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THE DEVELOPMENT OF DIGITAL POCKETBOOK BASED ON THE ETHNOSCIENCE OF THE SINGKAWANG CITY TO INCREASE STUDENTS' SCIENTIFIC LITERACY ON HEAT MATTER AND ITS TRANSFER

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Abstract. Many factors cause low student scientific literacy, one of which is due to the inappropriate use of the selected learning media in the learning process. This study aims to produce ethnoscience-based digital pocketbooks that are feasible and attractive to use by students and are effective in improving students' scientific literacy. The ADDIE model research procedure used includes five stages, namely: Analysis, Design, Development, Implementation, and Evaluation. The sample consisted of 141 fifth grade students in three Singkawang City Public Elementary Schools. Data collection techniques in the form of interviews, validation, questionnaires, and scientific literacy tests. Based on the results of the analysis stage, it was found that the KI and KD were related to cultural elements and local wisdom of the city of Singkawang. The design stage is obtained by designing a book framework, presentation of material, instruments. The development stage obtained material, graphic, and linguistic feasibility. Phase I validation was 3.25 with a percentage of 81.41% and stage II was 3.72 with an eligibility percentage of 92.92%. The results of the practitioner validator were 3.8 with a percentage of 95% and were classified as valid. Implementation stage, validation of the attractiveness of student and student responses to linguistic aspects of 3.31 and 3.46, respectively. While the material and graphic aspects of the student's response have a value of 3.23 and 3.22 respectively in the attractive criteria and student responses have a value of 3.33 and 3.39 respectively in the very interesting category. This means that ethnoscience-based digital pocketbooks are generally feasible, easy to understand, and interesting to use because they have a new display concept that is coherently integrated with local culture and a design that is in line with developments. Students' scientific literacy skills increased with an effect size value of 0.621 with moderate criteria at 73% presentation. It can be concluded that ethnoscience-based digital pocketbooks can effectively improve students' scientific literacy skills.

Keywords**:** Digital Pocket Book; Ethnoscience; Literacy Science

I. INTRODUCTION

The low quality of Indonesian education, especially in the fields of science and mathematics, as shown in the 2015 TIMSS (Trends in International Mathematics and Science Study) ranking (Martin et al, 2015), Indonesia is in position 44 out of 47. Besides, the low quality of Indonesian education is also low. shown in the PISA (Program for International Study Assessment) ranking. PISA positions Indonesia in rank 64 out of 72 OECD countries (Indriani, 2016). The low level of scientific literacy in this ranking indicates that science learning in Indonesia has not been carried out well. Even

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though science is a fundamental subject in increasing the progress of a country. Hamzah (2018) states that in the current era of globalization, the progress and decline of a nation is largely determined by the extent to which the nation has mastered science and technology. This explanation was also supported by the results of the field pre-assessments.

The results of the pra-research conducted at SDN 29 Singkawang, it was found that science learning was still not carried out properly. So far, Science has only been taught by memorizing and there is a lack of variation in the use of learning resources so that scientific knowledge is only limited to short-term memory. In the end, science learning has not been able to develop students' scientific literacy.

Many factors cause low scientific literacy. Supardi (2012) argues that "the low learning outcomes of science learning is due to the inappropriate use of the selected learning media in the learning process. In line with this statement, to improve scientific literacy, appropriate learning resources and learning media are needed. Learning media must also be able to make the material more concrete and easy for students to understand, according to the times, technology in the particular and local culture. Especially for science material, the content of printed books is not filled with animation, so it asks students to understand some abstract concepts just by reading. This makes students not maximal in learning science so that more effective books are needed that are easy to get and carry in helping students learn science, namely with digital pocketbooks.

The need for smartphones has penetrated almost all circles, including elementary school students. This fact should be of concern to the world of education, so Oyewusi and Ayanlola (2014) argued that in the world of education, the use of smartphones can be used to facilitate the learning process. With a combination of smartphone technology with printed media, it can be the right combination in adapting the needs and character of elementary school students in this modern era. So of course, digital pocketbooks can be used as an alternative learning media, especially science learning books, especially heat subjects and their movements.

The 2013 curriculum must be responsive to the development of science, culture, technology, and art that can build students' curiosity and ability to use it appropriately and require students to implement the learning outcomes they get at school to the community (Kemendikbud, 2012). In line with the objectives of the previous curriculum, that the improvement of cultural education and local excellence, provide opportunities for education units to develop competencies following student characteristics, thus encouraging teachers to be able to develop learning by utilizing local wisdom as a learning resource (Ahmadi et al, 2012; Rosyidah et al, 2013). Plus in practice thematic learning requires students to be active in learning so that students will be able to find the best ideas, thus teachers must be able to create an interesting learning process (Muhardini et al, 2020). The curriculum provides opportunities for students to learn from the local culture about various important values and provides the opportunity to participate and develop local cultural values into cultural values that are used in everyday life (Fikri et al, 2019). Referring to this, according to Sudarmin (2014), the mandate and principles of development of the 2013 science curriculum that currently applies is to pay attention to local culture as a source of science learning. One way is to provide learning media that can reconstruct cultural-based science knowledge or ethnoscience.

