



Development of Saintific-based Students' Worksheet (LKS) by Utilizing the Ferns Taxonomy Garden as a Supplementary of Plantae Teaching Material

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Abstract

MA Al Asror Semarang has a fern taxonomy garden that can be used for observing Plantae material, especially Pteridophyta, but doesn't yet have a student's worksheets that can direct the activity process. This study aims to develop student's worksheets (LKS) based on a scientific approach and testing the validity, practicality and effectiveness. This study uses the Research and Development (R&D) approach with the ADDIE model. Validity of student's worksheets is obtained from media experts, practicality is measured by teacher and student responses and effectiveness is measured by student learning outcomes. The results show that the students' worksheets was declared 'very valid' with an average score of 94.10%, 'very practical' by teachers and students responses with an average score of 82,66% and effective as a supplement for teaching materials because it can improve cognitive learning outcomes of students with N-gain of 0.58 (criteria 'medium') and optimize psychomotor learning outcomes of students with an average score of 86.34% (criteria 'very good'). Based on the results of the study, scientific-based student's worksheets by utilizing a fern taxonomy garden stated as worthy to be used as a supplement of teaching material for Plantae at the MA Al Asror Semarang.

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INTRODUCTION

Teacher acts as a facilitator for students so they can interact as much as possible with learning resources. Based on observations at MA Al Asror Semarang, students listen more to the teacher's explanation and fixate on a learning resource that hasn't been able to train students' skills or scientific work. According to Ariesta & Supartono (2011), the cause of the failure to achieve indicator scientific work of student because the tools and learning approaches used have not led students to the scientific work process. Scientific skills can be achieved through learning resources and learning approaches that support students' needs. Selection of appropriate learning resources aims to facilitate students in understanding the material being studied.

MA Al Asror has a ferns taxonomy garden which can be used as a learning resource on Plantae material, specifically Pteridophyta (Ferns). Passy et al. (2010) stated that gardens can be used as a means to teach and enrich the learning curriculum. Learning activities carried out by observing gardens can improve understanding of science concepts, skills, provide hands-on experience and increase environmental awareness (Morgan et al., 2009). However, to carry out this learning, the teacher does not yet have a study guide that can direct students to observing ferns. Based on this, a student worksheet is needed as an observation guide to make it more systematic and directed, so that it trains scientific skills of students. This is supported by research from Mustofa et al. (2013) that school garden observation learning activities can be elaborated in students' worksheets which include work steps and assignments to be more directed. Worksheets is a guide for students in understanding the process skills and concepts of the material being studied (Astuti & Setiawan, 2013). Students' worksheets is adjusted to the prevailing curriculum development so that learning objectives can be achieved.

Curriculum 2013 emphasizes the scientific approach in learning process. The scientific approach includes five steps: observing, asking, collecting data, associating and communicating

(Kementerian Pendidikan dan Budaya, 2016). Scientific approach is believed to be able to train psychomotor, affective and cognitive skills because in the learning step more involves direct student work. Therefore, it is important to use because the learning experience provided can fulfill educational goals and useful for problem solving and real life (Machin, 2014). Application of scientific approach to the learning process can fulfill the basic competencies determined because it includes activities that require students to observe plants directly. KD provisions on plantae material is apply the classification principle to classify plants into the divisio based on morphological and metagenetic observations of plants and link their role in the survival of life on earth (KD 3.8) and present data on the morphology and role of plants in various aspects of life in the form of written reports (KD 4.8).

Based on this background, it is necessary to develop students' worksheets based on a scientific approach by utilizing the ferns taxonomy garden to fulfill the KD learning requirements, so as to improve cognitive abilities and train students' psychomotor. Students' worksheets in this study includes observing, asking questions, collecting data, associating and communicating the findings conducted in the ferns taxonomy garden. Research by Yulianti et al. (2014) showed that development of scientific worksheets based on angiosperm submissions had a validity value of 91.25% and was feasible to be applied in learning activities. Mustofa et al. (2013) stated that development of students' worksheets based on observations of school gardens are worthy of being used as science teaching materials. This study aims to develop students' worksheets based on a scientific approach by utilizing the ferns taxonomy garden as a supplement of teaching material for plantae and testing the validity, practicality and effectiveness as supplementary teaching materials at the MA Al Asror Semarang.

