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Development of inquiry model worksheet for 4th grader elementary school student

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ABSTRACT

This study aims to develop student worksheets, and determine the effectiveness of thematic-based worksheets through the Inquiry model for fourth grade students at the State Elementary School I Pinang Jaya. The type of research is research and development (R&D) referring to the theory of Borg & Gall. The research population was fourth grade students at SDN Kemiling Cluster 1 and the sample was determined using a multistage random sampling technique of 54 students. The data collection tool uses tests for learning outcomes and observation instruments. The data analysis technique was carried out by quantitative analysis for product development, namely the effectiveness test using N-gain and t-test. The results showed that the worksheets developed were feasible to use and effective in improving student learning outcomes.



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Introduction

Education issues are interesting to be discussed in many forums, both formally and informally, related to its policy, implementation, and up to the impacts of that policy. Education process begin from family level continued to formal level at school, starts from elementary education to higher education. The educational issue that got a lot of attention is related to the process of establishing quality learners, which in this case, the quality of learning process and the competence of educators as an implementer of learning in the classroom.

Many factors that can be used to improves the learning quality, including selection and usage of teaching materials. Learning devices that meet well-presented curriculum bills will be able to motivate students to participate actively and creatively, able to solve problems in their life by using the concept of knowledge that had been learned, able to understand the lesson well, and able to self-organizing their knowledges. The goal is students are able to

find a concept of the study materials, not only give answers to the problems that founded. Learning activities can not be separated from the involvement of teaching materials. Everything that teachers use to convey a lesson can be classified as teaching materials. Teaching materials provide directions of the learning process to be implemented.

Learning materials are an important part in the implementation of education at school. Through teaching materials, teachers will be easier in teaching process and students will be more helped and easier to learn. Teaching materials can be made in various forms depending on the needs and the characteristics of presented teaching materials.

One of the teaching materials is the Student Work-Sheet (Lembar Kegiatan Siswa/ LKS). Student Worksheet is a collection of sheets that contain brief materials, student activities and tasks that must be completed by students according to their basic competencies.

The observation results at Elementary School 1 of Pinang Jaya showed that the scores of Natural Science examination is the most apprehensive score compared to other examinations. From the results of first theme of natural science daily exam scores, there are 18 students who does not reach KKM (minimum passing score) in class IV A or equal to 70,83% from the total of 26 students, and in class IV B, there are 19 students who does not reach KKM from the total of 28 students.

Based on the results of questionnaire distributed by researcher to teachers of class IV in 3 (three) different schools, it is concluded that the learning process that has been done so far is still teacher-dominated and use only one Student Worksheet per two students. The student worksheets that were used is a conventional worksheets which is less encouraging for students to be active in learning activities. Therefore, it is necessary to provide teaching materials that are inviting students to actively participate in the process of discovery or investigation in a scientific method, so students are able to discover their own knowledges and skills. A suitable teaching material is a material that can facilitate students to think critically, creatively and independently which will lead students to discover their knowledges and skills, so the learning process are run using a student-centered approach.

Based on the observations that have been described above, there are several problems arise, such as : The students' skills in natural science subject are still low, the learning process is still dominated by teachers, the teaching materials are an important part of the education performance in schools, the students are not challenged to link their knowledges with learning materials so that students are less motivated to explore their own knowledge, learning should be organized actively, inspiratively, fun and challenging, the created teaching materials should be able to facilitate students to think critically, creatively and independently, there are still some students whose score are below the minimum passing score.

A step to solve the above problem is to consider the characteristics and competencies of students, then it is necessary to develop an instructional media in the form of teaching materials. There are several types of teaching materials, e.g., printed books, modules, dictates, student worksheets and others. Student Worksheet is an activity sheet used to assist teachers to providing optimal learning. Student worksheet contains several indicators that should exist including the title / theme, objectives, time, instruction manuals, basic competencies and subject materials that must be achieved, information and tasks related to the material. Based on the description, it is necessary to develops a student worksheet as a teaching material to facilitate the conveys of teaching materials. Serene (2011: 520) states that the student worksheet is an instructional tool consisting of a series of questions and

informations which is designed to guide students to understanding complex ideas systematically.

Meanwhile, according to Toman (2013: 178), the worksheets that developed based on a particular approach allow students to participate actively in the learning process, helps them to learn better, and improve the students success. Therefore, by using student worksheets in learning activities, it can give a positive influence to students. It was emphasized in the literature that when they are well designed, worksheets can be a method of helping to shape expected behavioral changes in students (Proctor et.al., 1997).

