculum where the curriculum applied to the driving schools is a refinement of the 2013 curriculum, namely the independent curriculum. The independent curriculum is designed so that students, teachers and educational units are free to innovate in an effort to foster lifelong learning in accordance with the Pancasila Student Profile. The Independent Learning Curriculum with the concept of teachers as educators is able to build learning that focuses on developing basic competencies and student characteristics [1].

Natural Sciences is a subject in elementary school in the Merdeka curriculum which is a combination of Natural and Social Sciences [2]. In the Merdeka IPAS curriculum the aims are to develop interest and curiosity, play an active role, develop inquiry skills, understand oneself and the environment, and develop knowledge and understanding of the science concept [3]. Thus in this curriculum students are no longer the object of learning, but students are the subject of learning. Therefore the teacher must be able to prepare and plan lessons that can develop students' understanding and process skills. All of that can be realized if the teaching module is adequate when learning takes place.

Current learning must be innovative, interactive, and able to develop students' basic competencies [4]. Teachers can innovate when teaching with learning media as teaching modules that interest students. Teachers can also design learning that provides opportunities for students to actively interact, communicate well with fellow students or with educators. Teachers are also expected to have sufficient knowledge and understanding of learning media before being implemented in the learning process [5]. A good curriculum is a curriculum that can be applied according to the times, a curriculum that is adapted according to the context of the needs of students according to their nature and in accordance with current life trends. In the driving school curriculum there is a change in the naming of the Learning Implementation Plan (RPP) to Teaching Modules. The module is one type of printed teaching module. The difference between the module and the printed teaching module is that in the
module students can learn independently and contain concepts of teaching materials that students can learn from Deviana [6]. With appropriate activity and technology designs, science learning can be used to develop 21st century skills in students [7]. Activity designs like this can be embedded into various types of teaching modules, one of which is a teaching module.

Teaching modules have an important role in developing 21st century skills for students in science learning apart from being a source of independent learning for students. Febriana et al, has a key role in helping teachers design learning [8]-[9]. The form of teaching modules that are packaged as a whole and systematically, includes a set of planned learning experiences, designed to assist students in mastering specific learning objectives [10], effective teaching modules to improve creative thinking skills, communication and collaboration [11]. The quality of the developed teaching modules is measured based on the criteria of validity, practicality and effectiveness. Study instructions, competencies to be achieved, supporting information, exercises, work instructions and evaluations [12]. The advantages of the module are that students achieve their learning goals well in a time that suits their speed and abilities, students are motivated to more actively participate in learning, modules are made with patterns that suit the abilities of students Evitasari [13]. The drawbacks are that it contains elements of verbalism, requires high concentration, hard work in absorbing material, the presentation is static and cannot be changed. This teaching module was created as an implementation of the flow of learning objectives developed from learning outcomes.

Based on these problems, the teacher must be able to create an interesting learning module, one of which is through the Development of Science Teaching Modules in the Merdeka Curriculum that are appropriate and support the implementation of the Merdeka curriculum.

2. METHOD

This development research is the development of class IV science teaching modules in semester II. This research was conducted in January - March 2023 at SDN Karangsari 05 Cilacap with 32 class IV students as subjects.

According to Sugiyono which states that development research is a research method used to produce certain products with certain stages and through expert tests and tested in the field to determine the effectiveness of the products being developed [14]. The research and development method used is to develop science modules and data processing for class IV SD.

According to Tegeh, who stated that the research and development carried out was the development of the Science Teaching module using the ADDIE development model. The ADDIE development model is a development model with stages starting from needs analysis, product design, teaching module development, field implementation, and evaluation. With these stages the teaching modules developed are adapted to the characteristics of students. In line with this opinion, Aldoobie stated that the development of teaching modules using the ADDIE model is the most commonly used teaching module development model [15]. Using the ADDIE model in developing teaching modules will provide convenience in developing more effective and efficient products. In the ADDIE model, the goals for developing teaching modules can be developed, the contents and materials for teaching modules can be developed, and a more effective learning process implementation plan can be developed.