Science education can be developed based on the uniqueness and uniqueness of an area so that students do not see science as a foreign culture to learn but as part of the local culture and wisdom of the area where they live (Kartono et al, 2010; Shidiq, 2016). So that combining local culture and wisdom with digital pocketbooks can provide meaningful learning and student attraction in learning science to increase students' scientific literacy.

Referring to the existing problems, this study aims to develop an ethnoscience-based digital pocketbook. With the development of this pocketbook, it is hoped that it can become an alternative source and media for learning so that it can improve students' scientific literacy.

II. METHODOLOGY

The development of this digital pocketbook uses the ADDIE model research procedure which has a function as a support in building a dynamic and effective learning infrastructure for learning performance (Yusuf, 2009). ADDIE has five stages, Analysis, Design, Development, Implementation, and Evaluation. Data collection techniques in this study consisted of (1) interviews, (2) validation, (3) questionnaires, and (4) tests. The target of 141 students from three public elementary schools namely elementary state school 17, 89, and 29 Singkawang, in Singkawang, was to determine the increase in students 'scientific literacy using pre-test and post-test students' scientific literacy questions. The results of the students' pre-test and post-test were analyzed for improvement using the Effect Size test.

III. RESULTS AND DISCUSSION

A. Eligibility of Ethnoscience Based Digital Pocket Book

The results of the questionnaire recap indicate that the ethnoscience-based digital pocketbook that has been developed is suitable for use in the scientific literacy of elementary school students on Heat and Transfer material. The average percentage of eligibility level reaches > 80% with valid criteria. The digital pocketbook in this study was developed through five stages, namely: Analysis, Design, Development, Implementation, and Evaluation.

The stages of analysis in this study have obtained the relationship between Core Competencies and Basic Competencies with cultural elements and local wisdom of the city of Singkawang, the results of identifying student characteristics by observation, the results of instructional objectives, the results of source analysis, formulating the right strategy, and choosing a paper size of 21 cm x 29,7 cm which is the size of A4 paper on the grounds of expanding the space. Stages of designing the instrument in the form of a questionnaire, one of which was intended to assess the results of the analysis of the suitability of the pocketbook indicator

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with ethnoscience material. Assessment is carried out to determine material weaknesses and indicator suitability. At this stage, the material will be translated into two, namely the Heat and Transfer content material and the relevant ethnoscience content material. The results of the association of heat material and its transfer with ethnoscience content can be seen in Table I.

TABLE I
RESULTS ASSOCIATED BY HOT MATERIALS AND ITS TRANSFORMATION WITH ETHNOSCIENCE CONTENT

Heat and Its Transfer	Ethnoscience
Belalle'	
Drying the Rice	Radiation
Chinese New Year Lantern Parade	
Flying Lanterns	Convection
Naga Sedau Stove Industry	
Ceramic Drying	Expansion
Dome-shaped Ceramic Burning	Conduction
Window and Chimney	Convection
Ngabayotn/Riding dango ceremony	
Cook Lemang	Radiation
Tuak	Heat and Its Transfer

After going through the design stage, the ethnoscience-based digital pocketbook was validated to see its feasibility by 3 experts, namely one material expert, one graphics expert, and one linguist who was carried out twice in the testing phase. The feasibility of the ethnoscience-oriented digital pocketbook developed comes from an assessment instrument according to the Center for Curriculum and Bookkeeping (Puskurbuk, 2014), in addition to validation by the 3 experts, the digital pocketbook is also assessed by a practitioner validator (user) consisting of 15 people a teacher at SDN Singkawang City. Recapitulation of the validation results can be seen in Tables II and III.

TABLE II
RESULTS OF VALIDATION OF DIGITAL POCKET BOOKS STAGE I AND II

	Phase I			Phase II		
Component eligibility	**Average score**	**percentage**	**criteria**	**Average score**	**percentage**	**criteria**
Material eligibility	3.24	81%	Enough Valid	3.75	93.75%	Valid
Graphic feasibility	3.20	80%	Enough Valid	3.63	90.75%	Valid
Language eligibility	3.33	83.25%	Valid	3.77	94.25%	Valid
Average	3.25	81.41%	Enough Valid	3.72	92.92%	Valid

Based on Table II, in stage I, the average expert assessment of the digital pocketbook as a whole is 3.25 or 81.41%. The results of the expert's assessment are quite valid criteria. Then made improvements according to the suggestions and input of experts. The lowest rating is the graphic aspect. The use of letter sizes and images that are not large and contrasting as well as images that do not bring ethnoscience should be improved so that they are following the characteristics of elementary school students and can make it easier for students to read and understand the material while using the pocketbook It can be seen in stage II that the average result of the three validators, each of which assesses the feasibility of material, graphic, and language components, is 3.72 with a percentage of the feasibility of 92.92%. This indicates that ethnoscience-based digital pocketbooks are valid and very feasible to use.

