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THE DEVELOPMENT OF SCIENCE DOMAIN BASED LEARNING TOOL WHICH IS INTEGRATED WITH LOCAL WISDOM TO IMPROVE SCIENCE PROCESS SKILL AND SCIENTIFIC ATTITUDE

A. Dwianto[1]*, I. Wilujeng[2], Z. K. Prasetyo[2], I G. P. Suryadarma[2]

[1]SMPN 2 Paranggupito Kabupaten Wonogiri, Indonesia
[2]Universitas Negeri Yogyakarta, Indonesia

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ABSTRACT

This research was conducted to : (1) improve the science domain based learning media which is integrated with appropriate local potention for Science learning material "Object Change Around Us" for students grade VII of Junior High School, (2) know the effectiveness of science based learning media which is integrated with developed local potention to improve science process skill and scientific attitude of students grade VII of Junior High School. This research was a research and development which adapt 4D Thiagarajan model which include four steps, they were: (1) define, (2) design, (3) develop, and (4) disseminate and Borg & Gall development model which was done into 7 steps, they were: (1) research and information collecting, (2) planning, (3) developing preliminarry form of product, (4) preliminary field testing, (5) main product revision, (6) main field testing, and (7) operational product revision. The research result showed thet the science domain based learning media which was integrated with developed local potention were: (1) appropriate to be used for science learning material "Object Change around us" for students grade VII of JHS, (2) effective to improve science process skill and scientific attitude of students grade VII of JHS.

Keywords: learning media; science domain; local potention; science process skill; scientific attitude

INTRODUCTION

Science accomplishment of students in Indonesia is nowadays left behind from other countries. Based on the result study by Trends in International Mathematics and Science Study (TIMSS) year 2011, it was known that science achiecement of indonesian students took number 40 with the score 405 among 42 countries (Martin, Mulis, Foy, Stanco, 2012). The same result was also showed by Programme for International Student Assessment (PISA) study year 2012, in which the level of literal science by Indonesian students placed 64 among 65 countries with the average score of 382, very far from the average of all participants who reached 501 (Kelly *et al.*, 2013).

The process of science learning in Indonesia is having some weaknesses. Suastra (2005) stated that almost (90%) the purposes of science learning at school were directed to science achievement (science product) and the rests were directed to the skill process and attitude with scores. This condition showed that science learning seemed unworthy for students. Science learning still underlined on only cognitive aspects. Those were only memorizing some formula and concepts. Students less knew facts, principals, law and theories about science. Besides, the purpose of learning on process skill aspects was not optimal in science learning. It was also reaffirmed by Collette & Chiapetta (1994) who stated

***Alamat korespondensi:**
E-mail: agusdwianto81@gmail.com

most science learning at school only pointed on cognitive purposes and ignored affective ones including attitude, motives, and value. Science learning should be covered in a funny and interesting situation because students learnt contextual things (Bimo, 2013). Science concepts learnt were related to the phenomena experienced and faced by students in daily life. Science learning had to be oriented on science natures.

Science natures consists of 4 elements, science as a process, science as a product, science as a skill development, and science as an application. These four science natures should be reached together during learning process (Erina & Kuswanto, 2015). Science firstly was seen as a knowledge about universe accumulated through history records. Then the attention to its process appeared, it was skill needed to find new knowledge. From here then science natures were known as content amd process. McCormack & Yager developed taxonomy education of science into five domains which were considered they could answer all science aspects in learning, tehy were knowledge, process of science, creativity, attitudinal, and application and connections domain (McCormack, 1995). These five domains were the development of bloom taxonomy which had 3 domains in learning. With these five developed domains, students would get more meaningful learning and they were expected to help students improve their result study.

Five science taxonomy domains were presented in Figure 1 (Akcay & Yager, 2010). The focus of science learning was generally on knowledge and process domain. This focus by some tachers was then developed into attitude and creativity domain. Science learning should stimulate studentss to apply and combine concept and process skill with reality.