The development of teaching modules using the ADDIE model consists of five stages, namely the analysis stage, the design stage, the development stage, the implementation stage, and the eValuation stage.

The analysis stage (Analyze), according to Aldoobie, states that the analysis stage is the most important stage in the teaching module development process [15]. The first step is to make learning module development goals by carrying out the analysis stage before planning, developing, or even implementing. This is to facilitate the development steps so that it will be more time efficient. At this stage what is done is to identify the needs of students for teaching modules. Analysis of identifying needs includes identifying problems, identifying teaching modules that are suitable for students, and designing teaching modules to be developed. Identification of the problem is identifying the teaching modules that have been used in the learning process. From the identification of existing teaching modules, it will be known the weaknesses of the existing teaching modules so that it has an overview of teaching materials that will be developed in the learning process to achieve competency. From problem identification, one of the stages is curriculum identification. In identifying the curriculum that
is carried out is competency mapping from graduate competency standards, core competencies, basic competencies, indicators, and learning objectives.

The design stage, according to Woo, states that at this stage, it is clear to us that we must identify the strengths and weaknesses in our syllabus [16]. At this stage what is being done is to design a teaching module for spatial materials and class IV IPAS data processing. Some of the studies at the development stage of this teaching module are one of which is a curriculum study which includes a study of basic competencies, indicators, learning objectives, materials, and self-test exercises. From the learning objectives, it is hoped that the learning process will have a direction so that students can achieve the specified competencies. In the development of this teaching module, geometric material and data processing are presented in order to build thinking, so that students can understand the concept of the material and can solve problems and apply them in everyday life.

The development stage (Development), at this stage is the stage for creating, developing, modifying, and conducting field trials of teaching modules. The stage of making teaching modules is based on the results of the analysis stage and the design stage. According to Alodwan & Almosa, which states that the development stage begins with the production and testing of program methodologies [17]. Researchers utilize the data collected from the previous two stages to develop teaching modules that suit the needs of students.

Data processing The developed class IV Science Science teaching modules were tested on students, and validation was carried out by experts, namely material content experts, and design experts. In developing teaching modules, the development activities (develop) that are carried out are developing teaching modules based on the analysis and design stages. Furthermore, the teaching modules that have been developed are submitted for validation of the content of the material by experts or experts. Things that are validated for the contents of the teaching module material include the components of the material content and presentation, the language components and presentation, and the components of pictures, graphs and diagrams and their presentation. After the teaching module has been validated by the expert or experts, the contents of the material are then submitted for validation of the design or design by the expert or experts. Things that are validated by experts or experts include design or design components starting from the title page, each chapter's page, the basic competency framework, material summaries, student worksheets, and end-of-chapter exercises. From the results of validating the contents of the material and the design or design by the expert or experts, then a revision of the teaching module is carried out based on input from the expert or experts.

The implementation stage, the implementation stage is the field trial stage of the teaching modules being developed. According to states that at this stage is the implementation stage in the field in the learning process of the teaching modules being developed [18]. At this stage what must be prepared are three main steps, namely preparing teachers who will use the developed teaching modules, students who will be given the learning process with the developed teaching modules, and preparing the learning environment. With this preparation, learning activities can be carried out more actively, effectively and authentically.

The teaching modules that have been developed are class IV science and data processing modules. Furthermore, the teaching module is implemented in the learning process by conducting field trials. The steps taken in the field trials are preparing teachers and classes to be used for learning using the teaching modules that have been developed. During the learning process, learning models and methods refer to teaching modules with a scientific approach so that the effectiveness of learning can be known.