METHODS

This study uses the Research and Development (R & D) approach with the ADDIE model which is include Analysis, Design,

Development, Implementation, and Evaluation (Aldoobie, 2015). The product that developed is student's worksheets (LKS) based on a scientific approach which trial on 30 students X IPA classes at MA Al-Asror Semarang using the one group pretest-posttest design. Data collection techniques uses the questionnaires, tests and observations. Data analysis techniques are validity of students' worksheets by media experts, practicality by teacher and student responses and effectiveness by student's cognitive and psychomotor learning outcomes. Student's worksheets was stated 'valid' if the experts criteria >62.50%, 'practically' if teachers and students responses criteria >62.50% and 'effective' in improving student learning outcomes if the N-gain criteria based on students

cognitive learning outcomes >0.3 and psychomotor learning outcomes > 71%.

RESULTS AND DISCUSSION

This research was conducted to train students' skills in scientific activities through observing ferns and formulating the results of their observations on developed students' worksheet which eventually can optimize student learning outcomes. Students' worksheet is validated in advance by experts so that it is suitable to be used as a supplement to teaching materials and it is can be implemented in the learning process. The results of students' worksheet validation is presented in Table 1.

Table 1. Validation results of the student's worksheets

Component	Score (%)	Criteria
Aspect of content	96,87	Very valid
Aspect of language	93,75	Very valid
Aspect of graphical	91,67	Very valid
Average	94,10	Very valid

Data shows that the student's worksheet is in a very valid 'criteria, which means that it has fulfilled the assessment indicator requirements with some improvements. Developed student's worksheets display presented in Figure 1.

Developed students' worksheets contains titles and images of ferns, introduction contains KD, indicators and instructions for use, the contents section includes short material, pictures, observation tables and activity orders according to the stages of the scientific approach (observing, asking, collecting data, associating and communicating). Students' worksheets display includes cover that is designed as well as possible with a combination of color, writing and matching images so students are interested in using worksheets. The font used in this worksheet is calibri with the font size 12 pt. Improvement of students' worksheets by validator includes: a) Student's worksheets guidelines, which aim at directed learning activities. The instructions for students' worksheet are positioned one page with

KD and indicators that have been improved by moving on the second page so that it is not attached and designed with a more attractive appearance; b) Decapitation of words, which previously had errors that have been corrected by adjusting the rules for writing good and correct words; c) Special terms, which are important terms or scientific names in the summary of the material has been improved writing with bold so make it easier for students to read and remember; and d) Margin on the layout, which was previously uneven has been improved by giving a border to be more presentable and stimulating students interest in reading and filling in the worksheets. The improvement aims to produce good and proper worksheets to be tested into learning. Students' worksheet developed has been in accordance with the KD and learning indicators by covering scientific activities. Students' worksheet based on scientific is a study guide that can guide students in learning activities to be more directed and systematic.