TABLE III
RESULTS OF VALIDATION OF DIGITAL POCKET BOOKS PRACTICES

Validator	Average score	percentage	Criteria
Validator -1	4	100%	Valid
Validator -2	3.6	90%	Valid
Validator -3	3.8	95%	Valid
Validator -4	4	100%	Valid
Validator -5	3.6	90%	Valid
Validator -6	4	100%	Valid
Validator -7	3.6	90%	Valid
Validator -8	4	100%	Valid
Validator -9	3.8	95%	Valid
Validator -10	4	100%	Valid
Validator -11	3.6	90%	Valid
Validator -12	3.6	90%	Valid
Validator -13	3.8	95%	Valid
Validator -14	4	100%	Valid
Validator -15	3.8	95%	Valid
Average	3.8	95%	Valid

The teacher's assessment as a user is intended to provide assessments and suggestions/input so that the ethnoscience-based digital pocketbook developed can be used in studying science. Based on Table 3, the teacher's assessment reaches an average score of 3.8 with a percentage of 95% and is valid or very suitable for use.

After receiving suggestions and comments during validation, the researcher made changes according to the validator's directions, including in Fig. 1.

(a) (b)

Fig. 1 (a) Front Cover Before Revision; (b) Front Cover After Revision

Fig. 1 on the book cover has a change. To design a digital pocketbook cover image, according to the validator, it must describe ethnoscience content so that it represents the contents of the book and in attractive colors for elementary school students.

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B. The Attraction of Ethnoscience Based Digital Pocket Book

The ethnoscience-based digital pocketbook that has been revised according to the validator's suggestion, is looking for its attractiveness as a companion textbook at the implementation stage. The attractiveness of the digital pocketbook was obtained from the results of the questionnaire responses of 31 elementary school teacher candidates and 141 grade V students in three elementary schools in the city of Singkawang. The attractiveness of the enrichment book is determined based on the results of the assessment of each component being assessed, namely the feasibility of the material, graphics, and language (Pukurbuk, 2014). The results of student and student responses can be seen in Table IV.

TABLE IV
RECAPITULATION OF RESPONSE BULLETS

Aspect	College Student Response		Student Response	
	Average	Criteria	Average	Criteria
Theory	3.23	Interesting	3.31	Very interesting
Graphics	3.22	Interesting	3.39	Very interesting
Language	3.31	Very interesting	3.46	Very interesting
Average	3.25	Interesting	3.39	Very interesting

Table IV shows that the average result of student responses for the highest aspect is in the language aspect, which is 3.31. Likewise, with the results of student responses, the language aspect has the highest average of 3.46. This shows that the spelling contained in digital pocketbooks is following standard Indonesian rules as reported by Jannah and Dwiningsih (2013) in their research states that the feasible category in the language aspect is obtained because the language used in the book being developed is good and correct language according to standard Indonesian rules. Besides, the sentences and grammar used in digital pocketbook are easy to understand.

For the material and graphic aspects of the student response, each has a value of 3.23 and 3.22 in the attractive criteria. It can be concluded that the ethnoscience-based digital pocketbook developed is suitable for use during the learning process in the classroom, especially on heat and its transfer. Retnaningsih in Rosyidah et al. (2013) stated that teaching materials can be applied to science learning if students' responses regarding the application of teaching materials have minimal quality in good or interesting categories.

Whereas in the student response, these aspects each have a score of 3.33 and 3.39 in the very interesting category, meaning that ethnoscience-based digital pocketbooks are generally easy to understand and interesting to use because they have a new concept of the appearance that is coherently integrated with local culture and designs according to the times. This is supported by Suwarni (2015) which stated that textbooks have the principle of being consistent, systematic, and relating it to the latest scientific developments. Besides, illustrations, pictures, and attractive colors create an impression that attracts students' attention in reading and using them. This is in line with the research results of Fikri et al. (2019), an enrichment book that has colorful and attractive illustrations (pictures) can make students interested in reading enrichment books and illustrated captions (pictures) according to the images presented. Besides, it was confirmed by research Istiningrum et al. (2016) which explained that the cover design of textbooks must be proportional, the design of textbook content must be attractive, images and colors that make students less clear to read must be changed to attract students' interest.

