

Ethnoscience Based E-Book Sac Development to Promote Scientific Literacy of Theme 6 to The Fifth Grader of Elementary School in Mranggen Demak

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Published: 13 July 2022

To cite this article (APA): Kusumawati, E., Santoso, S., & Fahturohman, I. (2022). Ethnoscience Based E-Book Sac Development to Promote Scientific Literacy of Theme 6 to The Fifth Grader of Elementary School in Mranggen Demak. *Asian Journal of Assessment in Teaching and Learning*, 12(2), 24-34. <https://doi.org/10.37134/ajatel.vol12.2.3.2022>

To link to this article: <https://doi.org/10.37134/ajatel.vol12.2.3.2022>

Abstract

The study aimed at knowing and analyzing the need, design, properness and effectiveness of ethnoscience based *e-Book SAC* development to promote scientific literacy of Natural Science Subject-theme 6 of the fifth grader of Elementary School in *Mranggen Demak*. This study is a research and developmental model referring to Borg & Gall consisting of 10 phases simplified in four stages, i.e., preliminary stage, development and validation, field test and dissemination. In collecting the data, the study used observation, interview, questionnaire of need and expert validation sheet, student achievement test and documentation. The data analysis was qualitatively and quantitatively done. The subject of the study was 7 teachers and 45 students of fifth grader of Elementary School at the Sub-district of *Mranggen, Demak* Regency. The research result showed that the needed *e-book SAC* was digital book which is interactive, communicative and helping students study learning books easily, because the developed *e-book SAC* was completed with photos and videos relevant to the daily life as materials to be learned by students. The development design of the *e-book* was based on *ethnoscience* using the application of *Smart Apps Creator (SAC)* with the assistance of *Swishmax* software to make interactive design and animation. Based on the fit and proper analysis the developed model of *e-book SAC* was considered accountable due to the validation result of material and media expert with the value average or indicator average of 7,3% or equal to 91,6. The analysis result of the effectiveness of *e-book SAC* model based on *ethnoscience* showed that the model is effective to develop scientific literacy. The statement was based on the analysis result of N-Gain, and t-test examination on the experiment group 1, 2, and 3 with the average score of scientific literacy development on Fifth graders of 70,73, exceeding the determined minimum learning mastery standard, 65. The conclusion of the study is that the development of ethnoscience based *e-Book SAC* is necessary, accountable, and effective in line with the design of *e-book SAC* which is needed by teachers and students.

Keywords: E-book, ethnoscience, scientific literacy

INTRODUCTION

In response to the rapid development of information technology, it is necessary to prepare students with learning competence in digital era (Phoon et al., 2021). It will be a good opportunity or chance for students if they can make use new technology. Students need to have competences to keep in pace with technology.

It is necessary for students to own creativity potencies of searching new information through digital technology. Students should have high skill of digital literacy as one of the efforts of educational world to promote them to have competence in literacy (Dou & Huang, 2022).

The needed literacy is not only limited to reading competence but it is more on the understanding towards environment, health and economy, the use of technology as well as the development of knowledge and science. One of the literacy competences that need to be prepared by the world of education is scientific literacy. Scientific literacy is important to students in order that they understand science not only as a concept but also apply science in daily life. According to National Research Council (1996) in Valladares (2021) scientific literacy is necessary to develop due to: 1) giving a personal satisfaction and enjoyment which appears after understanding and learning science, 2) everybody needs information and to think scientifically to make a decision, 3) everybody needs to involve their ability at public discourse and in debating important issues one needs science and technology, and 4) scientific literacy is important in workplace, so it necessitates people to learn about science, reasoning, thinking creatively, as making a decision, and solve problems.

Scientific literacy turns to be very important to be owned by students as their preparation to face the challenge of 21 century. It is in line with the statement from Sjöström & Eilks (2018) scientific literacy is directly correlated with building a new generation of stronger scientific minds that can effectively communicate research science to the general public. Scientific literacy correlates directly by developing new generation having a strong thought and attitude who can effectively communicate knowledge and research to the society (Rahman, 2021).

