The Development of Science Student Worksheet for Elementary Student Grade IV Based on Scientific

S J Lubis¹, F Harahap² and D Saragi²

¹Student Postgraduate of Basic Education State University of Medan
²Lecture Postgraduate State University of Medan

E-mail: syibrinajihanlbs@gmail.com, fauziyahharahap@gmail.com

Abstract. The research is a type of research and development that aims to determine the validity and response of students and teachers to the science student worksheet constructed on the science approach. Science student worksheet development applies the 4-D model development procedure consist of 4 stages specifically: define, design, develop, and disseminate. The subjects of this research were IV A & IV B class at SD IT Deli Insani consist of 55 students. The data collection instruments were in the formula of assessment sheets for material authorities, learning design authorities, layout, linguists, and the response questionnaire sheets for students and teachers. This development research produces the material, learning design, layout, and language with an average percentage level 93.5% which is characterized as legitimate and suitable for usage, and get a decent response from the students reached 96.2% and with decent criteria and response teacher getting 94.9% with decent criteria. Based on expert validation, the developed student worksheets are declared suitable for use by students, especially class four. Based on the responses of students and teachers, the students’ worksheets developed received a good response so that it was stated that the worksheets were easy to understand and interesting to learn. The benefits of developing science student worksheets based on the developed scientific approach are expected to be reference materials for educators in developing student worksheets according to the needs of students and in accordance with the demands of the 2013 curriculum.

Keywords: Science student worksheet, scientific

1. Introduction

Learning in the 2013 curriculum is developing all subjects by developing numerous abilities of students, one of the abilities is to solve problems (Anas et al., 2020). In fact, the ability to solve problems is still not optimal, seen from the struggle of students’ understanding of the concept and assessment of the cognitive learning outcomes of students that students gain is not acceptable. Through the usage of the precise approach, comprehending their role, and being aware of changes in the learning process, teachers will be able to design learning as required in the 2013 curriculum, specifically realizing active learning, innovative, creative, and fun learning (PAIKEM) and a scientific approach. The scientific approach in the learning process is the characteristic of 2013 curriculum (Asmita S, et al, 2018).

Learning through a scientific approach is a learning process deliberate in such a way that students actively construct notions, laws, or principles through the stages of perceiving, formulating problems, proposing or formulating hypotheses, collecting data with numerous techniques, analyzing data,
representation conclusions, and communicating found concepts, laws, or principles (Sufairoh, 2016). Learning with a scientific approach has the characteristics of containing cognitive processes that are potential in encouraging intellectual development, especially high-level thinking skills of students, containing scientific process skills in constructing notions, laws, or principles and can develop the character of students (Kurniasih I, et al, 2014). Through a scientific approach, apart from being able to create students more active in constructing their knowledge and skills, it can also encourage students to convey investigative activities to discover facts from a phenomenon (Andriyani M, et al, 2018).

To realize learning based on the 2013 curriculum, the usage of assisting tools is also required to sustenance the learning process such as textbooks, learning media and student worksheets. The usage of student worksheet plays significant role in improving learning, this can be seen if the student worksheet used is of respectable quality. Student worksheet are sheets comprising tasks and activities that must be done by students (Poppy K D, 2009). Student worksheet also plays significant role in the learning process because it can increase the learning activities of students. In addition, usage in science learning to can assistance teachers to direct their students to discovery concepts through their own activities.

The assistance of student worksheet according to (Hidayat, 2013) are: 1) activating students in the learning process; 2) to help students in developing concepts; 3) train students to discover and develop a process skills; 4) as a guide for teachers and students to carry out the learning process; 5) assistance students to carry out notes about the material studied through learning activities; 6) to help the students to improve information about the concepts learned through systematic learning activities. Based on the outcomes of interviews and observations directed with teachers of SD IT Deli Insani Tanjung Morawa, grade IV^A and IV^B, it shows that the student worksheet used is student worksheet sold in the market so that it does not support students to be able to acquire independently and scientifically, the content of student worksheet is also frequently only a collection The questions are in the formula of multiple choices, there are no instructions on how to work on practice questions, and there is no use of color in the content display so that students are not attracted and feel bored when using them (Kartika et al. 2019; Siregar et al. 2020). Therefore, the student worksheet used is not in accordance with the needs of students.

Based on the results of interviews and observations conducted with SD IT Deli Insani Tanjung Morawa elementary school teachers, grades IV^A and IV^B show that the student worksheet used is student worksheet sold in the market so that it does not support students to be able to learn independently and scientifically, the content of student worksheet is also mostly only a collection, the questions are in the form of multiple choices, there are no instructions for working on exercise questions, and there is no use of color in the content display so that students are not attracted and feel bored when suggesting. So that the student worksheet used is not in accordance with the needs of students.

