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The Validity of Ethnoscience-Based Student Worksheets to Improve Student Science Literacy

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Abstract

Based on the facts on the ground, Indonesian students have low scientific literacy skills. This is shown by the 2018 PISA data which explains that the score of Indonesian students is 396 below the PISA average score of 500 and is ranked 70 out of 78 countries. Therefore, teachers must improve students' scientific literacy skills so that students' understanding of science can be trained so that they can keep up with the times. The purpose of this study was to improve the scientific literacy skills of class VII students through the development of ethnoscience-based student worksheets. The method used is a combined quantitative and qualitative method, through validation methods by two expert lecturers and analyzed descriptively quantitativel, with a 3D development model (define, design, and develop). The results showed that the validation of student worksheets was in the very valid category with a percentage of 85%. Based on these results, the worksheets of students based on ethnoscience are appropriate to be used as learning media to improve students' scientific literacy skills.

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INTRODUCTION

Scientific literacy is the ability to apply scientific information, make hypotheses, and draw conclusions from data and phenomena. According to the OECD (2018), there are three main competencies that make up scientific literacy: 1) describing phenomena from a scientific point of view, 2) analyzing and planning scientific research, and 3) interpreting facts from scientific data.

Based on the facts on the ground, Indonesian students have low scientific literacy skills. This is shown by the 2018 PISA data which explains that the score of Indonesian students is 396 below the PISA average score of 500 and is ranked 70 out of 78 countries (OECD, 2018). Therefore, teachers must improve students' scientific literacy skills so that students' understanding of science can be trained so that they can keep up with the times (Asyhari & Clara, 2017).

Scientific literacy skills can be developed by making local community culture or ethnoscience a source of learning (Innatesari, et al., 2015). According to Mahendrani & Sudarmin, (2015), ethnoscience is knowledge passed down from generation to generation from society which is associated with the idea of scientific knowledge. Learning through ethnoscience is very important because it seeks to examine the original knowledge typical of the community and relate it to previously studied material (Parmin & Sutikno, 2017). According to Atmojo (2012), learning through ethnoscience is relevant contextual learning that can increase students' scientific literacy.

The results of observations made at SMP Negeri 6 Sengkang show that the level of students' scientific literacy ability is still in the low category. The low scientific literacy of students is thought to be caused by the selection of inadequate learning resources. This is in line with the opinion of Kristyowati & Purwanto, (2019) who say that the selection of inadequate learning resources can be the cause of students' low scientific literacy. Based on this, learning media is needed that supports scientific literacy skills. To achieve scientific literacy indicators, learning media is needed as a learning tool, one of which is student worksheets (Iswantini, 2017).

The surrounding environment can be a learning medium that can be applied to student work sheet or student worksheets, with the hope that in the future it can increase the creativity of a facilitator/teacher and create new innovations in teaching, because science lessons are very different from other subjects (Baskoro, 2014).

1 Student worksheets are one of the teaching materials in the form of sheets that contain material, summaries, and instructions for carrying out tasks as a guide for students to carry out learning activities (Dachi & Perdana, 2021). According to (Noprinda & Soleh, 2019) student worksheets are learning tools used by educators to increase student participation in learning as an effort to form basic abilities that are in accordance with learning achievement indicators. Trnova's research (2014) states that teachers should create new modules and focus learning activities on students. Learning that carries local culture can train students' skills in applying knowledge so that it can be used as an effort to train scientific literacy skills (Nisaa, et al., 2015). In accordance with the results of Suryani et al.'s research, (2018) that learning that involves the Sego Megono culture in Spermatophyta material can foster students' scientific literacy. Learning by exploring the concepts, applications and processes of science, students can apply the knowledge taught at school and know the facts of science in everyday life that develop in society, so that students can be "literate" in science (OECD, 2018) .

