The Effectiveness of Natural Science Modules Based on Guided Inquiry Method in Elementary School Learning

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Abstract: This research is kind of development research (Research and Development) which aims to determine the effectiveness of natural science modules based on guided inquiry method that is developed. The development of natural science modules use ADDIE theory (Analyze, Design, Development, Implementation, and Evaluation). Analyzing data using descriptive qualitative technique that expressed in students score and score scale category. This development research produces products that meet the eligibility requirements with the results of the validation of the material declared very effectivity and the designer is effective and the linguist is declared suitable at this theory. The results are students give a good response of natural science module based on guided inquiry method while the teacher gives a good response on it and the method is effective.

1. Introduction

Natural Sciences is a theoretical knowledge that is obtained / arranged in a special / specific way, namely conducting observation of experimentation, inference, preparation of theory, experimentation, observation and so on linking between one way to another [1]. The learning process of science in schools emphasizes providing direct experience to develop the potential for scientific exploration and understanding of nature. Various problems in the implementation of science education that are in accordance with their nature are very complex, therefore thoughts are still being contributed to solving those problems. Science education is faced with problems between science learning tools that are able to integrate various disciplines through certain themes, between concepts in one subject with other subjects, so that teachers and students have the competency to equip competencies in various scientific disciplines.

One of the learning resources that are needed in the implementation of science learning in elementary schools is teaching materials in the form of science modules which are appropriate to the material students will learn in order to achieve the learning objectives. Modules were developed because in the preparation of modules more relative compared to other learning media such as the preparation of audio media, visual media and audiovisual media. It is said that the module arrangement is more relative, because the module preparation is relatively more practical and is able to make language according to the language and age of students and can be adapted to the existing curriculum.

Modules are developed and written so that students can learn on their own with or without a teacher. Modules can be used as a substitute for teacher functions. The modules developed can
adapted to individual student differences, namely regarding learning activities and learning material. Learning with modules highly values individual differences. According to [2], learning modules are systematically compiled and interesting teaching materials that cover material content, methods and evaluations independently to achieve the expected competencies. By using modules students will have more curiosity when learning science because the module contains a number of materials that can help students directly investigate the problems indicated in the problems students will be working on. With the module students can study on their own without the help of a teacher.

The Natural Sciences module to be developed should be carried out in guided inquiry to foster the ability to think, work and be scientific in the environment of students. In guided inquiry, the teacher directs students to a problem and students are able to solve the problem without guidance from the teacher, with guided inquiry guidance students can certainly be more concentrated to build new knowledge so as to get the understanding and skills needed in the inquiry model.

Inquiry is a technique or method used by the teacher to teach in the classroom. Inquiry is one of the learning methods used that is critical, analytical and scientific problem solving by using certain steps towards a convincing conclusion, because it is supported by data and facts. Learning in this model helps students to find identity that emphasizes more on the analytical process to find and find their own answers to a problem in question [3], stated [4] “inquiry-based learning is learning that involves students in formulating questions that lead to conduct investigations in an effort to build new knowledge and meaning”.

According to [5] guided inquiry criteria are scientific questions that will involve students, evidence obtained by students is able to be used to develop and solve problems faced, explanations are developed based on evidence obtained, evaluation of an explanation is used as an alternative that reflects scientific understanding and communicating the results obtained.

The advantages of using guided inquiry-based science modules are students can be more excited and motivated in learning and can make science as a fun learning in everyday life, students can also improve their skills in solving problems in new situations they encounter and students do not again feel that science is a complicated lesson that always uses memorization to die when doing tests at the end of the lesson.

The results of the study [6] concluded that “the guided inquiry learning model assisted by phet animation influences student activity and learning outcomes”. Furthermore, the results of the study [7] also showed that “Guided Inquiry and Multimedia-Based Student Worksheets that were developed can train students' science process skills so that students learn independently in finding answers to given problems”.