Efforts of developing scientific literacy on students can be done by giving them learning experiences which is not only theoretical but also practical. According to the Regulation of Education Minister Number 57, it is stated that Curriculum 2013 places schools as part of the society which gives learning experience so that the students have the ability to apply what have been learnt in school to the society and the society serves as a learning resource. A Part of the thematic learning in Elementary School is natural science. The learning of natural science is not just theoretical and memorized but it should be meaningful (Wuryani & Yamtingah, 2018).

Through the Curriculum 2013, learning activity has been demanded to apply 4C (Critical Thinking, Communication, Collaboration, Creativity). The competences can be realized through learning process or learning experience. Lee & Reeves (2017) explained, one's learning experience can be gained through action process or having self-experience on what is learnt, observation process and listening to certain media and listening process through language. In this case, the more concrete the students learn the materials, such as through a direct experience, so the more experience they will get.

Based on the above discussion about gap, the researcher intended to conduct a developmental study on ethnoscience based *e-Book SAC* development to promote scientific literacy. To begin the study, the researcher conducted an observation in *Krangsono 3-Elementary School Mranggen* on 5 January 2021 on the fifth grade students. The data was found that there are 46 fifth grade students among which 35 students have got smartphone and 11 others have not. It showed that the use *e-book SAC* was applicable, while those who do not have *smartphone* could be handled by the teacher with appropriate treatment. Therefore, the author was interested in conducting a study entitled "ethnoscience based *e-Book SAC* development to promote scientific literacy of Natural Science Subject-theme 6 of the fifth grader of Elementary School in *Mranggen Demak*."

LITERATURE REVIEW

According to Rahim et. al. (2020) *e-book* is a publication consisting of text, figure, as well as sound and published in digital form which is readable in computer or other electronic devices, such as android, smartphone, or tablet. *Ethnoscience* is a strategy of creating learning environment and designing learning experience integrating culture into the learning process of Natural Science.

Dragoş & Mih (2015) suggested five basic principles of scientific literacy, i.e., 1) Contextual, in line with local wisdom and era development, 2) Fulfillment of social, cultural and national need, 3) In accordance with learning quality standard compatible with 21st learning characteristics, 4) Holistic and integrated with other various literacies; as well as Collaborative and Participative.

METHODOLOGY

The study is a Research and Development on Media of ethnoscience based *e-Book SAC* to promote scientific literacy of Natural Science Subject-theme 6 of the fifth grader of Elementary School in *Mranggen Demak*. Moore et al. (2014) stated that a research and development is a process of developing a new product or perfecting the existing product, which can be held accountable. Additionally, according to Green et al. (2012) a research and development method is a research method used to result in a certain product and to examine its properness and effectiveness.

In terms of the research design, the study used *Research and Development* approach. Borg and Gall in Aka (2019) with mixed methods design as well as exploratory mixed design. The model effectiveness examination of the *e-book SAC* media used pre-experimental designs with one-group pretest-posttest design (Klassen et al., 2012).

The subject of the study is teacher and students of Five Grader of Elementary School in Sub District of Mranggen, Demak Regency. The first research question which is concerned with the need for learning media was answered by using percentage. The second question was concerned with the model design and the model properness test of the ethnoscience based *e-Book SAC* to promote scientific literacy of natural science of the fifth-grade students of Mranggen Demak, and was answered by using the procedure of research and development. The research hypothesis was examined by using technique of n average difference (t-test). The data analysis was conducted through computerization using software of *Statistical Packages for Social Science (SPSS) 23.0 for Windows*.

The Model Visualization of the Media of ethnoscience based *e-Book SAC* development to promote scientific literacy of Natural Science Subject-theme 6 of the Fifth Grader of Elementary School in *Mranggen Demak* is presented in Figure 1.