However, the student worksheets that are available in schools in general is a conventional type of worksheet, which is not integrated with a particular model. In addition, the available student worksheets are also mostly not developed by the teacher themselves, which its contents are only a collection of questions without learning materials to support learning. In fact, the student worksheet should be developed by the teacher themselves because teachers are the people who knows better about what is right for their students.

The 2013 curriculum using integrated thematic learning with a scientific approach. In accordance to these characteristics, it is necessary to select a learning model that is also scientific. One such learning model is the Inquiry learning. Kahn and O'Rourke (2005) describes an inquiry learning model as a broad umbrella term to describe an approach of learning that is driven by an inquiry process in their definition. Coombs and Elden (2004) mphasizes the importance of the students knowledge that present in the process of finding. They define inquiry as a learning process that occurs when students develop an understanding of new information by relating it to previous knowledge in an organized and systematic way. In this context, inquiry learning is an exploration that based on the student's real life issues using process and tools of inquiry. According to Rooney (2012), inquiry learning model encourages students to think in a high level and show a positive attitude on the student learning activities.

Hansen and Buczynski (2013) shows that with the use of inquiry model, students are actively involved to think critically about the concepts of science, and students can make connections between what information they already knew and the new presented material. Learning outcome is a product of learning process that encompasses both cognitive and affective aspects (Lizzio et.al, 2002.). Cognitive outcome is refer to the development of professional knowledge and skill, while non-cognitive outcome is focus on behavioral and individual values changes. Hamalik (2011:155) states that learning outcome as an occurrence of behavioral changes in students, which are observed and measured in the form of knowledge, attitude and skill changes.

This research goal is to realize the development of teaching materials of thematic-based student worksheet through Inquiry model, so it can improve the learning outcome of natural science for 4th grader elementary school student, and also to know the difference in the effectiveness of learning outcome of natural science between the one that using learning materials of thematic-based student worksheet through inquiry model and the one that not using student worksheet on 4th grader students from Public Elementary School I of Pinang Jaya.

Method

Research and development methods are about to produce a student worksheet products, and test the effectiveness of these products. Borg and Gall (2003:569-575) states that development research is a process to develop and validate products that are used in education and learning. The procedure consists of ten steps. The following steps to produce the product include : early research and information gathering, planning, development of initial product, initial trial, product revision, field trial, product revision, operational field trial, final product revision, implementation.

The approach used in this research is a quantitative approach. The type of this research is research and development, namely student worksheet development on the theme of "Various Jobs" to improving learning outcome of the 4th grader elementary school students. The population of this research is the Cluster 1 students from elementary school of Kemiling sub-district, and sample in this research is the Public Elementary School 1 of Pinang Jaya with total 26 students of class IV A as experiment and 28 students of as IV B as control.

The Instruments used to collect data in this study is a questionnaire of teacher's needs, validation sheets, pretest and posttest questions.

The result of data validation was analyzed by descriptive quantitative method. Percentage of questionnaire data was obtained based on Likert scale calculation with the criterias of very appropriate: score 4, quite appropriate: score 3, less appropriate: score 2, not appropriate: score 1. The formula used in calculations to get a percentage is:

$$\text{Percentage (\%)} = \frac{\text{Obtained score}}{\text{maximum score}} \times 100$$

Interpretation criteria, a student worksheet is said to be appropriate if the content and presentation are suitable with the model of inquiry learning, and the student worksheet suitable with the student worksheet producing requirements if the result reaches $\geq 81\%$, so that can be used in learning process.

Pretest and posttest are used to see the improvement of learning outcome which is used to measure the effectiveness of the developed student worksheet.

The efectiveness of student worksheet were studied with the use of N-Gain. The increasing of score magnitude was calculated by the following normalized gain formula:

$$g = \frac{\text{posttestscore} - \text{pretestscore}}{\text{maximumpossiblescore} - \text{pretestscore}}$$

N-Gain Index is classified in table 1.

Table 1 Score of Normalized Gain Index

Gain Index	Classification	Effectivity
$(g) > 0,70$	High	Very effective
$0,30 < (g) < 0,70$	Medium	Effective
$(g) < 0,30$	Low	Less effective

Results and Discussions

1. Research Outcomes

The first hypothesis is the formation of thematic-based student worksheet through Inquiry learning model, so it can improve the learning outcomes of natural science for 4th grader elementary school students. The development of teaching material product in the form of student worksheet through Inquiry model with development procedure refers to Borg & Gall development model which contains the following main steps of developmental research;

2. Early Research and Information Gathering

In this study, researcher started with a preliminary study, then analyzing the teachers' needs. Result from the analysis then become the consideration of researcher to conduct research. Researcher using an observation technique. While do the observation, researcher identify the learning process in the classroom. Data from observation were analyzed and used as a consideration and base of student worksheet research. Writer choose Elementary school 1 of Pinang Jaya, Kemiling Sub-district, Bandar Lampung City as the research place. The reason is because the school using 2013 curriculums and located in an easily accessible area and already accredited. This study begins with a preliminary study to see the present conditions of the school by analyzing student learning outcomes and teachers' needs.