The evaluation stage (Evaluation), according to Aldoobie, states that the evaluation stage is the final stage of developing teaching modules with the ADDIE model [18]. At this stage it is very important to evaluate all the stages that have been carried out to find out that the teaching modules developed are in accordance with the objectives of developing teaching modules and in accordance with the needs of students. From the results of the evaluation, a revision of the teaching module was then carried out based on the results of the analysis from the previous stage.

To measure the validity, practicality, and effectiveness of the developed teaching modules, instruments were developed to measure this. The instruments compiled and used to measure validity, practicality, and effectiveness consist of: 1) validation sheets, 2) teacher response questionnaires and student responses, 3) learning implementation sheets, and 4) learning achievement test sheets. To
analyze the trial data of teaching modules that have been developed, descriptive statistical analysis techniques are used.

The data obtained in the assessment sheet is in the form of qualitative data in the form of a score, for this reason an analysis is carried out in the form of quantitative data. To analyze the data by changing qualitative data into quantitative data using a Likert scale, as shown in the table below.

Table 1. Score Classification (Likert Scale)

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good/Fair (SB)</td>
<td>5</td>
</tr>
<tr>
<td>Good/Suitable (B)</td>
<td>4</td>
</tr>
<tr>
<td>Fairly Good/Suitable (C)</td>
<td>3</td>
</tr>
<tr>
<td>Not Good/Appropriate (K)</td>
<td>2</td>
</tr>
<tr>
<td>Very Poor/Appropriate (SK)</td>
<td>1</td>
</tr>
</tbody>
</table>

1) Calculate the percentage score by comparing the total score of the assessor with the total ideal score multiplied by 100%. The formula according to Arifin (Mulyatiningsih, 2011) is as follows:

\[ P = \frac{\sum R}{N} \times 100\% \]

Information:
P = Percentage score  
SR = Sum of score answers from assessors  
N = Ideal score  

2) Convert the average score from qualitative to quantitative according to the assessment aspect. The validity criteria used are classified in the table below.

Table 2. Level of Achievement with a Scale of 5

<table>
<thead>
<tr>
<th>No</th>
<th>Level of Achievement</th>
<th>Qualification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>81 - 100%</td>
<td>Very good</td>
<td>Very decent, very valid, and not revised</td>
</tr>
<tr>
<td>2</td>
<td>61 - 80%</td>
<td>Good</td>
<td>Appropriate, valid, and not revised</td>
</tr>
<tr>
<td>3</td>
<td>41 - 60%</td>
<td>Pretty good</td>
<td>Inadequate, less valid, and revised</td>
</tr>
<tr>
<td>4</td>
<td>21 - 40%</td>
<td>Not good</td>
<td>Unfit, invalid, and revision</td>
</tr>
<tr>
<td>5</td>
<td>&lt; 20%</td>
<td>Very Less Good</td>
<td>Very unfit, very invalid, and revision</td>
</tr>
</tbody>
</table>

(Arikunto, 2010)

In this development, teaching modules are said to be valid at least meet good qualifications.

3. RESULT AND DISCUSSION

Based on the objectives of the research and development of this module, the development of contextual-based teaching modules with a scientific approach was carried out. The development of teaching modules that is carried out is the development of quality, valid, practical, and effective teaching modules using the ADDIE model.

The stage of analysis (analyze), at this stage is to analyze the independent curriculum in accordance with what is in effect and carry out curriculum planning including the elaboration of indicators, planning lessons, compiling material frameworks, and compiling evaluations that can be realized in Learning Implementation Plans (RPP).

In general, the characteristics of class IV students at SDN Karangsari 05 Cilacap still experience difficulties in understanding science and data processing. So far, in the process of learning the material, they only memorize science concepts so that they finish that science is not related to real life.
At the design stage (Design) is to make an initial design of teaching modules. At this stage, the design of teaching modules is carried out by creating a framework, compiling content, and assessing instruments.

a. Material Content Test Results By Experts

The development draft as the initial product of the development of science learning modules in class IV semester II which has been completed is submitted to experts to be tested for feasibility. Dr. Dr. was used as a material content expert to assess this development product. Sungkowo Edy Mulyono, S.Pd., M.Si. He is a lecturer at the Postgraduate Program and also PGSD Semarang State University. In this case the methods used to collect data are validation sheets, interviews, and discussions with content experts.