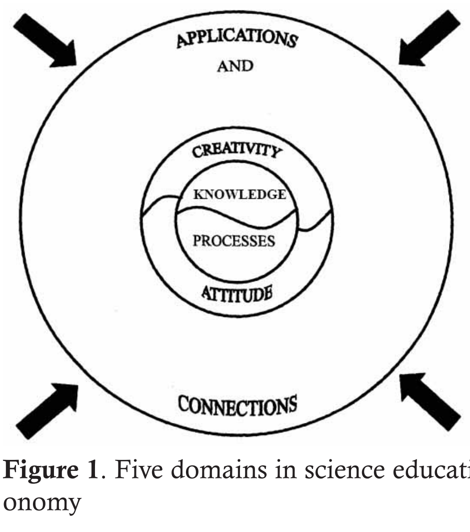

Figure 1. Five domains in science education taxonomy

Based on the first study using questionnaire and observation done in SMP N 1 Paranggupito, SMP N 2 Paranggupito, and SMP Pancasila 13 Paranggupito Wonogiri Regency, it was taken the information that learning models beloinging to teachers were not developed individually and they only adopted from materials arranged by MGMP. Science learning done till now hs not developed science domains, espcesially science process domain and attitude domain. Science teachers in Paranggupito dubdistrict also stated the abscense of science domains based learning material which was appropriate and efective to improve process skill and scientific attitude of students so that it needs some improvement. Based on this first data study, some materials based on science domain were needed to improve science process skill and scientific attitude among students.

Science process domain emphesized the use of some process skills to learn how scientists thought and workd. Yager (1992) stated that many scientists worked by using some specific process skills. How they thought and worked were important parts needed to be applied on students during learning process. Science process domains were : observing and imaging, clarifying and organizing, measuring and drawing chart, comunicationg, predicting and concluding, proposing hipothesis, studying hypothesis, testing hypothesis, identifying and controlling variables, interpretting data, making instruments, or using simple tools and models. McCormack (1995) stated some science process skills were : (1) observing and imaging, (2) classifying and organizing, (3) measuring and drawing chart, (4) communicating, (5) predicting and infering, (6) making hypothesis, (7) testing hypothesis, (8) identifying and controlling variables, (9) interpreting data, and (10) constructing and using instruments, simple equipments and models.

Policy system in Indonesia had given a big opportunity for teachers to integrate local potention with learning process. The fact on the field, integrating local potention with learning process has still faced some problems. The main problem was that teacher does not know how to integrate environment potention with learning process exactly (Alexon, 2010). Besides, Widowati (2010) revealed some factors why teacher did not use local potention in learning process were their outnumbering onus in teaching, the abscence of adapted models, facilities, fund, and time.

Local potention is the original society knowledge. Local potention for some people was ignored because the main view of knowledge from western was seen to be the strongest and the most useful. Science learning in Indonesia could not ignore culture contribution nor local potention. Students could not separate from value developing in the society, with many ethnic background and culture (Sajidan *et al.,* 2015).

Many valuable local potention have not been integrated with learning process. Integrating local potention indeed has been done by some teachers in Indonesia. It was still limited. Atmojo (2015) stated although local potention has been implemented in curriculum, not all students get the knowledge and they felt this implementation was only an extracurricular that were to follow. Students have not understood the value of technology, science and local culture value, so they have no knowledge and appreciation towards local potention around them.

Science process skill is skill that could be trained and it represented scientist behavior. Science process skill facilitates science learning, makes sure students' active participation, and trains them in learning, and also trains them how to think and work like scientists. Science process skill was devided into two, they were basic process skill and integrated process skill. Basic process skill included observing, taking conclusion, prdicting, using time and space relation, and using number. Integrated process skill included controlling variables, defining operational, formulating hipothesis, formulating models, interpreting data and experimenting (Raj & Devi, 2014).

Yager (2012) explained that attitude domain emphasized on humanity, value, and skill to make decision that was needed to develop. This domain included: (1) developing positive attitude of students towards science in general, science in school, and science teachers, (2) developing positive attitude of students towards themselves, for example through confidence *I can do it,* (3) digging human emotion, (4) developing care and respect towards others feeling, (5) expressing private feeling through constructive ways, (6) making decision on private problems, and (7) taking decision related to environment and social (McCormack, 1995).

Scientific attitude is different from attitude towards science. Although both concepts have relation but theere is significant difference. Attitude towards science is a tendency on feeling happy or unhappy towards science, for example thinking science is difficult to learn, less interesting, boring, or the opposites of them. whereas scientific attitude is an attitude belonging to scientists in searching nad developing new knowledge, for example objective towards facts, careful, responsible, open minded, always want to observe, etc (Bundu, 2006). Scientific attitude according to Harlen (Bundu, 2006) includes: curiosity, respect to data/fact, think critically, discovery and creativity, open minded and cooperative, perseverence, care towards environment.