3. Planning

The result of the planning step that had been done by the researcher was the student worksheet framework preparation, systematics determination, Planning of evaluation tool, and preparation of assessment instrument design.

4. Research of Initial Product Format

This activity was done part by part according to the prepared student worksheet framework. The draft consists of cover (title page), preface, table of contents, Basic Competencies mapping, learning objectives, and student worksheet's instructions of use. Preparation of the student worksheet contents was in accordance to the Inquiry step.

5. Initial Trial

The initial trial that have been done by the experts aim to produced a product -in the form of student worksheet- that can be used by students. This internal trial consist of

several tests from material expert and media expert. On validation process, the validator is lecturers and teachers who gave advice or input for the student worksheet design improvement and suitability (revisi LKS I). Validators provide suggestions based on criteria of content, feasibility of content, suitability of thematic-based student worksheet through inquiry model, and suitability of student worksheet with the student worksheet producing requirements. Here is the recapitulation of score by validator :

Table 2 Recapitulation of Validator Score

Validator	Score
Material Expert	91, 66
Media Expert	91, 66
Teachers	91, 37

6. Product Revision

Product revision was implemented after product validation. Product validation was done by three experts, i.e., media expert, material expert, and class teacher. Some of the advises and revisions are the steps in the student worksheet shall be suitable with the Inquiry steps, make a references, improve contents to be more contextual, and change the images in the student worksheet learning activities.

7. Main Field Trial

The main field trial is the continuation of the experts test. Where the researcher spread the effectivity questionnaires to 6 teachers of 4th grader class from 3 different schools. From the questionnaire results, obtained this following data.

Table 3 Recapitulation of Effectivity Questionnaire

School Name	Score
Teacher of Class IV A Elementary school I of Beringin Raya	93,33
Teacher of Class IV B Elementary School I of Beringin Raya	95,66
Teacher of Class IV A Elementary school 2 of Beringin Raya	94,00
Teacher of Class IV B Elementary School 2 of Beringin Raya	94,66
Teacher of Class IV A Elementary School I of Pinang Jaya	96,00
Teacher of Class IV B Elementary I of Pinang Jaya	96,66

Based from the results above, then the developed student worksheet is feasible to go to the next stage of operational field trial, where the target is students from 4th grade classes of Elementary school I Pinang Jaya.

8. Product Revision

This step was conducted after the main field trial, all comments and advises from the previous main trial become a consideration for the product improvements. Some improvements were done by filling the section images that looks empty.

9. Operational Field Trial

Before the main learning activity begin, students are tested by a pre-test first. After the pre-test done, students do the learning activities with the student worksheet, and at the end of the learning, students do a post-test. This was intended to see whether or not the changes/ improvements in students learning outcomes before and after using the thematic-based student worksheet through the inquiry model on the theme of “Various Jobs” with sub-theme “Types of Job”.

10. Final Product Revision

The final product revision process is based on the results of the hypotheses test and the findings in the field when the product is tested. Based on the results of hypotheses test, its obtained that the student learning outcomes are increased. Furthermore, based on the result of consultations with material expert and media expert, it was concluded that this thematic-based student worksheet through inquiry model is not revised and feasible to be implemented.

11. Second Hypotheses

Student worksheet was effective to improve students learning outcome. Before the learning activity begin, students do a pre-test and after that do a post-test with the following results;

Tabel 4 Student learning Results On Field Trial

School	Average score		increment %
	pretest	Posttest	
IV A	55,77	73,65	17,88 %
IV B	53,39	59,29	5,90 %

The table above showed that, generally, there are differences and improvements in student learning outcomes after learning using thematic-based student worksheet through inquiry model with the theme of “Various Jobs” sub-theme of “Types of Jobs”.

The result of difference analysis using independent two samples t-test formula (independent) was obtained a value of $T_{value} = 7,149 > t_{table} 2,00$. There is a significant difference between the learning outcomes of the experimental and control classes. Furthermore, to test the effectiveness of learning outcome, N-Gain Test was used, with the following results in the table 5 below.