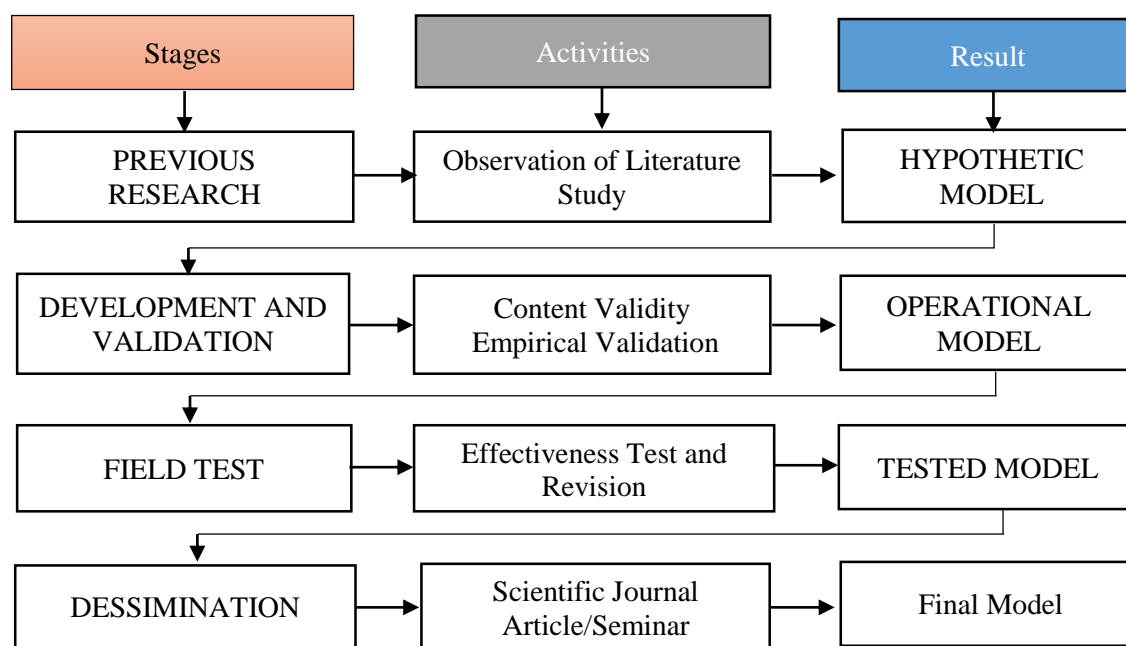


Figure 1. Procedure of Borg & Gall research and development

Data analysis

The data analysis are activities of arranging and presenting research data derived from the research result. Data analysis is needed to test the truth of research hypothesis. In line with the main objective of the study, i.e., to analyze the accountability (properness) and effectiveness of the model (Goertzen, 2017).

The properness examination was conducted by taking the data of teachers and students' response related to ethnoscience based *e-Book SAC* development to promote scientific literacy of Natural Science Subject-theme 6 of the Fifth Grader of Elementary School in *Mranggen Demak*. The examination of model properness was done by the following formula:

$$NA = \frac{\sum SR}{\sum SI} \times 100\% \quad (1)$$

Notes:

- NA : final result
 SR : validator score
 SI : ideal score (maximum score x item number)

Table 1. Score of media expert examination score

The number of the Gained Score	Assessment Category <i>e-book SAC</i>
$0 \leq x \leq 25$	Low
$25 \leq x \leq 50$	Fair
$50 \leq x \leq 75$	Good
$75 \leq x \leq 100$	Excellent

Based on the average result, it was known the condition of the developed media of *e-book SAC*, if the result of the experts' assessment was categorized fair or low, it means that the product development should be revised as suggested by the assessors. The *e-book SAC* development result was revised as suggested by the media expert. If the research result has been good or very good, the product was only fixed on the aspect which not yet revised.