Biology material that has the potential to train scientific literacy is soil pollution material as contained in Basic Competencies 3.8. in Basic Competencies it targets students to be able to analyze the occurrence of environmental pollution and its impact on ecosystems (Innatesari, et al., 2015). Culture or community knowledge that can be associated with soil pollution is *mangeppi ase* in the maintenance of rice fields in the Bugis community. *Mangeppi* is done when the rice grains have come out. The owner of the rice field surrounds the rice field carrying a bucket filled with water that has been dipped in betel leaves and turmeric. Water in the bucket, has been given a prayer. The water used for *mangeppi* is water that has been given a prayer, a prayer to *Dewa Seuwae*, usually the prayer is:

*" D*ē *_ wata, panc*ā *ijiwi iy* ē *uwa* ē *w* ē *, uwa* ē *napunai barakka, uwa* ē *pacomm* ō *kiwi asew* ē ē *, uwa* ē *pa* ē *laiwi b* ē *kkangng* ē *, uwa* ē *pa* ē *laiwi anango* ē *, o..puang, dance to my pa'doangenk' "* .

It means O.. God, make this water a blessing, water that fattens rice, water that drives away pests, water that drives away bedbugs, o.. God grant me my wish.

Several studies have tried to link student worksheets with students' scientific literacy skills, including research conducted by Sumanik (2022) in his research discussing the development of electronic student worksheets based on scientific literacy. The results of his research showed results

that were feasible for use by students. Both were carried out by Ulandari, et al. (2021), they argue that the development of student worksheets with a green chemistry perspective is feasible to use with a validity percentage of 91.67% and can be used to train students' scientific literacy skills. Another research was conducted by Astuti, (2019) which focused on empowering scientific literacy through the development of student worksheets based on guided inquiry. Thus it can be said that there has not been found the development of ethnoscience-based student worksheets in Bugis society that can train students' scientific literacy skills.

This research is expected to contribute to the development of ethnosian-based worksheets that can be used as a reference for other researchers and readers on this topic. Researchers focused on developing student worksheets based on ethnoscience.

Therefore, the purpose of this research is to develop student worksheets based on ethnoscience that can train students' scientific literacy skills, by testing their validity by validators so that these worksheets can be used by students.

The following is the conceptual framework in this study.

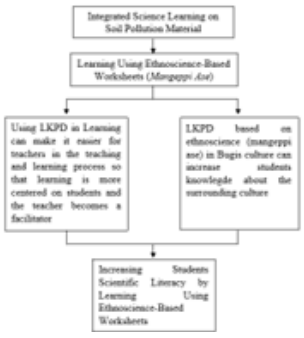

Figure 1. Conceptual Framework

METHOD

The development model used by researchers uses the instructional system development model proposed by (Thiagarajan in Trianto 2010), a modified 4D model. The 4-D model consists of four stages of development, namely Define , Design , Develop and Disseminate. The Dissemina stage was not carried out due to considerations of implementation time and the consideration that at the Develop stage a good (valid) worksheet of students with ethnoscience content on salt hydrolysis had been produced.

At the definition stage, researchers conducted an initial and final analysis by making improvements to science learning tools, requiring innovations that have natural science content that is integrated with local culture. In the task analysis the researcher considers the achievement of the basic competencies of the students.

In the design stage, researchers designed learning tools that were integrated with the culture in South Sulawesi. In this stage the researcher designs student worksheets containing reading texts to simple experimental steps integrated with ethnoscience. The regional culture taken in this study is the maintenance of paddy fields by sprinkling the rice with water (*mangeppi ase*).

The development stage, before carrying out field trials, learning tools need to be tested for feasibility until valid/effective criteria are obtained. The learning device developed is in the form of ethnoscience-based student worksheets.

The validation instrument used in student worksheets has four important components, including format (there are 7 items), illustration (there are 3 items), language (there are 4 items), and content (there are 4 items).

Data collection techniques based on validity use data from the review in the form of suggestions from the validator and improvements made by researchers. While the data validation results are in the form of scoring on the developed ethnoscience-based student worksheets. Validation data can be obtained from two validators. The data analysis technique is based on the recapitulation of the validation results from the two validators by comparing all the results of the criteria points obtained and then analyzed descriptively quantitatively. The results of the data are presented and then calculated from the Likert scale, the developed student worksheets can be said to meet the criteria if the percentages obtained are ≥65%, so they are suitable for use in learning activities.