The analysis of the needs of students and teachers was carried out by allocating questionnaires. The results of the analysis of class IV^A and IV^B students show that the practice of the scientific approach in the learning process has not been maximal, the practice of numerous activity attendants is also infrequently provided by the teacher, and students sense approve that student worksheet based on the scientific approach needs to be used in learning activities, particularly in science learning.

The results of the analysis of the needs of class IV^A and IV^B teachers show that they still irregularly use transcribed attendants to carry out numerous activities during learning, the learning process with the scientific approach has not been maximally carried out, and the teacher also approves that student worksheet is used based on a scientific approach in the learning process.

Science learning is attached to how to find out about nature and systematically. Consequently, that science is not only the mastery of a collection of knowledge in the form of facts, concepts, or principles but also a process of discovery. Science can be observed from a product perspective and from an attitude knowledge perspective (Sulistyorini S, 2007). Specifically learning science has a process dimension, a result (product) dimension, and a scientific attitude development dimension.
These three dimensions are interrelated. This means that the science learning process should contain the three dimensions of science.

The explanation above is the background for the researcher to improve science student worksheet based on a scientific approach that is valid and suitable for usage in elementary student grade IV. The product is estimated to be a substitute for educators as teaching materials and can assist students to construct their own understanding through scientific learning activities. In line with research conducted by (Julianti D P., et al, 2018) which states that the development of learning materials is needed to assist the achievement of the estimated learning objectives. One of the benefits of developing student worksheets is that they can be designed according to the circumstances of students and school characteristics.

From the description above, it can be concluded that the use of student worksheet is needed in the demands of the 2013 Curriculum, therefore it is important to develop a scientific-based student worksheet. The development of this student worksheet is expected to be used as an alternative to maintenance learning, particularly for elementary student grade IV semester I (odd) in the material properties of light.

2. Method
This research is a type of research and development that acclimates the research model developed by (Thiagarajan, 1974). This model consists of 4 stages, namely define, design, develop, and disseminate. The research was conducted in the odd semester of the 2020/2021 school year.

The place for this research was at SD IT Deli Insani, Tanjung Morawa Sub-district, Deli Serdang Regency, North Sumatra. The research subjects were 27 students of SD IT Deli Insani class IV\(^A\) and 28 IV\(^B\) students. The data collection instruments in this study were in the form of material expert validation assessment sheets, learning design experts, layout experts, linguists and teacher response questionnaires for students and teachers. Data analysis techniques on the validity of student worksheet from experts are determined by the level of validity and decision making for student worksheet revision uses the following qualifications:

| Level of Validity | Qualification | Description |
|------------------|---------------|-------------|
| 81.26%<P≤100%    | Valid         | No need for revision |
| 62.26%<P≤81.25%  | Rather Valid  | No need for revision |
| 43.76%<P≤62.25%  | Less Valid    | Revision     |
| 25%<P≤39%        | Invalid       | Revision     |

Analysis of responses to the development of science student worksheet based on a scientific approach given to grade IV students (IV\(^A\) and IV\(^B\)) and grade IV teachers (IV\(^A\) and IV\(^B\)). Analysis of the responses of students and teachers using a 1-4 linkert scale. The qualification criteria for the results of students and teachers can be seen in the following table:

| Achievement Level | Criteria      |
|------------------|---------------|
| 81.26%<P≤100%    | Very good     |
| 62.26%<P≤81.25%  | Good          |
| 43.76%<P≤62.25%  | Not good      |
| 25%<P≤39%        | Not good      |
3. Result And Discussion

3.1 Research Result

This research procedure includes 4 stages, explicitly the definition stage, the design stage, the development stage, and the dissemination stage:

**Define**, at this stage what is done is to identify the problems faced by students and teachers by distributing needs analysis questionnaires. The results of the analysis of the needs of students and teachers show that scientific learning has not been maximally carried out, the use of activity guides such as experimental activity guides is also rarely done, particularly during science learning activities.

**Design**, the design of the science student worksheet is based on a scientific approach that has three main parts, specifically an introduction / pre-content section consisting of pages, introduction words, table of contents, core competencies, basic competencies, learning indicators, instructions for using student worksheet. The core/content of the material consists of learning 1 to 4, play activities while learning, summary, evaluation. The closing/post content section consists of a list of references and a biography of the author.