Therefore the teacher's role as a facilitator, where the procurement of modules is expected to be able to change the conditions of learning from the teacher's usual role determines what is learned to be how to provide and enrich student learning experiences in science learning. In addition, the teacher also prepares modules that are appropriate to the student's condition. The development of this module is expected to be used as an alternative to support learning.

2. Material And Methods
The subjects in this study were three expert validators (media experts, design experts, and material experts), then teachers and fourth grade students at SD Negeri 101828 Pancur Batu. Class IVA was taken by 9 students for small group tests and 3 students were taken for individual trials with varying abilities, gender and intelligence levels, while class IVB students were 20 people as samples for field trials taken in total sampling. The object of this research is the development of learning tools namely guided inquiry-based science modules on learning outcomes.

This type of research is research and development (Research and Developmental). The development model that is referred to in this research is the ADDIE development model. According to [8] the ADDIE model is "the basic stages of learning system design that are simple and easy to learn and this model, provides an extension of the ADDIE stage into a more detailed procedural guide namely: analyze, design, development, implementation, and evaluation".
The trial design of the science module for odd semester students consists of several stages: (1) validation of science subject matter experts, (2) validation of learning design experts, (3) validation of learning language experts, (4) development revision (stage I), based on an assessment in the form of input, criticism or suggestions from material experts, learning design experts and learning linguists to be improved, (5) one-on-one trial (individual) of this program based on a questionnaire filled out by 3 participants in grade IV SD Negeri 101828 Gelugur Kebun of Pancur Batu Subdistrict which has high, medium and low achievements, (6) product revision (phase II) small group evaluation of the program based on a questionnaire filled by 9 students in grade IV of SD Negeri 101828 Gelugur Kebun of Pancur Batu Subdistrict, (7) product revision (stage III), (8) field trials of 20 fourth grade students of SD Negeri 101828 Gelugur Kebun, Pancur Batu Subdistrict, (9) final revision to produce products used develop.

The research will describe the data collection techniques that will be chosen in conducting the research. The following data collection techniques that will be used in this study are: non-test techniques, interviews, questionnaire methods, observation methods. To measure the validity of the developed science modules, research instruments were arranged. The instruments developed in this trial are as follows: module validation sheet, teacher validation sheet, student response questionnaire. And the data analysis techniques are: module validity data analysis, teacher response questionnaire analysis, and student response questionnaire analysis.

3. Results and discussion
From the data obtained from the study of material experts, learning design experts and linguists as well as the results of assessment or questionnaire responses of grade IV teachers of SD Negeri 101828 Gelugur Kebun in the form of qualitative data were converted into quantitative data scores. The rules for scoring are adjusted to assessments that use a Likert scale. Then analyze each aspect, namely the components and the number of indicators and the highest ideal score. Complete media feasibility calculations can be seen in the appendix of the feasibility module based on guided inquiry.

To find out the feasibility of the guided inquiry-based science module validity testing was carried out by the material, learning design expert, learning linguist and one teacher who was included as the fourth grade guardian of SD Negeri 101828 Gelugur Kebun. Where each expert and also the teacher gives an assessment to each indicator contained in the science module validation sheet in the form of a quantitative descriptive assessment questionnaire expressed in the distribution of scores and rating scale categories.

Validation that is carried out at the validity test stage is theoretical validity, that is, validity carried out by people who are considered experts and are competent to validate and experience in their fields based on theoretical or logical considerations. There are three parts of the science module that will be validated, namely material, design, and language of learning and teacher's assessment of the science module. In the validation stage, the researcher conducts an assessment by conducting a discussion with a discussion technique by showing the initial design of the inquiry-based science module guided to the material expert, instructional design expert, linguist and class teacher response. In addition, researchers also provide a validation mark to the validator in order to obtain the validation results authentically. Experts provide an assessment on the same initial design that is valid by making revisions to certain sections. The following will be detailed for each validated section.

From the data validation results of the material expert lecturers, obtained an average total score of 86.66% with very valid criteria can be seen in table 1. the validity criteria of the IPA module are obtained by converting the total score of each first revision to the third revision in the feasibility table. Judging from the appropriateness of the content, every aspect assessed in the product developed has met the eligibility criteria because the material used is already good in accordance with IC and BC, the material is quite accurate, has good supporting material through the fluidity of the material, fulfills the feasibility aspect of presentation, and the material is presented with a guided inquiry model.

