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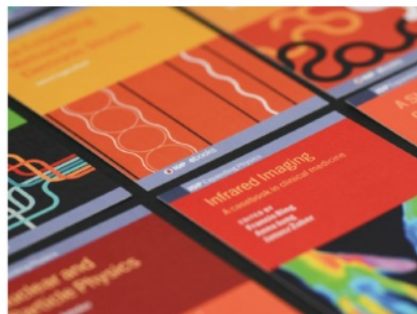
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Analysis of expert validation on developing integrated science worksheet to improve problem solving skills of natural science prospective teachers

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Abstract. This study aims to develop student worksheets for higher education that apply integrated science learning in discussing issues about motion in humans. These worksheets will guide students to solve the problem about human movement. They must integrate their knowledge about biology, physics, and chemistry to solve the problem. The worksheet was validated by three experts in Natural Science Integrated Science, especially in Human Movement topic. The aspects of the validation were feasibility of the content, the construction, and the language. This research used the Likert scale to measure the validity of each aspect, which is 4.00 for very good validity criteria, 3.00 for good validity criteria, 2.00 for more or less validity criteria, and 1.00 for not good validity criteria. Data showed that the validity for each aspect were in the range of good validity and very good validity criteria (3.33 to 3.67 for the content aspect, 2.33 to 4.00 for the construction aspect, and 3.33 to 4.00 for language aspect). However, there was a part of construction aspect that needed to improve. Overall, this students' worksheet can be applied in classroom after some revisions based on suggestions from the validators.

1. Introduction

4 The natural science learning includes four main elements, namely attitude, process, product, and application. The four elements of learning science is realized through learning activities with the process of collecting data through observation, experimentation, and analysis of deduction to explain a phenomenon that occurs in nature. Thus, natural science is defined as "systematic, organized, general, universal, and a collection of observed and experimental data [1].

This is in accordance with Regulation of the Minister of Education and Culture of the Republic of Indonesia (or called Permendikbud) No. 64 of 2013 on Basic and Secondary Education Content Standards which explains that the competence that must be possessed at the junior high school leads the students to have scientific attitude through natural science starting from the submission of questions, formulating hypotheses, designing and carrying out experiments, recording and presenting the results of the investigation in form tables and graphs, conclude, and report the results of the oral and written inquiry to answer the question.

In addition, other rules contained in the Regulation of the Minister of National Education of the Republic of Indonesia (Permendiknas) no. 22 Year 2006 states that science learning at junior high school level is done in an integrated manner. Integrated natural science learning continues throughout the current curriculum. In Indonesia, science teachers of junior high school are expected to provide direction for learners to achieve competencies in science curriculum in junior high school including integration in it.



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Integrated science lesson is a natural science study whose study materials include biology, physics, and chemistry as a whole [2,3]. The purpose of this integrated science lesson is to enable learners to connect the concepts contained in the three different disciplines and apply them in the real world experienced by learners in their daily lives. It can construct their own knowledge, strengthen self-reliance and self-awareness, boost their experimental skills, stimulate students' cross-linking skills, and minimize gender differences in learning science [4]. However, despite of the learning by making connection in science can perform innovative and successful research; it is rarely taught in college class [5].

Universitas Negeri Surabaya (Unesa) as one of higher education institution has an important role in preparing prospective science teachers who are able to teach science in an integrated way through learning in Science Education Department. Science Education Department has made various efforts to improve the quality of its graduates in meeting the needs of junior high schools including the design of curricula that integrate the three different disciplines, namely biology, physics, and chemistry, into subjects that integrate natural science in inside.

One such course is Motion and Change that discusses the motion of living things in terms of the three fields of science. In Motion and Change courses conducted during fifteen meetings in a semester students will know about the motion of living things and the changes that occur in biology, physics, and chemistry views. Ideally in the course of Motion and Change students are expected to be able to study the concept of motion in living beings and the changes are divided from three different fields of science and then combine these concepts into a unified whole as part of integrity natural science.

Based on research that has been done before by the researchers, obtained data that is learning movement Motion and Changes made during this divided into three parts separated according to the field of science lecturer concerned. Each lecturer who is a member of a team of teachers in one class will carry out the lesson during the five meetings with the assessment conducted for two times the Middle Semester Exam and Final Semester Exam. The type of integration that has been carried out so far is more towards the practice of integrating with the connected model of each lecturer who is related to the other fields according to the mastery of their respective fields of science.

Assessment is done with indicators developed by respective lecturer in accordance with the field of expertise. Although the learning outcomes indicate that the student has achieved the learning indicator, this learning still does not meet the idealism of the lecturer on the main purpose. They argue that what should be a team of teachers from three fields of science who attend in one class to discuss issues related to motion in living things then lead students in the settlement of it. The type of integration expected in this course is webbed type where each lecturer acts as facilitator according to their respective discipline and complements one another.

The expectation is hit by various obstacles. One of them is the teaching time of the lecturers of the lecture teams who are not allowed to attend every meeting for one semester. The lecturers have teaching hours on other subjects simultaneously with the Motion and Change course so that the lecturer team divides the meeting in one semester into three sections. In addition, the faculty lecturer team of Motion and Change also has other teams of courses so that time is more limited. In the end the lecturers teach according to their respective fields of science and try to integrate the natural science in a limited understanding.