Based on those backgrounds, this research is conducted to: (1) develop based science learning materials which is integrated with appropriate local potention for science learning with material Object Change around us for students grade VII JHS, (2) know the effectiveness of science domain based learning material which is integrated with developed local potention to improve science process skill and scientific attitude of students grade VII JHS.

METHOD

This research was research and development. This research developed a product as science domain based learning material which was integrated with local potention to improve science process skill and scientific attitude of students. Developed learning materials consisted of syllabus, study plan, worksheet and assessment for JHS material grade VII with theme Object Change around us.

Development procedure was adopted from 4D Thiagarajan model which included 4 steps, they were: (1)define, (2)design, (3) develop, and (4)disseminate (Thiagarajan & Sammel, 1974), and development model of Borg & Gall which included 10 steps, they were: (1) research and information collecting, (2) planning, (3) developing preliminarry form of product, (4) preliminary field testing, (5) main product revision, (6) main field testing, (7) operational product revision, (8) operational field testing, (9) final product revision, (10) dissemination and implementation (Borg & Gall, 1983). Development model of Borg & Gall in this research was done till step 7.

Define step (research and information collection) was the first step research and first data collecting. Activities done were literature study, introduction study, and need analysis. Literature study was done by studying theory about learning material, science domain, local potention, acience process skill, scientific attitude, and other supportive theories. Introduction study was done to know the problems and the product needed on the field. Result of this introduction study was then studied to determine the needed product. Curriculum analysis and material analysis were also done in this step. Curriculum analysis was done vy identifying standard competemce that students must poses and determine the indicators of achieving this standard competence. Material analysis was done by determining concept that will be tought and making map concept to ease developing learning material.

Design/planning step was step of designing product that will bedeveloped. The activity done was determining product component, purpose of developing product and target of product user. Determining product component was accompanied with determining forms for each components, they were syllabus, study plan, assessment, and LKPD.

Develop step was step of developing product. The activities done in this step were : (a) develop preliminary form of product, it was step of developing first product, arranging instruments, validating product, and firs revision; (b) preliminary field testing, it was testing test on the field (limited). Test was done to know the product effectiveness of science domain based learning material which was integrated with local potention to improve science process skill and students' scientific attitude. The result of this limited test was used to repair the product; (c) main product revision, it was step of revizing first result test field (limited).the revision was done by repairing product based on the result of limited test.

First test was done by using experiment design One-Group Pretest-Posttest Design. This experiment design was seen like Figure 2 below (Sugiyono, 2014).

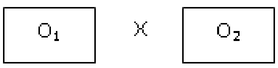

Figure 2. One-Group Pretest-Posttest Design

This experiment design was done by measuring first subject skill before and after treatment. The result of the measurement was then compared to know the effectiveness of science domain based learning material whch was integrated with local potention in improving science process skill and students scientific attitude.

The activities done in disseminate step were main field testing and operational product revision. Main field testing was done by using experiment design of Pretest-Posttest Control Group Design. In this design there were two groups taken randomly, then both group were measured before and after treatment. Experiment design of Pretest-Postest Control Group Design was showed in the Figure 3 (Sugiyono, 2014).

Test was done to know the effectiveness of learning material product based science domain which was integrated with local potention in improving science process skill and students' scientific attitude. After doing main field testing, the analysis of research purpose was done. The purpose that was not achieved bacem note, so the same mistake did not occur when the product was published. The result of main testing was done to revise the product.

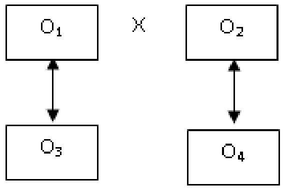

Figure 3. *Pretest-Posttest Control Group Design*

The research was done on December 2015 – February 2016. It was in SMPN 2 Paranggupito, Wonogiri Regency. The subjects tested were students grade VII of SMPN 2 Paranggupito in the academic year 2015/2016. There were 65 students with details: (1) first test used 22 students from VII A; (2) main test used 22 students of VII C as experimental class and 21 students of VII B as control class.