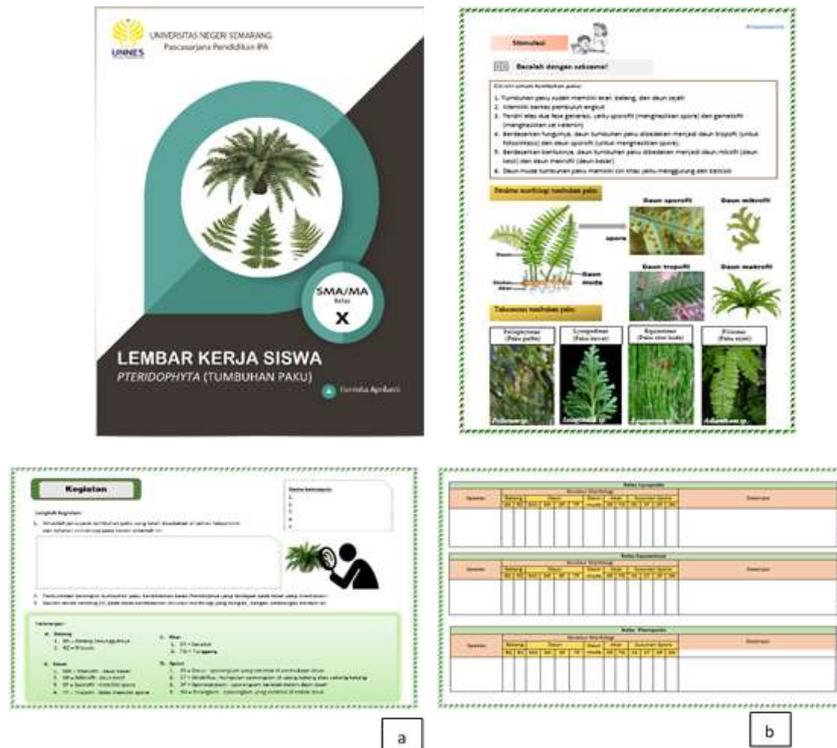


Figure 1. Cover (a), short material (b), activity command (c) and observation table (d)

The valid students' worksheets, generate positive responses by teachers and students. This is can be seen from the results of the practicality of the student's worksheets presented in Table 2.

Table 2. Practicality of the student's worksheets

Responden	Score (%)	Criteria
Teacher	80,70	Practically
Students	84,63	Very practically
Average	82,66	Very practically

The results of the analysis show that the students' worksheets based on a scientific approach utilizing the fern taxonomy garden 'very practical' is used as a supplement teaching materials. This is because students and teachers give a positive response to the students' worksheets that developed. Students respond that worksheets is very helpful in conducting observations of ferns in the taxonomy garden because it is equipped with scientific steps. The students' worksheets developed can train students' thinking processes and skills in learning and it can direct the observation process in ferns

so that the subject matter is easy to understand. In line with the study that conducted by Nuritasari (2016) that the students' worksheets is believed to be able to help students understand the subject matter. Based on research by Hidayati et al. (2012), development of the students' worksheets by utilizing the environment around the school received a positive response by students.

The teacher responds that students' worksheets can be used and it is very helpful in directing or guiding the observation process in the taxonomy garden that refers to the scientific approach in accordance with the curriculum 2013. The teacher feels helped by the students' worksheets because it contains activities and information related to Pteridophyta material in accordance with competence base specified. The students' worksheets also provides observation tables and information that can help students in formulating their observations. Display of student's worksheets is more interesting and systematic and easy to understand, so students are enthusiastic and motivated to learn.

The students' worksheet is declared effective as a supplement for teaching materials.

The effectiveness of students' worksheets is measured based on students' cognitive and psychomotor learning outcomes. Cognitive ability is a knowledge and understanding of concepts to achieve and improve learning outcomes through learning efforts after following one subject matter measured through a test (Murti et al., 2014). In this study, students cognitive learning outcomes obtained an N-gain score of 0.58 which is in 'medium' criteria. It indicates that there is an increase in cognitive learning outcomes of students between before and after doing learning using the student's worksheets based on scientific approaches.

Increased cognitive learning outcomes due to the learning environment that supports students to carry out scientific activities through worksheets that are implemented in the ferns taxonomy garden. This fact is in accordance with the statement of Winarti et al. (2016) that cognitive learning outcomes can be improved through the expansion of the learning environment. Students interact directly with ferns which are included in the Plantae material, making it easy to understand and remember the material being studied. This is in accordance with Ahn & Class (2011) who concluded that learning with practicum was able to improve students cognitive abilities, so that the theories learned were easily understand and remember. Isnaningsih & Bimo (2013) show that worksheets discovery oriented science process skills can improve science learning outcomes with classical mastery learning 71.79%.