The effectiveness analysis is done by the technique of measuring the difference between the result data of *pretest-posttest*. The technique of data analysis of the result of students' pre-test and post-test used the following procedures:

- Giving score to student for each test item according to the scoring guideline
- Calculating the sum of the score gained by students
- Calculating the student's score by using the following formula

$$Student = \frac{Gained\ Score}{Maximum\ Score} \times 100 \quad (2)$$

The effectiveness Test was done by using the *N-gain* test. The result of the *N-gain* test was interpreted by the table of *gain* (g) assessment classification.

$$N.G = \frac{post\ test\ score - pre\ test\ score}{Maximum\ Possible\ score - pre\ test\ score} \quad (3)$$

Table 2. Average of Normalized Gain Score and its Classification

Gain average	Classification	Level of effectiveness
$\langle g \rangle \geq 0,70$	High	Effective
$0,30 \leq \langle g \rangle < 0,70$	Medium	Fairly Effective
$\langle g \rangle < 0,30$	Low	Less Effective

Hake in Meltzer 2002: 1

The hypothesis testing involved two groups of population, therefore it used *t-test*. Wagala (2020) explained that if the sample is correlated/paired, e.g., comparing before and after treatment or comparing the control group and experiment group, then it uses the formula of *t-test of related sample*.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} - 2r\left(\frac{s_1}{\sqrt{n_1}}\right)\left(\frac{s_2}{\sqrt{n_2}}\right)}} \quad (4)$$

Description:

- t : t obtained which is then consulted with t-table
 \bar{X}_1 : average of sample 1

- $\overline{X_2}$: average of sample 2
 S_1 : standard deviation of sample 1
 S_2 : standard deviation of sample 2
 S_1^2 : variant of sample 1
 S_2^2 : variant of sample 2
r : correlation

RESULTS AND DISCUSSION

Need analysis of *e-book*

There are two aspects of need analysis of the *ethnoscience* based *e-book SAC* in the study, those are literature analysis (Handbook about Heat Material dan its Transfer), need of teacher and students (response of teacher and students towards the use of Handbook about Heat Material dan its Transfer). The study was conducted to determine the appropriate media used for synchronous and asynchronous learning. Conceptual Analysis on Heat Material and Its Transfer can be described as the following diagram in the Figure 2.

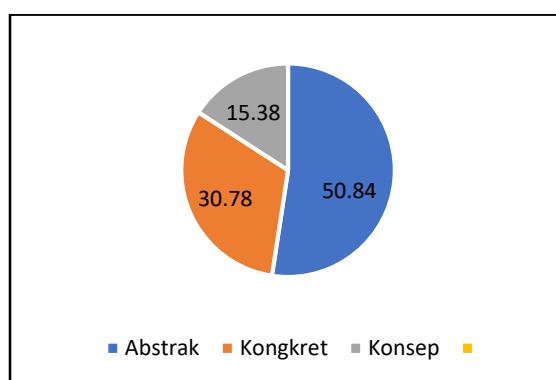


Figure 2. Analysis of handbook of heat material and its transfer

The next stage was analysis on the need of teacher and student towards the use of *e-book SAC* in online process of learning. In this stage, it was done the preliminary analysis, i.e., distributing questionnaire through *google form* link to know the condition of classroom, teacher and students' learning facilities as well as the necessity of learning by using *ethnoscience* based *e-book SAC*. It needed a field study to know the need of the *ethnoscience* based *e-book SAC* by distributing questionnaire on the need of *ethnoscience* based handbook to teacher and students via online or offline/directly visited some Elementary Schools in Mranggen Sub-district, especially in the cluster area of Ki Hajar Dewantara. The analysis result of the need of teacher on *e-book SAC* is follows:

Based on the need analysis of teacher towards the *ethnoscience* based *e-book SAC*, there was at average 85.09% of teachers need *e-book SAC*, while 14.91% of teachers used other learning instead of *e-book SAC*. According to the teachers, *e-book SAC* is an interesting digital book to children in which children are interested in digital book so as to be more motivated to learn. Then, the analysis of students' response towards the use of *e-book SAC* in learning.