The technique of collecting data in this research were test, questionnaire observation, and Focus Group Discussion (FGD). Test was done by using instruments of collecting data in the forms of science process skill questions. This technique was udone to measure students science process skill. Questionnaire was done by using worksheet for teachers in the first introduction study, validation sheet of learning material, validating sheet of science process skill questions, students scientific attitude questionnaire, and questionnaire response of students towards LKPD. Observation was done by using sheet observation in introduction study. Focus Group Discussion (FGD) technique was used to validate instruments that would be used by validators. FGD was done to get suggestions from expert and friends about the instruments that would be used.

Data analysis in this research used three technique, they were: (1) analysis of product appropriateness, (2) analysis of validity and instrument reliability, and (3) analysis of developed product effectiveness. Analysis of appropriateness was done qualitatively and quantitatively. Qualitative data were criticism, suggestion and opinion from validators and students towards LKPD. Quantitative data were scores from validators in validation sheet of learning materials and scores of questionnaire responses from students towards LKPD.

Scores from validators were then tabulated and counted its average. The total of average score from 58 questions in validation sheet of learning material was then changed into interval data with 4 criteria scales by category (Depdiknas, 2010) as it was prsented in Table 1.

Scores of students questionaire response towards LKPD were tabulated and counted their total average score. Total average score of 17 questions in students questionnaire responses towards LKPD was then changed into interval data with 4 categori scales (Depdiknas, 2010) as it was seen in table 2.

The validity of process skill questions and students scientific attitude questionnare in this instrument research was counted based on Aiken's V formula, it was by determining content validity coefficient. Content validity coefficient (V) was counted based on the validators scores towards item from how far this item represented measured construct. An item could represent measured construct if it was relevant with determined indicators.

Aiken's V statistic was formulated as below:

$$V = \frac{\sum s}{[n(c-1)]}$$

Notes:
V= content validity coefficient
s= r – lo
lo= low validity score
c= high validity score
r= score given by validators
n = total validators
the range of V score was among 0 to 1.00. an item could be valid if it had value V ≥ 0,50 (Azwar, 2014).

Skill questions of instrument reliablity and students scientific attitude questionnaire theoritically were determined by using Borich (1994) equation:

$$R = 100\%\left[1 - \frac{A-B}{A+B}\right]$$

Notes:
R= instrument reliablity
A= high frequency score by validators
B= low frequency score by validators

Instrument reliablity could be called good if value R was bigger or as same as 75% (Borich, 1994).

Science process skil data in this research were taken through test, whereas scientific attitude data were taken through questionnaire. Scientific attitude data were ordinal which were transformed into interval data. Transformation method used was Method of Successive Interval (MSI) which was explained by Hays (Waryanto & Millafati, 2006), with the help of add programme in Successive Interval Microsoft Excel.

The analysis of learning material effectiveness based science domain which was integrated with developed local potention to improve science process skill and students scientific attitude in the first test was done by comparing pretest and postest score of science process skill and students scientific attitude. Statistic test that was done was paired t 2 test. Ho of paired t 2 test for science process skill was that science domain based learning material which was integrated with local potention was not effective to improve students skill of science process grade VII JHS. Ho of paired t 2 test for scientific attitude data was that science domain based learning material which was integrated with local potention was not effective to improve students scientific attitude in grade VII JHS.

Analysis of the effectiveness of science domain based learning material which was integrated with developed local potention to improve science process skill and scientific attitude in the

Table 1. Criteria of product appropriateness

Value	Interval score		Criteria
A	Mi + 1,5 SDi<≤ Mi + 3,0 SDi	189 <≤232	Very Good
B	Mi + 0 SDi<≤ Mi + 1,5 SDi	145 <≤189	Good
C	Mi - 1,5 SDi<≤ Mi + 0 SDi	102 <≤ 145	Enough
D	Mi - 3 SDi<≤ Mi - 1,5 SDi	58 <≤102	Bad

Table 2. Response criteria of students towards LKPD

Value	Interval Score		Criteria
A	Mi + 1,5 SDi<≤ Mi + 3,0 SDi	55,3 <≤68	Very Good
B	Mi + 0 SDi<≤ Mi + 1,5 SDi	42,5 <≤55,3	Good
C	Mi - 1,5 SDi<≤ Mi + 0 SDi	29,8 <≤ 42,5	Enough
D	Mi - 3 SDi<≤ Mi - 1,5 SDi	17 <≤29,8	Bad

main test was known by comparing gain score of science process skill and scientific attitude between experimental and control class. Gain data was taken by using standard gain technique (Meltzer, 2002).