Table 1. Validator Assessment Score

Information	Score
Very valid	4
Valid	3
Less valid	2
Invalid	1

Source: Riduwan (2012)

Data were analyzed using the formula:

$$\%\ Validity = \frac{Total\ score\ obtained}{Maximum\ total\ score} \times 100\%$$

Furthermore, the percentage of validity obtained is then interpreted into categories based

on the following table:

Table 2. Level of Student Worksheet Validity

Percentage (%)	Validity Level	Information
76 – 100	Very valid	Worth using without revision
51–75	Valid	Usable with minor revisions
26 – 50	Less valid	Not worth using because it needs major revisions
0 – 25	Invalid	Should not be used

Source: Riduwan (2012)

RESULTS AND DISCUSSION

Development of Student Worksheets

In developing ethnoscience-based student worksheets, it is necessary to go through several stages so that student worksheets are valid, practical, and effective for use as learning tools. These stages follow the 3D development model which consists of define, design, and develop. The product produced by researchers is in the form of developing student worksheets based on ethnoscience to increase students' scientific literacy.

Define stage

The initial and final analysis aims to determine the problem that forms the basis for developing student worksheets based on ethnoscience, namely the low ability is caused by a lack of learning tools that support students' scientific literacy abilities.

Concept analysis to determine the parts of ethnoscience material that can be related to soil pollution material. In this study, the ethnoscience associated with soil pollution is *mangeppi ase* in Bugis culture.

Task analysis to identify the skills needed to develop tasks that students must have in participating in learning based on material (concept) analysis. The skills needed are scientific literacy skills with indicators of identifying phenomena, explaining hypotheses, designing problem solutions, and evaluating problem solutions.

Design stage

Instrument design

The validation instrument used has four important components, namely format consisting of 7 items, illustration consisting of 4 items, language consisting of 3 items, and content consisting of 4 items.

Format selection

The student worksheet format is the font used, namely Times New Roman, size 12 for discussion of material and subtitles, while size 14 is used for titles.

Preliminary design of student worksheets

The researcher has made a product design, following the format that has been determined at the previous format selection stage, which can be seen in Table 4.

Develop stage

At this stage the product design results are revised based on suggestions from two validators. Suggestions from the validator can be seen in Table 4. The revised product results can be seen in Table 5.

Student Worksheet Validation

Aspects validated in student worksheets include: (a) student worksheet format, (b) student worksheet illustrations, (c) student worksheet language, (d) student worksheet contents. these four aspects are measured through 18 indicators .

Based on the results of the assessment of the two validators, data obtained from the validation worksheets of students are shown in Table 3 and Table 4.

Table 3. First Validation Results

No	Rated aspect	Validation		Average	(%)	Inforation
		V1	V2			
1	Format	2,7	2,4	2,5	62.5	Valid
2	Illustration	2	2	2	50	Less valid
3	Language	3	2,7	2,8	70	Valid
4	Content	3	3	3	75	Valid
The average aspect assessed		2,7	2,5	2,6	65	Valid

Based on the results of the first validation in Table 3 the format aspect was declared valid with a percentage of 62.5%, the illustration aspect was declared valid with a percentage of 50%, the language aspect was declared valid with a percentage of 70%, and content aspects are declared valid with a percentage of 75%.

Among these four aspects, the lowest score is the illustration aspect, this is because there are

no illustrations on student worksheets that are in accordance with ethnoscience material, besides that the illustrations displayed are also less attractive, so improvements need to be made so that student worksheets are more attractive and make it easier for students to understand the content. Supported by Kurnia's statement (2019) the preparation of student worksheets must pay attention to the suitability of the images with the material included so that students can understand the activities in student worksheets. Using the right images can encourage students to interact with learning resources (Fakhrurrazi, 2018). Overall, the average obtained in the first validation, namely 65%, is included in the valid category, but it needs to be revised.

Some suggestions from the validator can be seen in Table 4.

Table 4. Validator Suggestions

Revised Aspect	Revision Description
Illustration	Look for images that are relevant to the material
Illustration	Add source to image
Content	Add material
Content	Pay attention to every writing

Ethnoscience-based student worksheets before and after revision can be seen in Table 5.

After the revision was carried out based on suggestions from the validator, then the revision results were validated again by the validator to determine the feasibility level of the revised ethnoscience-based student worksheets.