Table 5 Result of N-Gain Pretest-Posttest after being calculated

No	Elementary School 1 of Pinang Jaya	Gain

1.	0.39
Class IV A (Experiment)	
2.	0,13
Class IV B (Control)	

From the table above, the average gain of the experiment class shows a result of 0,39 which means the normalized gain is in the medium classification, so the effectiveness level is effective. The results showed that the thematic-based student worksheet through the developed inquiry model included in the effective criteria, this can be seen from the average score of the students whose using the thematic-based student worksheet through the inquiry model is 73.65, this is higher than the average score of the students who does not use thematic-based student worksheet through inquiry model, that is 59,29 with the normalized Gain score is 0,39. This can be happened because the students using a student worksheet that use the inquiry model steps, where in this model, learners are required to follow each steps in a systematic way.

So it can be concluded that the use of thematic-based student worksheet through the inquiry model on “Various Jobs” theme and “Types of Job” sub-theme was greatly help the students in the learning process, it can make learning activities more active and innovative, and students can find and solve their own problems by linking the learning materials with their own knowledges and experiences in daily life. It will make it easier for students to absorb informations and process new materials, which will impact the students’ learning outcomes to be better and improved. This student worksheet can also be used as an alternative teaching material for learning activities in classroom and as a self-learning material for students.

Research Discussion

Based on the research that had been conducted, The results of the study have shows the increased score in the pre-test and post-test in both initial trial and field trial. Here are the results of research and the discussion of the thematic-based student worksheet through inquiry model research. Research on the development of thematic-based student worksheet through inquiry model Research on the development of thematic-based student worksheet through inquiry model in a thematic learning with theme of “Various Jobs” and sub-theme “Types of Job”, can be described as follows. The research of thematic-based student worksheet through inquiry model was adapting the nine steps of R & D by Borg & Gall (2003 : 569 - 575), the first step is the initial research and information gathering, after the researcher know what problems happened, the researcher does the planning to conduct research on the teaching materials of student worksheet that will be used by the students, so it can improve the students’ learning outcome. Furthermore, the researcher preparing the research for initial product of student worksheet, in this step, researcher pours the research pattern that will be conducted in thematic-based student worksheet through inquiry model. The next step is the initial trial, researchers does the validity test with three validators, this aims to validate the developed product whether it is suitable with study requirements or not, so it is worth to be trialled. The results of validity test can be described as follows.

1. Validation by Material Expert

Assessment from material expert includes the suitability of student worksheet with the content quality and suitability of student worksheet with inquiry. Some advises

from material expert for product improvement are revising the steps inside the student worksheet so it more suitable with the steps of inquiry, and create a references list in the student worksheet.

2. Validation by Media Expert

Assessment from media expert includes the requirements for making student worksheet i.e, didactic, construction and technical requirements. Some advises from media expert for product improvement are changing the contents of the student worksheet to be more contextual, and changing the display image on the worksheet's content to use the elementary school students' uniforms.

3. Validation by Classroom Teacher

Assessment from classroom teacher includes the suitability of student worksheet's contents, the suitability of thematic-based student worksheet through inquiry model, and the suitability of student worksheet with the producing requirements. In the validation process, there is no revision from classroom teacher because it was considered feasible to be used to obtains research data.

After conducting the validation test, researcher revising the product based on advises and comments from validators. The next step is the main field trial, at this stage, researcher tested the effectivity of student worksheet first. After that, researcher tested the product on the experimental group, the obtained data states that students' learning outcome were increased in pre-test and post-test score. Then, researcher did a revision to perfecting the product.

The last step is the operational field trial. At this step, it was obtained data of students' learning outcome that shows the improvement in pre-test and post-test scores, so it can be concluded that the developed product was effective in a thematic learning and also improve the students' learning outcomes. The form of the thematic-based student worksheet product through developed inquiry model can be described briefly in the following: the title page (cover), on cover page consist of title, author's name, student worksheet's identity, supporting image, user target, student worksheet statement, and background. Preface, a form of expression from the author's mind.