Based on the results of the content expert's validation assessment in the form of a score, then the score data is processed by calculating the proportion of the score by means of the total score obtained from the validation assessment by the expert compared to the ideal total score for the validity of the material content multiplied by 100%. The formula according to Arifin (Endang: 2013) is as follows:

\[ P = \frac{\sum R}{N} \times 100\% \]

Information:
P= Percentage score
SR = The total score of the answers from the assessor
N = ideal score

The total score obtained from the validation results of the content expert's assessment is 49 out of an ideal score of 55. The score data is processed in the form of a percentage using the formula above to obtain 89.09%.

After the score data is processed, then converting the qualitative average score into a quantitative value according to the assessment aspect. From the score obtained, it is then adjusted to the validation criteria in the score table, the score of 89.09% is included in the very good category so that this learning teaching module does not need to be revised and is very feasible or very valid for use in class IV students at SDN Karangsari 05 Cilacap.

b. Design Test Results By Experts.

After testing the content of the material by the expert, the development product for class IV science teaching modules was submitted for design testing by the expert. The expert on the design of the IPAS teaching modules to assess this development product was Prof. Dr. Supriyadi, M.Sc., he is a lecturer at the Postgraduate Program and also the PGSD of Semarang State University. In this case the methods used to collect data are validation sheets, interviews, and discussions with design experts.

Based on the results of the design expert's validation assessment in the form of a score, then the score data is processed by calculating the percentage of the score, namely by means of the total score obtained from the validation assessment by the expert compared to the ideal total score for design validity multiplied by 100%. The formula according to Arifin (Endang: 2013) is as follows:

\[ P = \frac{\sum R}{N} \times 100\% \]

Information:
P= Percentage score
SR = The total score of the answers from the assessor
N = ideal score

The score obtained from the results of the expert design assessment is 160 out of an ideal score of 185. The score data is processed in the form of a percentage using the formula above to obtain 86.49%.

After the score data is processed, then converting the qualitative average score into a quantitative value according to the assessment aspect. From the score obtained, it is then adjusted to the validation criteria in the score table, the score of 86.49% is included in the very good category so that this learning teaching module does not need to be revised and is very feasible or very valid for use in class IV students at SDN Karangsari 05 Cilacap.

c. Field Trial Results

After the product development for class IV science teaching modules was validated by experts, namely validation of material content and design, then the product development for class IV science teaching modules was carried out field trials in the science learning process, namely teacher and student responses.

In this case, 32 students and class IV students at SDN Karangsari 05 Cilacap as students and fellow teachers in class IV.

Based on the results of the field test in the form of a score, then the score data is processed by calculating the percentage of the score by means of the sum of the scores obtained from teacher and student assessments compared to the ideal score multiplied by 100%. The formula according to Arifin is as follows [19]:

\[ P = \frac{\sum R}{N} \times 100\% \]

Information :
P= Percentage score
SR = The total score of the answers from the assessor
N = ideal score

The score obtained from the results of field trials is 1,767 from an ideal score of 1,920. The score data is processed in the form of a percentage with the above formula obtained at 92.03%.

After the score data is processed, then converting the qualitative average score into a quantitative value according to the assessment aspect. From the score obtained, it is then adjusted to the validation criteria in the score table, the score of 92.03% is included in the very good category so that this learning teaching module does not need to be revised and is very feasible/very valid for use in class IV students at SDN Karangsari 05 Cilacap.