**Develop**, the first stages taken at this stage are to validate the original draft student worksheet that has been assembled to experts in their fields. The experts referred to are natural science material experts, learning design experts, layout experts, and linguists. The results of the science student worksheet validation assessment based on the scientific approach can be seen in the following table:

| Validator                  | Percentage | Validity   | Appropriateness |
|----------------------------|------------|------------|-----------------|
| Natural Science Expert     | 92.6%      | Very Valid | Proper          |
| Learning Design Expert     | 93.7%      | Very Valid | Proper          |
| Layout Expert              | 90.3%      | Very Valid | Proper          |
| Linguist                  | 97.9%      | Very Valid | Proper          |
| **Average**               | **93.6%**  | **Very Valid** | **Proper**     |

Based on the table and figure above, it indications that the assessment of the validate of science material experts acquires a percentage of 92.5% or is very valid so that it can be stated that science student worksheet based on the scientific approach is very valid and suitable for practice in grade IV elementary students because it is in accordance with material and science learning objectives. In the assessment of the validate, the learning design expert obtained a percentage of 93.7% or the category was very valid and suitable for use in fourth-grade elementary students because the learning design or learning steps confined in the student worksheet were in accordance with the scientific approach and in accordance with the characteristics of grade IV elementary students.

The layout expert who received a prize of 90.3% or was categorized as very valid so that it could be assessed that the Science student worksheet based on a scientific approach was very valid and commendable of use. The assessment of the linguist validates attained a percentage of 97.9% or a very valid category so that it can be stated that the science student worksheet based on a scientific approach is very valid and is used for fourth-grade elementary school because the language confined in student worksheet is very appropriate to the stages of children's language development, especially for fourth-grade elementary school, and the language used is also in accordance with the rules of good and correct Indonesian.

The average estimate of the four experts validates is 93.6% or categorized as very valid and can be stated in the science student worksheet based on a valid approach and suitable for use by fourth-grade elementary students because, in terms of material, learning design, layout, and language are appropriate with Science material for grade four elementary student, in accordance with the student worksheet function as a mediator that makes it easier for students to understand science material, in
accordance with the stages of a scientific approach, and in accordance with grade four elementary students.

The revised student worksheet was based on the suggestions and input of the four experts validates, then the student worksheet was tested on all students (grades IV\textsuperscript{A} and IV\textsuperscript{B}), and class teachers (IV\textsuperscript{A} and IV\textsuperscript{B}) SD IT Deli Insani. The results of the student and teacher questionnaire responses can be seen in the following table:

**Table 4. Students and Teachers' Responses to Science Worksheet Based on Scientific Approach**

| Respondents          | Percentage | Criteria |
|----------------------|------------|----------|
| Students class IV\textsuperscript{A} | 96,9%      | Very good |
| Students class IV\textsuperscript{B} | 96,6%      | Very good |
| Teacher class IV\textsuperscript{A} | 96,6%      | Very good |
| Teacher class IV\textsuperscript{B} | 93,3%      | Very good |
| Average              | 95,8%      | Very good |

Based on the results of the table above, the results of the response of class IV SD IT Deli Insani students, namely class IV\textsuperscript{A} reached 95.9% which means very good criteria, while in class IV\textsuperscript{B} reached 96.6% which means very good criteria. The results of the fourth-grade teacher response at SD IT Deli Insani, that is class IV\textsuperscript{A} reached 96.6% which means very good criteria, while in class IV\textsuperscript{B} it reaches 93.3% which means very good criteria. So it can be concluded that the response of class IV\textsuperscript{A} and IV\textsuperscript{B} students and class IV\textsuperscript{A} and IV\textsuperscript{B} teachers of SD IT Deli Insani to science student worksheet based on the scientific approach is very good or gets a positive response from students and teachers.

**Disseminate,** at this stage the science student worksheet is based on the final scientific approach (final design) which is packaged and distributed as student worksheet that has met valid, practical, and effective criteria. Meanwhile, for this stage of dissemination, the next researcher is given the opportunity to deploy on a wider scale. In addition, the reason for this stage was not carried out considering the results of the development were limited to partner schools, namely SD IT Deli Insani Tanjung Morawa.

3.2 Discussion

Based on the research results that have been described, a draft was obtained in the form of a science student worksheet with a scientific approach consisting of a title page, a foreword, a table of contents, core competencies, basic competencies, learning indicators, instructions for using student worksheet, concept maps, learning 1 through 4 which consists of activities of observing, asking questions, gathering information, associating, and communicating, playing while learning, summaries, evaluations, answer keys, reference lists, and author biographies.