From the results of the assessment by the learning design expert, obtained an average total score of 77.66% with valid criteria. Aspects of the data can be seen in table 4.6. The validity of the Natural
Sciences module is obtained by converting the total score of each aspect from the first revision to the third revision. So it can be concluded that the science module has content that is in accordance with the science module material developed. Therefore based on data analysis conducted by the learning design expert, the natural science module developed can be said to be valid.

From the results of the assessment by learning language experts, obtained an average total score of 86 with a very valid / very decent criteria. Aspects of the data can be seen in table 4.8. the validity of the science module is obtained by converting the total score of each aspect from the first revision to the third revision. So it can be concluded that the natural science module has a language that is suitable with the natural science module material developed. Therefore, based on data analysis conducted by learning language experts, the natural science module developed can be said to be very valid. The results of the average validation in the form of a score against the assessment indicators of the inquiry-based science module based on experts are presented briefly in Table 1 and Figure 1.

| No | Validator          | Percentage | Validity   | Eligibility   |
|----|--------------------|------------|------------|---------------|
| 1  | Material Expert    | 86.66%     | Very Valid | Very decent   |
| 2  | Layout Design Expert| 77.66%     | Valid      | Worthy        |
| 3  | Linguist           | 86%        | Very Valid | Very decent   |
|    | Average            | 83.44%     | Very Valid | Very Valid    |

Figure.1 Results of Expert Validation of the Guided Inquiry-Based Science Module

Based on the tables and diagrams above the average rating of the three validators 83.44% can be stated that the natural science module that was developed is very valid and is very suitable for use in Grade IV students of SD Negeri 101828 Gelugur Kebun, because it is in accordance with the material and objectives of learning activities in theme 2 Always Save Energy in sub theme 3 about force and motion. So it can be concluded that the guided inquiry-based science module is declared to be very valid and very appropriate for grade IV elementary school students, because it successfully performs its role as a mediator, achieves the objectives of using the module, and makes it easy for students to understand and carry out the science learning process.

The guided inquiry-based science module, based on the results of the student response questionnaire, was said to be valid. The following is a recapitulation of the questionnaire responses of students from the three trials or stages of application in Table 2.
Table 2 Results Questionnaire Student Responses to the Guided Inquiry-Based Science Module

| Number | Trial       | Average | Feasibility | Information |
|--------|-------------|---------|-------------|-------------|
| 1      | Individual  | 87.50%  | Very good   | Very decent |
| 2      | Small group | 89.68%  | Very good   | Very decent |
| 3      | Field Group | 87.76%  | Very good   | Very decent |
| Average|             | 88.31%  | Very Valid  | Very decent |

The field trial involved one teacher who was included as the fourth grade guardian of SD Negeri 101828 Gelugur Kebun, by providing a teacher evaluation sheet for the guided inquiry-based science module to be filled in by the class teacher. The results of the field trials in the form of opinions and suggestions will be the basis for product revisions that will be tested at a later stage. Following are the results of the assessment sheet for the Natural Sciences module and are seen in Table 3.