Writing Test Results

At the end of the use of class IV science and technology teaching modules after field trials in the learning process, a written test was carried out. This written test aims to determine the level of student mastery of the material using this teaching module. KKM IPAS in class IV SDN Karangsari 05 Cilacap is 75, while the author's stipulation is that as many as = 80% of students who have completed the use of this teaching module are said to be good. After the written test was carried out, the completeness result was that there were 29 children out of 32 children who completed, which means that 90.625% of the children completed. From the results of this completeness, the Science Science teaching module is very feasible or very valid for use in class IV students at SDN Karangsari 05 Cilacap.

Based on the results of the data analysis that the researchers had done, the validation results from the material content expert got a score of 49, then the score was processed and
obtained 89.09%. The percentage data is converted to a table of achievement levels in the very feasible or very valid category. The validation results from the design or design expert got a score of 160, then the score was processed and obtained 86.49%. The percentage data is converted to a table of achievement levels and in the very feasible or very valid category.

After being revised, a field trial was carried out in class IV science learning at SDN Karangsari 05 Cilacap. The score obtained from the field trial was 1,767, the score was processed in the form of a percentage obtained at 92.03%. The percentage data is converted to a table of achievement levels and in the very feasible or very valid category. From the results of these percentages, the average yield is 89.203%. The percentage is converted to a table of achievement levels and in the very feasible or very valid category.

Then a written test was carried out, from the written test conducted on 32 students in class IV as many as 32 children, the written test results were obtained as follows: the average score was 82.97, and the highest score was 96, the lowest score was 73. Meanwhile, the number of students who scored = 75 or complete is 29 children out of a total of 32 children so that the percentage of completeness is 90.625%. From the analysis of the data from the written test results, the developed teaching modules are suitable for use in science learning.

According to Setiyadi, which states that teaching modules that have been validated by experts and declared to meet validity standards or are very valid, these teaching modules are suitable for use in the learning process [20]. Furthermore, according to Setiyadi states that the instrument developed for validation meets the validity standard if it is developed based on theoretical rational studies and internal consistency [20]. Furthermore, these instruments can be used for validation so that the results of the validation will meet the standard validity criteria.

According to Zulkifli, Razak, & Mahmood states that the module is made with the aim of: 1) this module is suitable for the target population; 2) this module can be implemented properly; 3) the module is appropriate for the allotted study time; 4) this module can improve reasoning; and also 5) this module can build critical thinking [21]. In another study, Woo stated that it is very important to make improvements to teaching modules based on the results of revisions at the previous stage so that the teaching modules developed are more perfect so as to improve the quality of learning and in accordance with learning objectives [16].

According to Van den Ham & Heinze states that the development of teaching materials in accordance with learning objectives has a very important impact on student achievement [22]. The results of another study by Alodwan, et al state that the development of teaching modules using the ADDIE model can provide hands-on learning, provide learning experiences, increase learning motivation, increase learning achievement, and build active interaction [23]. According to Aldoobie states that in order to develop teaching materials that are effective, interesting, efficient, in accordance with student needs, improve learning achievement, and improve the quality of learning development steps starting from analyzing student needs to evaluating learning outcomes must be carried out honestly to get desired result [18].

The results of research from Arfiliana, et al which state that the development of teaching modules is a medium for presenting messages, building more effective learning interactions, and increasing learning achievement [24]. Teaching modules that are developed according to the needs and characteristics of students have an impact on the development of thinking and student achievement. According to Kurniasih, et al stated that the development of teaching modules can increase the level of thinking and student achievement [25].
4. CONCLUSION

Based on the results of the researcher's analysis of the validation results of material content experts, design experts or teaching module designs developed in the very feasible category. The results of field trials of teaching materials developed can make students interested, motivate learning, and have very good responses so that they are in the very feasible or very valid category. The results of written tests can improve student learning outcomes. From this description, the Class IV Science Teaching Module for elementary schools is very feasible to use in the learning process. Suggestions for developing teaching materials further, to develop this product to be better then in the next development to pay attention to curriculum development.

5. REFERENCES


Author declaration

Author contributions and responsibilities
The authors made major contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.

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