Development of *e-book*

The development of *ethnoscience* based *e-book SAC* is to increase scientific literacy. The *e-book* begins with preliminary study of literature, response of teachers and students towards the use of *e-book SAC* for learning Natural Science. Here are the stages of *ethnoscience* based *e-Book SAC* development.

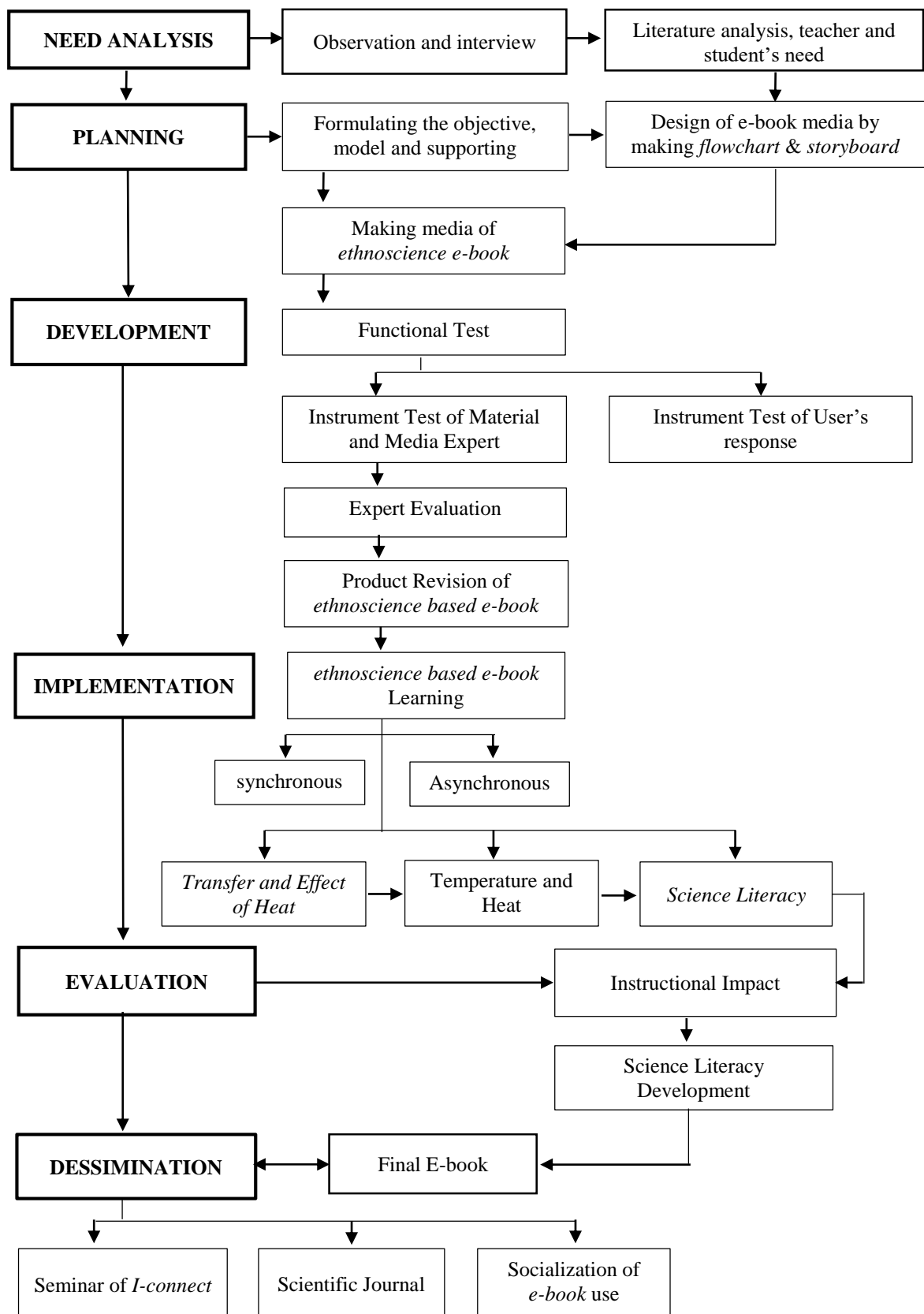


Figure 3. Design of *ethnoscience based e-book SAC* model

Properness of *E-book SAC* model

The properness test in the model development was based on the evaluation result of media and material experts including the responses of teachers and students of the fifth grader of elementary schools in Mranggen Sub-district. The aspects evaluated by the validators of material expert covers the materials, construction and language. Meanwhile, the properness evaluation in the aspect of media includes material, face and language showed in which the evaluation result of the two validators showed that the development of *ethnoscience* based *e-book SAC* does not need any revision due to the average scoring or the indicator average of 7,3% or equals to 91,6%, which means the development of *ethnoscience* based *e-book SAC* is proper to be used for a learning.

The validation of the *e-book SAC* was done by the media experts, i.e., Dr. Eko Darmanto, and Dr. Sumaji, M.Pd, either the media expert's validator or the material expert's validator gave the evaluation of the properness of *e-book SAC* to be used to develop the scientific literacy of theme 6 of the Fifth-grader students of elementary school. The properness was also strengthened by the teachers' response who have given the evaluation of high leveled properness to be used for online or offline learning. As suggested by Azizah. (2020: 73), *e-book SAC* is an application which has an appearance like PPT or *e-book SAC* so that it facilitates students to understand information they get.

In addition to the ease of its application, *E-book SAC* is also supported by *e-book* model development which facilitates them to learn consisting of: a) Introduction, including title page/initial appearance, copyright page, acknowledgement, theoretical framework, direction, mapping of the content of *e-book SAC*, b) Content, containing materials of sub-theme 1, sub-theme 2, sub-theme 3, link of video of every sub-theme, evaluation in form of exercises, c) Closing, containing reflection, glossaries, bibliography, and profile of the author.