$$Satandard\ Gain = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score}$$

Gain data was analyzed by using independen t test. Ho for independent t test of science process skill was that science domain based learning material which was integrated with local potention was not more effective than learning material that was usually used by science teachers to improve students science provess skill in grade VII JHS. Ho for independent t test of scientific attitude data was that science domain based learning material which was integrated with local potention was not more effective than usual learning material used by science teachers to improve students scientific attitude in grade VII JHS. Independent t test was done towards science process skill gain and students scientific attitude in both expereimental and control class. The measurement of each static test was done by programme SPSS 22 in the level of significance 0,05. The criteria taken was that ho was rejected if its significance score < 0,05.

RESULTS AND DISCUSSION

Result Analysis of Product Appropriateness

Validation data of learning material from each validators were tabulated for each components and subcomponents from the assessment available in research instrument. The total average score from each validators was counted then changed into qualitative data (interval data) with Likert scale of 4 criteria to know the appropriateness of developed learning material. The result of the appropriateness of science domain based learning material which was integrated with local potention was showed on Table 3, whereas the chart score of total average of learning material validation sheet was presented in Figure 4.

Data on Table 3 showed the total score of average given by expert lecturers, friend, and science teachers in order 223,5; 230; 226. The total average score from each validators was changed into qualitative data (interval data) with Likert scale of 4 criteria and the result were: (1) the appropriateness of science domain based learning material which was integrated with developed local potention according to expert lecturers was very good with value A, (2) the appropriateness of science domain based learning material which was integrated with developed local potention according to friends was very good with value A, (3) the appropriateness of science domain based learning material which was integrated with developed local potention according to science teachers was very good with value A.

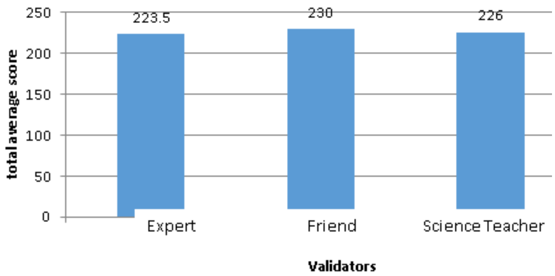

Figure 4. Chart of total average score of learning material validation sheet

With those, science domain based learning material which was integrated with developed local potention was appropriate to use in learning process with material Object Change around us for students grade VII of JHS.

Questionnaire response data of students towards LKPD were got from questionnaire. Questionnaire response data of students towards LKPD were tabulated then counted their total average. Then the total average score was changed into Likert scale of 4 criteria. The recapitulation of students data analysis response towards LKPD was presented in Table 4. The data in table 4 showed that developed LKPD had very good criteria with value A. So, the developed LKPD was appropriate to use in main test.

The recapitulation of students data analysis response towards LKPD was presented in table 5. The data in table5 showed that developed LKPD had very good criteria with value A. So, the developed LKPD was appropriate to use in

Table 3. The result analysis of learning material appropriateness

Validator	Total average score()	Interval score	Value	Criteria
Dosen Ahli	223,5	A = 189 <≤232	A	Very Good
Teman Sejawat	230	B = 145 <≤189 C = 102 <≤145	A	Very Good
Guru IPA	226	D = 58 <≤102	A	Very Good

learning process.

Table 4. Recapitulation of students response data towards LKPD in first test

Total average score (X)	Interval Score	Value	Criteria
59,7	A = 55,3 <≤68 B = 42,5 <≤55,3 C = 29,8 <≤42,5 D = 17 <≤29,8	A	Very Good

Table 5. Recapitulation of students response data towards LKPD in main test

Total average score (X)	Interval score	Value	Criteria
58,5	A = 55,3 <≤68 B = 42,5 <≤55,3 C = 29,8 <≤42,5 D = 17 <≤29,8	A	Very Good

Analysis of instrument validity and reliablity

Analysis of instrument validity and reliability was done to know the appropriateness of instrument of science process skill question and scientific attitude questionnaire which were parts of this developed research instrument. The validity of science process skill question was done on each number of questions based on its relevance to the measurement purpose with criteria: relevant, useful but irrelevant, and irrelevant. The validity of scientific attitude questionnaire was done on each number of students scientific attitude questionnaire based on its relevance to the measurement purpose with criteria: relevant, useful but irrelevant, and irrelevant.