C. Increasing Students' Science Literacy

In this study, scientific literacy ability was measured based on student cognitive learning outcomes which were evaluated based on the pretest and postest scores given before and after the students used ethnoscience-based digital pocketbooks. Table V shows the pre-test and post-test results of students' cognitive learning.

TABLE V
PRE TEST AND POST TEST RESULTS OF SCIENCE LITERATION

	n	Maximum Score	Minimum Score	Standard Deviation
Pre test	141	51	38	28.287
Post test	141	98	75	55.555

Based on the data in Table V, it is obtained the results of calculations using an effect size of 0.621 with moderate criteria at 73% presentation. So that the average scientific literacy test of students after using digital pocketbooks is higher than the average learning outcomes of students before using digital pocketbooks, from this conclusion it can be concluded that there is a significant increase in Science literation. As stated by Astuti (2012), there has been an increase in students' scientific literacy skills from learning media that have been developed and applied in the science learning process. This shows that the product of ethnoscience-based digital pocketbook development is effective and can be used in the science learning process of heat material and its transfer. Syahroni et al (2016) stated that electronic pocketbooks are one of the teaching materials that help improve psychomotor abilities. The increase in students' scientific literacy after using this pocketbook is due to the description of the material in the pocketbook which is packaged by displaying scientific contexts integrated with local culture and local wisdom such as convection events in lantern lamps, radiation events in drying rice during the “beranyi” season, and events of expansion and conduction in the process of making a ‘tungku naga”. Supported by Nofiana (2018), the application of learning based on local excellence (local wisdom) can improve students' content, context, and science process skills (student scientific literacy). Based on the context of the sins, it makes it easy for students to understand the concept of heat and its transfer because it is found in students' daily lives. As reported by Pursitasari et al. (2019), students are skilled in connecting experiences in everyday life with the ability to classify and organize the subject matter.

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Indicators of scientific literacy in this study include science as a body of knowledge, science as a way of thinking, science as a way of investigating, interactions between science, technology, and society. The acquisition of indicators of students' scientific literacy skills before and after studying ethnoscience-based digital pocketbooks is shown in Fig. 2.

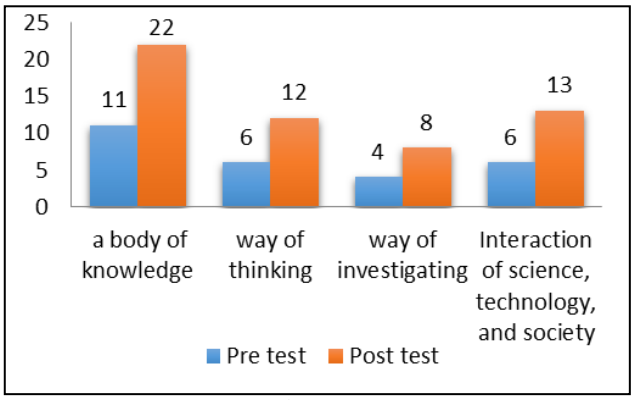

Fig. 2 Pre-test and post-test results for each indicator Student Science Literacy

It can be seen in Fig. 2 that overall there is an increase in students' scientific literacy on each indicator before and after using the ethnoscience-based digital pocketbook that was developed. The highest indicator of scientific literacy is found in science as a body of knowledge, then followed by indicators of interaction between science, technology, and society, then science indicators as a way of thinking, and the lowest is science as a way of investigating.

The highest gain in science indicators as a body of knowledge is because the pocketbook developed presents facts, concepts, principles, and laws that require students to remember knowledge or information. So that students can apply these concepts and principles in solving problems in everyday life. These results can be seen in the answers of students who can answer questions well on this aspect. Meanwhile, the lowest science indicator lies in the science indicator as a way of investigating. It can be seen in the answers of students who have not been able to relate the cause and effect of the investigation event and have not been able to interpret the results of the investigation. This can be due to the lack of student involvement in investigative activities that require students to do thinking activities so that students cannot conclude some concepts from the information they get in full. Utami in Safitri (2015), to be able to build more mature scientific concepts, students must be able to build their thinking skills, find and transform complex information by themselves, and check new information in their way so that they arrive at conclusions that form knowledge. to the science of thinking activities. So it takes routine activities so that students get used to carrying out investigations in building their thinking activities.

IV. Conclusions

The ethnoscience-based digital pocketbook on heat and its displacement material that was developed met the valid category so that it was suitable for use in the scientific literacy at the elementary schools of Singkawang City. The use of ethnoscience-based digital pocketbooks in science learning can also effectively improve the ability of the four indicators of scientific literacy of fifth-grade elementary school students in the content dimension with the moderate category.

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