Student worksheet was developed using the 4-D model development research type, namely 1) defining stage by analyzing beginning-end, student analysis, concept analysis, task analysis, 2) the design stage by selecting the media, selecting the format, and designing science student worksheet based on the scientific approach 3) the development stage consists of expert validation (material science, learning design, layout, language) and testing the product to see the responses of class IV\textsuperscript{A}, IV\textsuperscript{B} students, class IV\textsuperscript{A} teachers, class IV\textsuperscript{B} teachers; 4) the dissemination stage by distributing revised products only to SD IT Deli Insani.

The results of the science student worksheet assessment based on a scientific approach by expert validates were 92.5% which were categorized as very valid so that it could be stated that the student worksheet developed was feasible for use in grade four elementary students because it was in accordance with the material and objectives of science learning. By studying science, students are expected to know, respond to, and appreciate science and technology and can instil habits of critical, creative, and independent thinking and behaviour. Natural science learning in elementary school must
be modified so that students can easily learn it. Ideas and concepts should be simplified to suit their cognitive, affective, and psychomotor abilities and stages of development.

The results of the assessment of the learning design expert validate, which is 93.7%, are categorized as very valid so that it can be stated that the science student worksheet based on the scientific approach is suitable for use in fourth-grade elementary students because the learning Design or Learning steps in the developed student worksheet are in accordance with the scientific approach and also in accordance with the characteristics of grade four elementary students. According to Rusman (2015:231), there are five steps of the scientific approach, namely: (1) observing; (2) asking questions or formulating problems; (3) trying or proposing a hypothesis; (4) reasoning or collecting data; and (5) building networks or communicating concepts. Likewise, with the learning presented in the science student worksheet based on the scientific approach which also has five sequential stages, namely: observing the text and the surrounding environment, asking questions by encouraging students to discuss and argue based on the results of observing activities carried out, gathering information with conducting experimental activities, associating with processing data obtained from experimental activities and communicating the results of activities that students have done by making conclusions from what is found in information seeking and associating activities.

The results of the layout expert validate are 90.3% or very valid so that it can be stated that the science student worksheet is based on a scientific approach to the material properties of the light used in grade IV SD students because the display presented in the student worksheet has been developed according to standards textbooks according to the National Education Standards Agency (BNSP) which have three indicators, namely module size, module cover design, and module content design.

The result of the linguist validate is 97.7% or very valid so it can be stated that the science worksheet based on a scientific approach to the material properties of light is very valid and suitable for use in fourth-grade elementary school because the use of language in student worksheet is in accordance with the development of students elementary school is one of the uses of simple language and in accordance with Indonesian language rules (Ulfahet al., 2018).

From the results of the assessment obtained from the four validates, the average obtained was 93.6% or very valid so that it can be stated that the science student worksheet based on the scientific approach on the material properties of light is valid and suitable for use by grade four elementary school because of In terms of material, learning design, layout, and language are in accordance with the grade four elementary school material science, in accordance with the function of student worksheet as a teaching material that makes it easier for students to understand material science, according to the stages of the scientific approach, according to the characteristics of grade four elementary school. After the science student worksheet based on the scientific approach was validated by each validate (material, learning design, layout, language), a field trial was conducted by distributing questionnaire sheets in the form of questionnaires to teachers and students to see their assessment and response to the validated student worksheet.

The results of the average response score of students to science student worksheet based on the scientific approach were 96.2% which had very good criteria so that it could be stated that the science student worksheet based on the scientific approach received a good response by IV^A and IV^B grade students of SDIT Deli Insani Tanjung Morawa. The results of the average score of teacher responses to science student worksheet based on the scientific approach were 94.5% which had very good criteria so that it could be stated that the science student worksheet based on the scientific approach received a good response by class IV^A and IV^B teachers at SDIT Deli Insani Tanjung Morawa. Based on the results of the responses of teachers and students, it can be concluded that the science student worksheet based on the developed scientific approach received a good response and was in accordance with the needs of students and teachers.

4. Conclusion
The conclusion of this study is the feasibility of the science student worksheet based on a scientific approach developed based on the results of validation with a high level of validity. Based on the
results, criticism, and suggestions of material experts, linguists, learning design experts, and layout experts. The mean validity is 93.6% which is categorized as very valid and very suitable for use by grade four. Based on the results of the responses of students in class IV A, class IV B, class IV A teachers, and class IV B teachers, the mean score is 95.8% which is stated as very good criteria. It can mean that the science student worksheets based on the scientific approach developed are easy to apply and interesting to study.

Science student worksheet based on a scientific approach to the material properties of light can be used by teachers and other schools as a reference for learning activities, according to the potential and resources that the school has and takes into account the characteristics of students.

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