The attractiveness of *e-book SAC* is necessary for students to feel comfortable and delighted in learning with *e-book SAC*, therefore the developed *e-book SAC*, completed with figure, photo, video or test questions which can be done online. The attractiveness of the e-book can be seen from the appearance of the materials which are easy to learn supported with pictures/figures, photos or videos. It is done with an expectation that the students do not feel bored in learning Natural Science through the e-book SAC.

The effectiveness of *E-book SAC* model

Score of pre-test and post test

The analysis of N-gain is aimed at knowing the effectiveness of the use of media or specific treatment in research of *one group pretest posttest design*. Pretest and pots test was conducted to control group and experimental group. It was done to know the effectiveness of *e-book SAC*. To examine the effectiveness of *e-book SAC* by using Test of N-Gain was by calculating the interval of pre-test and posttest. The analysis that N-Gain showed that the average score of pre-tests was 45,43 with low category, while the score of post-test in the control group was at average 53,10 with low category.

Table 3. Recapitulation of literacy development

Class	Average of the analysis result of N-Gain				
	Pretest	Posttest	Pre and Post test	Score ideal-Pretest	N-Gain
Control	45.43	53.10	7.43	51.58	0.14

Table 4. Recapitulation of literacy development

Class	Analysis N-Gain				
	Pretest	Posttest	Pre and Post test	Score of ideal-Pretest	N-Gain
Experiment 1	16,50	70,40	54,03	83,10	0,70
Experiment 2	15,40	70,45	56,05	84,60	0,70
Experiment 3	13,10	71,36	58,26	86,90	0,70
Average	15,00	70,73	56,11	84,86	0,70

The result of the score analysis towards the experiment group showed that the pre-test score was at average 15,00, i.e., low category, and the score of post-test of the experiment group was at average 70,73, i.e., in category high. The result of N-Gain test was at average 0,70, in high category. The result of N-Gain test showed that there was significant increase of (0,70), which means the learning with the ethnoscience based *e-Book SAC* was effective to promote the scientific literacy of the fifth-grade students of elementary school.