Efforts to realize the integration of natural science in the Course of Motion and Change requires a strategic way so that the implementation of integrated natural science learning can be realized. This strategy will lead students to apply their knowledge in the field of Biology, Physics, and Chemistry; especially, when they learn about motion of living things. One of the strategies that can be done to realize the learning is by using Student Worksheet modeling the integration of science to prospective teachers as well as trained high-level thinking skills. Student worksheet available in Motion and Change Subjects are student worksheet that covers topics of Motion and Change by Physics, Chemistry and Biology. Thus, a student worksheet that integrates natural science is required for Motion and Change lectures.

Based on the description, it is necessary to study the development of Student Worksheet (LKM) on Motion and Change Subjects oriented to integrity of natural science to tackle problem solving skills for prospective teachers of science.

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2. Research method

This research is a development research with 4-D design model developed by Thiagarajan, Semmel, Dorothys, Melvyn I, and Semmel. This model consists of four stages, namely define, design, develop, and disseminate. Disseminate stage (dissemination) is not done and limited to development stage (development) only [6]. Development of student worksheet Lecture Motion and Change berorientasi integrity of natural science conducted in Science Education Department of Unesa. This research will be conducted for a maximum of eight months since May s.d. November 2017. This article will examine the validation that has been obtained during the development of the student worksheet.

3. Result and discussion

Validation is based on theoretically feasible student worksheet criteria, which include didactic requirements (learning problem solving skills and academic ability), construction requirements (student worksheet contents), and technical requirements (student worksheet view). Expert Validator consists of three expert lecturers at the Department of Science Unesa. The three lecturers are natural science lecturers who have ever taught the subjects of Motion and Change. They are also incorporated in the preparation of RPS Motion and Change of the School Year 2017-2018. Assessment by validators is obtained after conducting Review 1 and obtaining input to revise the student worksheet. The feasibility of student worksheets based on expert validation is presented in Table 1.

Table 1. Results of expert validation.

No.	Criteria	V1	V1	V3	Modus	Criteria
Didactic Requirement						
1	Emphasis on problem solving skills	4	4	2	3.33	Valid
2	Helping learners choose problem-solving strategies based on analysis	4	4	3	3.67	Valid
3	Give attention to differences in individual academic ability	4	3	4	3.67	Valid
4	Shows natural science integrity	3	4	4	3.67	Valid
Construct Requirement						
1	Headline compliance	4	4	3	3.67	Valid
2	Goal suitability	4	4	4	4	Very Valid
3	student worksheet Guidelines	3	4	3	3.33	Valid
4	Writing a bibliography	3	4	3	3.33	Valid
5	Use of Indonesian is good and correct according to EYD	4	4	4	4	Very Valid
6	Correct use of sentences	4	4	3	3.67	Valid
7	The suitability of the material in the student worksheet	4	4	4	4	Very Valid
8	The suitability of the student worksheet's questions and the contents of the student worksheet	4	4	3	3.67	Valid
Technical Requirement						
1	Interest and suitability of Cover	4	4	4	4	Very Valid
2	Matching image in student worksheet	3	4	3	3.33	Valid
3	The suitability of images and colors in	4	4	4	4	Very Valid

No.	Criteria	V1	V1	V3	Modus	Criteria
	student worksheets to motivate learners					

Nieveen N [7] on product quality criteria that the feasibility of a product can be reviewed based on aspects of validity, practicality and effectiveness.

The process of developing the student worksheet is done by paying attention to the lesson plan Course of Motion and Change that has been made by the Teaching Lecturer Team. Based on the RPS developed, students are expected to solve the problems related to the movement of living things by integrating the basic knowledge obtained in the previous semester. The basic knowledge includes knowledge in the field of biology (muscle motion), the field of physics (biomechanics), and the field of chemistry (the use of energy in living things).

After Draft 1 was produced, the student worksheet was reviewed by three lecturers involved in the Motion and Change Lectures in the previous school year. The results provide suggestions for researchers to revise the student worksheets used. These suggestions include limiting immune experiments that measure VO_2 max, improved student worksheet formats, improved student worksheet cover, and improved student worksheet guidelines. After the revision, the student worksheet is validated by the validator.

Table 1 showed that the developed student worksheets and Changes have scored an average of 3 to 4 that categorized as the 'Valid' and 'Very Valid' criteria. Based on these results it can be said that student worksheet Motion and Changes that have been developed eligible for use in learning.

According to [7], the way of packing a good Worksheet is to pay attention to the constructivist structure. The results of content validation indicate that the student worksheet already contains problem solving components delivered in clear sentences and uses Indonesian rules. The constructivist principles are contained in the research components that are visible from the student's activities in determining the problem to be solved, the activities of designing the experiment to solve the problem, the experimental activities with the group, and the analysis activities carried out after the experimental execution. Thus, lecturers will give a chance for students to share their idea to integrate their science knowledge. In addition, it is suggested by some lecturers to use technology tools, such as a video to visualize the process motion in living things.

This preparation of students' worksheet is needed to improve learning outcome. It is said that a lesson that designed with hand-on and mind-on activity will improve inquiry and discussion skills, while teachers also use a technology as a learning tool [8].

4. Conclusion

The feasibility of student worksheets is reviewed from the aspect of validity, i.e. expert validation indicates that the student worksheet's rating reaches in the "Valid" and "Very Valid" categories with achievement scores of 3 to 4. Thus, this students worksheet can be applied in class to improve students' ability to integrate science knowledge based on their daily life.

Acknowledment

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