Student learning activities that contained in thematic-based student worksheet through inquiry model adapting six components from the opinion of Sanjaya (2006: 201) i.e., orientation, formulate problems, formulate hypotheses, collect data, hypotheses test and formulate conclusions. Those six components were applied in the student learning activities through this research of thematic-based student worksheet through inquiry model which make students' activities more active, so it can improve students' learning outcome. According to the opinion of constructivism psychologist, Sukardjo (2013: 54), this learning theory emphasizes that individuals gain knowledge from the process of knowledge formation by linking a previously possessed knowledges with the current knowledges and was done independently by the individual. This thematic-based student worksheet through inquiry model is considered very suitable to use, because in the learning steps, learners are directly involved to gain their understanding through systematic inquiry steps. This is

similar to Suhana's opinion (2012:77), inquiry method is a serie of learning activities that maximally involve all the students' components to search and investigate systematically, critically and logically, so they can find their own knowledges, attitudes and skills as a form of change.

So, it can be concluded that the use of thematic-based student worksheet through the inquiry model on the theme 4 and sub-theme 1 is very helpful for students in the learning process, make learning activities more active and innovative, help the students to find and solve their own problems by linking the materials with the knowledges and experiences they have from daily life, it will make students easier to absorb informations and process new materials, which will impacts on the improvement of students' learning outcomes. And this student worksheet can be used by teachers as an alternative teaching materials in the learning process from classroom and as a self-learning materials for students (Lee, 2014:101)

Effectiveness of Thematic-Based Student Worksheet Through Inquiry Model

The effectiveness of thematic-based student worksheet through inquiry model were seen from the comparison of pre-test and post-test outcomes between the experimental class and the control class. The result of analysis by using t-test shows that the learning scores after following the lesson using thematic-based student worksheet through inquiry model is higher than before using thematic-based student worksheet through inquiry model.

One of the learning theories that become the reference of this thematic-based student worksheet through inquiry model research is the constructivism learning theory, where according to this theory, learning is not only related to a memorizing course material, but learning is also a meaningful experience for students. Students find information by themselves and transform complex information, check for new information and revise it if the rules are not appropriate.

The learning process should be designed and managed in such a way to encourage students to organize their own experiences into a meaningful knowledge. So, in the view of constructivism, students' role are very important to be able to build constructivis habits of mind. In order to build a thinking habit to students, it needs a learning freedom and attitudes.

Vann and Harrey (2005: 115) stated that the atmosphere of inquiry learning that built into a school context is closely linked to the self-directed learning in a classroom performance.

Aykol & Garrison (2011) stated that learning with inquiry model provides a deep and meaningful learning experience.

According Sanjaya (2006: 208) the advantage of inquiry method is: the inquiry method is a method that emphasizes the research of cognitive, affective and psychomotor aspects in a balanced way, so the learning process will be more meaningful. Inquiry method provides space for students to learn according to their learning style. Inquiry method is a model that considered suitable for the development of modern learning psychology, which considers learning process as a process of behavior change. Another advantage of this learning method is to serve the needs of students who have above average level. That means, students who have good learning ability will not be late from students who have weaker learning ability.

The effectiveness of student worksheet teaching materials is corroborated by Yildirim's opinion (2011: 52) that states the activity sheet may affect the student's

accomplishments. Based on these theories, in this research, the effectiveness of learning was measured through student learning outcomes, by looking at the level of learning outcomes that obtained before and after using thematic-based student worksheet through inquiry model. The effectiveness of learning can be seen from the increment of average scores before and after using thematic-based student worksheet through inquiry model. Furthermore, the normalized gain score of students' learning outcomes that using thematic-based student worksheet with inquiry model was categorized into the medium category. Utami (2016) states that student worksheet can attract students' responses to sound their opinions, asking questions and discussions in a group. Celikler (2011: 56) also states that the experimental group students that learn by using activity sheets were more successful than the control group students that learn by traditional teaching methods, and a developed student worksheet influences on their learning outcomes.

The results showed that this developed thematic-based student worksheet through inquiry model were categorized in the Effective criteria, as seen from the average score of students who using the thematic-based student worksheet through inquiry model is 73,65 which is higher than the average score of students who did not use thematic based worksheet through inquiry model with 59.29, with a normalized Gain score of 0.39. This can be happened because students using student worksheet with inquiry model steps, where in this model, learners are required to follow each steps systematically. Lederman, Judith, and Antink (2013: 17) reveals that inquiry is a skill development for processing, classifying, predicting, measuring, questioning, interpreting and analyzing data.

Conclusions

Based on the research and discussion results above, it can be concluded as follows. The thematic-based student worksheet product with inquiry model was made through validations of material expert, design expert, and practitioners, and based on the test results to students as users, it can support the learning process quite well. The produced student worksheet product in this study was effective to improve the student learning outcomes, and significantly improving the learning results which were studied from the differences of pre-test and post-test scores, and the score results were significantly different between the experimental class and the control class on 4th grader students from Public Elementary School I of Pinang Jaya.

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