Hypothesis testing

The result of effectiveness with N-Gain Test still needs proving, i.e., by hypothesis testing to prove that there was significance of effectiveness of the ethnoscience based model of *e-book SAC* by using data analysis of t-test. As the pre-requisite of t test, it was first done a data normality test and data homogeneity test and if the pre-requisite was significant then t-test was conducted.

Pre-requisite test

Test of normality

Test of Normality is a test conducted to know data population whether or not they are normally distributed as well as to measure ordinal, interval or ratio data. Therefore, concerning the data normality test, the data should be derived from those which are normally distributed. Otherwise, the data cannot be proceeded to *t-test*.

Test of Normality is also to know the data of *posttest* score of the increase in scientific literacy of theme 6 of the fifth graders of elementary school as the experiment and control group whether or not they have normal distribution. Regarding the normality test, the study used test of *Kolmogorov-Smirnov* with the significance of 0.05. The data are considered normal if the significance value is higher than 0.05. The hypothesis is as follows:

H_0 = normally distributed data (significance value > 0.05)

H_1 = not normally distributed data (significance value < 0.05)

Table 4. Test of normality

<i>Tests of Normality</i>						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Class A	.133	30	.188	.971	30	.579
Class B	.114	30	.200*	.981	30	.853
Class C	.130	30	.200*	.937	30	.077
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Value of Sig. Class A = 0.188

Value of Sig. Class B = 0.200

Value of Sig. Class C = 0.200

Since the value of sig. < 0.05 then the level of trust is 95%, the posttest score of class A, B, dan C are normally distributed.

Test of homogeneity

Test of Homogeneity is used to know whether or not the population's variants are the same. The test is conducted as the prerequisite in the analysis of independent sample of *t test*. The underlying assumption in the variant analysis (Anova) is that the population variant is the same. Test of homogeneity can be done if the data group are normally distributed.

Test of homogeneity in this study is used to know whether the experiment group and the control group have the same variant or not. The test of homogeneity used SPSS with *lavene* test. If the score of significance shows the values more than (>0.05), so the variants of both groups are the same (homogenous) and if the variants are less than (<0.05), then the variants are different (not

H_0 = Variants of both groups are the same (homogenous).

H₁ = Variants of both groups are different (not homogenous).

Table 5. Test of homogeneity

<i>Test of Homogeneity of Variances</i>					
		<i>Levene Statistic</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
Value	Based on Mean	.062	2	102	.940
	Based on Median	.041	2	102	.960
	Based on Median and with adjusted df	.041	2	101.346	.960
	Based on trimmed mean	.084	2	102	.920

Value of Sig. = 0.940. Since the value of significance >0.05 (higher than significance value >0.05) so the data value of *posttest* is homogenous.

t-test

T-test is one of the tests which is done to know the effectiveness of a developed model. Besides, *t test* is also aimed at knowing the accuracy of the resulted data according to the reality in the field. To know the effectiveness of a developed model, the data were gained from score of pre-test and *post-test*. To prove the effectiveness significance of the model development, the data analysis of *t-test* as follows:

$$t = \frac{Md}{\sqrt{\frac{\sum x^2 d}{N(N-1)}}} \quad (5)$$

Description:

- Md = mean of the difference of *pre-test* from *posttest* (*posttest* – *pretest*)
 $\sum x^2 d$ = Number of quadratic deviation
 N = Object on sample
 d.b. = determined by N-1

Table 6 is the main table of the analysis of independent sample of *t-test*. It is seen that the value of 2 tailed significance (*t-tailed*) is 0.000 <0.05.

Table 6. *T-test*

One-Sample Test							
Test Value = 65							
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference		
					Lower	Upper	
Value of Posttest	15.564	104	.000	5.69524	4.9696	6.4209	

Calculation of *t-test*

As the basis of evaluation of the scientific literacy development by determining *test value* 65 (passing grade value = 65).