The validity of science process skill questions was presented on tavle 6. The questions consisted of 20 multiple choices (no 1-20). Based on the analysis result in table 6, it was known that question number 3 and 7 had content validity coefficient 0,92, whereas others numbers had 1.00. the reability of instrument theoritically was 80,0 % so it could be said as good reliability. It showed that al numbers of science process skill questions were valid and appropriate to use in this research.

The recapitulation of validity scientific attitude questionnaire was presented on table 7. The questionnaire consisted of 13 questions (no 1-13). Based on the analysis result in table 7, it was known that all numbers of questionnaire had content validity coefficient 1.00. instrument reliability theoritically was 100% so it could be said to have a good reliability. It showed that all numbers of questionnaire of students scientific attitude were valid and appropriate to use in this research.

Table 6. Recapitulation result of science process skill validity.

Number of Questionnaire	V	Note
1	1,00	Valid
2	1,00	Valid
3	0,92	Valid
4	1,00	Valid
5	1,00	Valid
6	1,00	Valid
7	0,92	Valid
8	1,00	Valid
9	1,00	Valid
10	1,00	Valid
11	1,00	Valid
12	1,00	Valid
13	1,00	Valid
14	100	Good
15	1,00	Valid
16	1,00	Valid
17	1,00	Valid
18	1,00	Valid
19	1,00	Valid
20	1,00	Valid
R	100	Good

V= content validity coefficient
R= instrument reliability

Analysis Result of Product Effectiveness

The product effectiveness in improving science process skill in the first test was known by comparing pretest and postest value. Statistic test used was paired t test by using $\alpha = 0{,}05$, the value of significance 0,000. Since the significance value was 0,000 or it was $< 0{,}05$ so Ho was rejected. So, by using $\alpha = 0{,}05$ it could be concluded that science domain based learning media which was integrated with local potention was effective in improving science process skill of students grade VII of JHS.

Table 7. recapitulation result of scientific attitude questionnaire validity.

Number of Questionnaire	V	Note
1	1,00	Valid
2	1,00	Valid
3	1,00	Valid
4	1,00	Valid
5	1,00	Valid
6	1,00	Valid
7	1,00	Valid
8	1,00	Valid
9	1,00	Valid
10	1,00	Valid
11	1,00	Valid
12	1,00	Valid
13	1,00	Valid
R	100	Good

V= content validity coefficient
R= instrument reliability

The product effectiveness in improvingscientific attitude in the first test was known by comparing pretest and postest value of students scientific attitude. Statistic test used was paired t test by using $\alpha = 0,05$, the value of significance 0,000. Since the significance value was 0,000 or it was < 0,05 so Ho was rejected. So, by using $\alpha = 0,05$ it could be concluded that science domain based learning media which was integrated with local potention was effective in improving scientific attitude of students grade VII of JHS.

The effectiveness of science domain based learning media which was integrated with developed local potention in improving science process skill in the main test was known from statistic test by using independent t test on the data of science process skill. Statistic test by using independent t test on the data of science process skill resulted significance value 0,009. Since the value was 0,009 or it was < 0,05, Ho was rejected. So, by using $\alpha = 0,05$ it could be concluded that science domain based learning media which was integrated with local potention was more effective than usual learning media used by teachers in improving science process skill of students grade VII.

The effectiveness of science domain based learning media which was integrated with developed local potention in improving science process skill in the main test was known from statistic test by using independent t test on the data of scientific attitude. Statistic test by using independent t test on the data of scientific attitude resulted significance value 0,008. Since the value was 0,008 or it was < 0,05, Ho was rejected. So, by using $\alpha = 0,05$ it could be concluded that science domain based learning media which was integrated with local potention was more effective than usual learning media used by teachers in improving scientific attitude of students grade VII.

CONCLUSION

Based on the data and result analysis, it could be concluded that science domain based learning media which was integrated with developed local potention were : (1) appropriate to use for learning media with theme Object Change around us for students grade VII of JHS, (2) effective in improving science process skill and scientific attitude of students grade VII of JHS. Science teachers are expected to use this science domain based learning media which is integrated with developed local potention during learning process at school. This integrated media is effective in improving science process skill and scientific attitude of students. Students will also understand more the nature of science with this science domain learning media.

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