Table 3. Teacher Response Assessment Results

| Indicator                                                                 | R1 | R2 | Level     |
|--------------------------------------------------------------------------|----|----|-----------|
| Compliance with the 2013 curriculum                                      | 3  | 4  | Validity  |
| Conformity of core competencies and basic competencies                   | 4  | 4  | Very Valid|
| Accuracy of learning indicators                                          | 3  | 3  | Very Valid|
| The suitability of learning outcomes                                     | 3  | 4  | Valid     |
| The truth of concepts / learning materials                               | 3  | 4  | Very Valid|
| Clarity of instructions for using the Module                             | 3  | 4  | Very Valid|
| Can be used as a guide for teachers in learning                          | 4  | 4  | Very Valid|
| Can change learning habits that are teacher-centered and student-centered| 3  | 3  | Very Valid|
| Matching material order                                                  | 4  | 4  | Valid     |
| Student involvement in learning activities                               | 3  | 3  | Very Valid|
| Student centered                                                         | 4  | 4  | Valid     |
| Conformity with learning characteristics                                 | 3  | 3  | Very Valid|
| The ability to stimulate the depth of student thinking through the depth of student thinking through personal assignments, group assignments and formative exercises | 3  | 3  | Valid     |
| The suitability of learning activities with guided inquiry               | 4  | 4  | Valid     |
Providing hands-on experience | 3 | 3 | Very Valid
---|---|---|---
Students activities that are carried out encourage students to conclude the concepts and facts that have been learned by students. | 4 | 4 | Valid
Practical activities / experiments are easy to carry out | 3 | 3 | Very Valid
The subject matter is in accordance with the allocation of time in school | 3 | 3 | Valid
Linkages between learning activities | 4 | 4 | Valid
The grading instructions used are easy to understand, precise and clear | 3 | 3 | Very Valid
Measuring cognitive, affective and psychomotor abilities | 3 | 4 | Valid
Measuring achievement indicators of learning success | 3 | 4 | Very Valid
The suitability / accuracy of the illustrations with the material | 4 | 4 | Very Valid
Presentation of text, tables, figures and attachments accompanied by references / sources of reference | 3 | 4 | Very Valid
Balance between text and illustration | 3 | 4 | Very Valid
Glossary clarity | 3 | 4 | Very Valid
The accuracy of color selection in the image | 3 | 4 | Very Valid
Prints of images and writing clearly | 4 | 4 | Very Valid
The physical appearance of modules can encourage students’ interest in reading | 4 | 4 | Very Valid
The sentence is easy to understand and does not cause a double meaning | 3 | 4 | Very Valid
Language uses standard language | 3 | 4 | Very Valid
The language used is communicative | 3 | 4 | Very Valid
Amount | 106 | 119 | Very Valid
Average | 3.31 | 3.71 |
Percentage | 82% | 92% |
Criteria | SV | SV |

Based on the above calculation, observations made by the teacher or guardian of class IV SD Negeri 101828 Gelugur Kebun, in revision I reached 82% and revision II reached 92%. If matched with the eligibility criteria table, this score is included in the criteria are very valid or very feasible. If
it is made into a diagram then the results of the criteria for evaluating the teacher's response to the Natural Sciences module can be seen in Figure 2

Based on the assessment given by the validator and also the assessment given by the class teacher to the guided inquiry-based natural science module that was developed as well as the suggestions and input provided by material experts, design experts, linguists, class teachers, and student response questionnaire, it can be concluded that the science module is based the guided inquiry developed is said to be very valid or very feasible to use in learning.

4. Conclusion

The conclusion of this research is based on the findings from research data, the systematic presentation is carried out with due regard to the research objectives that have been formulated. The conclusions obtained include:

The feasibility of the guided inquiry-based module developed based on the results of validation has a high degree of validity. Based on the results of the study, critics and material expert suggestions obtained a percentage of validity reaching 86.66%, learning design experts obtained a percentage of validity reaching 77.66% and linguists obtained a percentage of 86%, based on the validation results the guided inquiry-based modules were developed in. very valid criteria or very feasible to use in learning in elementary school.

Assessment based on questionnaire responses of grade IV students at SD Negeri 101828 Gelugur Kebun on the guided inquiry-based science module in individual trials obtains a percentage of 87.50%, in small group trials obtains a percentage of 89.68%, and in field trials obtains a percentage of 87.76%. Based on the validation result data, the guided inquiry-based module that was developed entered into very valid criteria or very suitable for use in learning in elementary schools.

The grade teacher / grade IV guardian grade at SD Negeri 101828 Gelugur Kebun on the inquiry-based science module obtained a percentage of validity reaching 82% and 92%. Based on the validation result data, the guided inquiry-based module that was developed entered into very valid criteria or very suitable for use in learning in elementary schools.

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