Learning at the fern taxonomy garden by using students' worksheets as a learning guide provides direct knowledge and experience to students. Knowledge and experience of the student learning environment can influence changes in student mindset (Susilowati & Anam, 2017), so that it impacts on learning outcomes. Student learning outcomes are also measured from psychomotor aspects. Psychomotor aspects are important because science learning not only collects knowledge, but also the application of motor skills that are beneficial to students (Sumarni et al. 2016). The use of students' worksheets based on a scientific approach can

optimize students' psychomotor learning outcomes. These results are because the students' worksheets developed can guide students to conduct observation activities systematically. This is in accordance with the statement of Choo et al. (2011), that student worksheets are instructional tools that consist of a series of questions and information designed to guide students to understand complex ideas systematically when working on assignments. Psychomotor learning outcomes are presented in Figure 2.

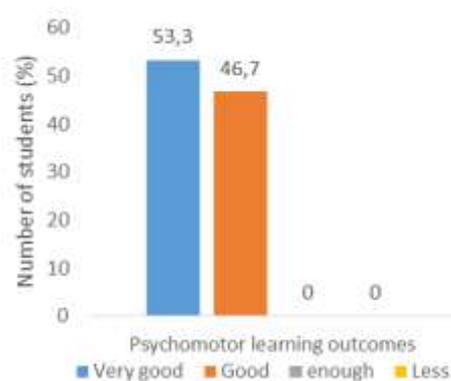


Figure 2. The number of students (%) that achieve psychomotor learning results with various criteria

The percentage of students who have psychomotor learning outcomes with the criteria of 'very good' is higher than the criteria of 'good' and no one has the criteria 'enough' or 'less'. The results of the observation show that students were very enthusiastic about observing ferns found in the taxonomy garden by using developed the student's worksheets to obtain 'very good' psychomotor values. This is in line with Hazami et al. (2015) that the success characteristics of psychomorphic aspects can be seen from the enthusiasm of students in carrying out the learning process, especially in practical activities. Students psychomotor abilities are very good because students not only can see, but also can hold or observe and interact directly with ferns contained in the learning material so that they discover the facts of the material. This is in accordance with the statement of Murti et al. (2014) that practicum-based learning is a method that can help students discover facts from the

theories they learned in lectures on plant anatomy, so that they have cognitive and psychomotor abilities.

The use of worksheets can improve cognitive learning outcomes and optimize student psychomotor learning outcomes. This indicates that the developed students' worksheets is effectively used as a learning resource. Kristanti et al. (2012) states that effectiveness can be achieved because of the increase in student learning achievement. Research by Rosita & Marwoto (2014) showed that the development of Problem Based Learning Worksheets which is one of the learning models of the scientific approach oriented to green chemistry can improve the understanding of concepts and students soft conservation skills. The Effectiveness of students' worksheets is used as a source of learning because it can guide students to conduct scientific observations and provide opportunities for students to interact directly with plants by utilizing the ferns taxonomy garden that exist in the school environment, thus optimizing student learning outcomes. Results of research by Linawati et al. (2012) showed that students who learn about the classification of plants by utilizing the Educational Tourism Gardens have complete learning outcomes ≥ 75 which means effective. Hazami et al. (2015) said that learning is directly oriented to the application of the environment can improve learning outcomes.

CONCLUSION

The development of learning guide on pollution and environmental conservation using project-based learning (PjBL) model was effective on the activities, attitudes, skills, and cognitive learning outcome of students and the knowledge of students and to stimulate the student activities into conservation actions in supporting Adiwiyata School by utilizing the surrounding environment of the school. The learning guide on pollution and environmental conservation was stated valid and practical.

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