Table 5. Student Worksheets Worksheets Before and After Revision

Before Revision	Information
	The front of the student worksheet only displays the indicators to be achieved, without attaching material, and some of the writing still contains words that are not appropriate
	Assignments without image display

After Revision	Information
	In the student worksheet, material and pictures are added, so that it can make it easier for students to do the assignment
	In the assignment, pictures are displayed so that students more easily understand the intent of the reading displayed

Table 6. Second Validation Results

No	Rated aspect	Validation		Average	(%)	Information
		V1	V2			
1	Format	3,3	3,7	3,5	87.5	Very valid
2	Illustration	3	4	3,5	87.5	Very valid
3	Language	3	3	3	75	Valid
4	Content	3	4	3,5	87.5	Very valid
The average aspect assessed		3,1	3,7	3,4	85	Very valid

After revising based on suggestions during the first validation, the results of the second validation were obtained as shown in Table 6 the format aspect was stated to be very valid with a percentage of 87.5%, the illustration aspect was stated to be very valid with a percentage of 87.5%, the language aspect was stated to be valid with a percentage of 75%, and the content aspect was stated to be valid. aspects stated very valid with a percentage of 87.5%.

Overall, the value of the results of the validity test of ethnoscience-based student worksheets, namely 85%, is included in the very valid category, so that student worksheets are suitable for use without revision. In line with that, the research results of Sholikhah, et al., (2021) show

that the results of validating student worksheets based on ethnoscience to increase students' KPS are feasible to use with an overall average score of 88.55%. As said by Andriyatin, et al (2016) good student worksheets are student worksheets in which there are apperception activities to evaluation activities, so that student worksheets can be used as a whole in learning activities where the material and information contained can be conveyed to students as a whole, so that students become more active in learning in class.

Applying Ethnoscience to learning is an innovation as an essential material or task. Ethnoscience really needs to be applied in learning because the approach does not only contain material, but in it it can also create learning situations that integrate culture as one of the stages of the science learning process (Saputra, 2016), in line with the opinion of Khoiriyah & Qosyim, (2021) learning by Ethnoscience student worksheets can provide an increase in students' scientific literacy. This is because ethnoscience-based student worksheets can provide new knowledge through activities to reconstruct community knowledge into scientific science. Learning with an ethnoscience approach is able to provide new knowledge for students so that they can motivate learning because they realize that science is close to everyday life, so that students get a learning experience that is more than usual. As explained by Majid (2011) the demands of the 2013 Curriculum are that besides students studying existing material, students are also expected to study culture, especially the native culture of the surrounding community and then transform it into scientific science that they can learn.

CONCLUSION

The development of student worksheets follows the 4D development model which is modified to 3D, namely: Define/definition includes (a) initial-end analysis the problem that forms the basis for the development of ethnoscience-based student worksheets is that this low ability is caused by a lack of learning tools that support students' scientific literacy abilities. (b) Concept analysis, in this study, ethnoscience associated with soil pollution, namely *mangeppi ase* in Bugis culture. (c) Analysis of tasks to compile tasks that students must have in participating in learning based on material analysis (concept). The skills needed are scientific literacy skills with indicators of identifying phenomena, explaining hypotheses, designing problem solutions, and evaluating problem solutions. The design stage includes (a) Instrument design, used to have four important components, namely format consisting of 7 items, illustration consisting of 4 items, language consisting of 3 items, and content consisting of 4 items. (b) Selection of the format, namely the font used, namely Times New Roman size 12 for discussion of material and sub-headings, while size 14 is used for titles. (c) Initial draft of student worksheets, following the format determined at the previous format selection stage. The develop stage, at this stage the product design results are revised based on suggestions from two validators, so that a valid product is produced.

The level of validity of the results of the validator analysis shows that the worksheets of students based on ethnoscience are in the very valid category with a percentage value of 85%.

The drawbacks in this study are the lack of coverage of the material included, in this study only taking material from soil pollution, the advantages of this research are that there are updates in student worksheets which were initially only general in nature or only referred to textbooks, now developed with sheets ethnoscience-based student work. The researcher hopes that this research can become a reference for other researchers to examine more deeply related to the development of ethnoscience-based student worksheets with broader material.

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