1. Hypothesis

- H₀ = $\mu_1 \geq \mu_2$, the development of *ethnoscience* based *e-book SAC* shows that the increase of scientific literacy of the experiment group is not better than the conceptual understanding of the control group at average.
- H_a = $\mu_1 < \mu_2$, he development of *ethnoscience* based *e-book SAC* shows that the increase of scientific literacy of the experiment group is better than the conceptual understanding of the control group at average

2. Criteria

If P-value > 0.025 then Ho is accepted.

If P-value < 0.025 then Ho is rejected.

Value of Sig. (2-tailed) = 0.000

P-value = $\frac{1}{2}$ of value sig. (2-tailed) = 0,000

P-value < 0,025 then Ho is rejected.

Test of right side.

Ho = at average students' ability is not more than 65.

Ha = at average students' ability is more than 65.

Conclusion withdrawal

The gained value of Sig. (2 tailed) was 0.000. The P-value = $\frac{1}{2}$ x Sig. 2 tailed = $\frac{1}{2}$ x 0.000 = 0.025. Due to $0.025 < 0.05$ it means Ho was rejected. Therefore, it can be concluded that at average the increase (development) of the scientific literacy of the experiment group was found to be better than that of the control group, or in other words the experiment group with their average score of the scientific literacy of the fifth grader students got more than 65 score, i.e., at average 70.73 exceeding the *ethnoscience* based *e-book SAC* determined minimum passing grade. Based on the evaluation result, it was proved that the *ethnoscience* based *e-book SAC* was effective to develop the scientific literacy of the fifth grader students of elementary school of Mranggen Demak.

CONCLUSION

Based on the research result of the development of the *ethnoscience* based *e-book SAC* it can be concluded as follows:

1. The *e-book SAC* development was applied based on the real need in field regarding the necessity of e-book for online learning. The need analysis on the *e-book* showed that the *e-book* was highly needed as the online learning material substituting for the handbook regarded less effective in the online learning. Besides, the availability of the printed handbook is limited, i.e., one book is used for 3 students.
2. The design of *ethnoscience* based *e-book* development based on the need of *e-book* for online learning began with a need analysis, planning, development, implementation, evaluation and dissemination. The design of model was developed in line with the learning ability of the fifth grader students of elementary school, so that the *e-book* was easy to learn and to understand.
3. Based on the properness analysis, the developed model of *e-book* was considered proper, so it means that *ethnoscience* based *e-book SAC* can increase the scientific literacy of the fifth grader of elementary school. It was based on the validation analysis result of the experts of learning material and media which both were considered very proper to be used for learning to develop scientific learning.
4. The analysis result of the model effectiveness of the *ethnoscience* based *e-book SAC* showed that the model of *e-book SAC* was proven to be effective to increase scientific literacy. The conclusion was based on the analysis result of N-Gain, and the examination of *t-test*, which showed that the experiment groups of 1, 2 and 3 with the average score of scientific literacy development of the fifth grader students had got the average score of 70,73, which exceeded the determined minimum passing grade of 65.

RECOMMENDATIONS

Based on the conclusion, it is recommended as follows:

1. The initial stage of a model development which should be done is knowing the basic need concerning type, material and form of the developed model. Besides, a need analysis should be conducted to get direct information from the model users, i.e., teachers and students.

2. In designing a model, there needs to be accurate thought considering level of need and potential availability to be developed and considering stages of designing a model, i.e., need analysis, planning, development, implementation, evaluation and dissemination.
3. Based on the properness test, the *ethnoscience* based *e-book SAC* is proper to be used for developing scientific literacy of the fifth grader students of elementary school. Therefore, it is recommended that the *ethnoscience* based *e-book SAC* can be used for increasing the scientific literacy of the fifth grader of elementary school.
4. The *ethnoscience* based *e-book SAC* was proved to be effective to increase (develop) the scientific literacy of the students. Thereafter, the model of e-book is recommended to be used by the fifth grader.

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