European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available on-line at: www.oapub.org/edu

doi: 10.5281/zenodo.1341388 Volume 4 | Issue 12 | 2018

THE EFFECTIVENESS OF LEARNING MODULE TO TRAIN CRITICAL THINKING SKILL

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Abstract:
The limited material and students' low thinking skill on science in grade eighth of SMPN 1 Paringin inspire the researcher to compose learning material in the form of module. This research aims to evaluate the quality of Natural Science learning module in grade 8. The research model uses Tessmer model which covers 1) self evaluation, 2) expert review, 3) one-to-one, 4) small group, and 5) field test. The research is conducted in SMPN 1 Paringin academic year 2016/2017. The module effectiveness data covers cognitive learning result, critical thinking skill, good attitude, social skill, and students' responses. The research result shows that the developed module is effective. The effectiveness is based on some parameters, they are; 1) students' cognitive learning result is beyond classical accomplishment, 2) students' critical thinking skill is very good, 3) students' attitude covering honesty and responsibility is averagely very good, 4) students' social skill covering cooperation and contributing idea is averagely very good, 5) students' responses are generally good.

Keywords: natural science module, critical thinking skill, effectiveness

1. Introduction

The natural science learning has very complex characteristics for it needs critical thinking and problem analyzing skill. Critical thinking is one expected outcome from natural science learning. However, in fact the natural science learning nowadays still implement conventional method. National Education Department (2011) stated that the natural science learning at present tends to be science-product-oriented. It can be seen from how the students learn natural science material by memorizing concepts,

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principles, laws, and theories. Consequently, attitude dimension, the process, and application can not be accomplished optimally. Therefore, improvement is needed in natural science learning.

Natural science learning can be improved by composing material in the form of learning module based on 2013 curriculum to train students' critical thinking. Students are expected to learn independently through this module in their environment. Using this module, it is hoped that the students can learn from real experience around them, be active, critical, excited, and eager to share with their friends that they get chance to learn independently.

The developed product is in form of module prototype. This development is done through procedural steps to improve product. Every step is a micro cycle ended with revision (Plomp and Nieveen, 2007). This research is expected to obtain effective module.

2. Material and Methods

The development model used is formative evaluation model by Tessmer (1998) which covers expert review, one-to-onee, small group and field test.

Result of critical thinking skill, attitude, social skill, and students' feedback towards small group test. The data is collected using scoring sheets on cognitive study result, critical thinking skill, attitude, social skill, and students' feedback towards small group test. The actual effectiveness is obtained from the scoring sheets on students' cognitive study result, students' critical thinking skill, students' attitude, students' social skill, and students' feedback on field test.

The effectiveness data is analyzed using rubric through some ways below; a) Students' cognitive study result data uses score 10-100; b) critical thinking skill data is obtained from stidents' activity while doing practicum with group and then it is matched with kinds of citical thinking skill (formulating problems, making hypothesis, designing experiment/observation, collecting data, formulating conclusion, and presenting experiment result). The result obtained is categorized into very good (4), good (3 - < 4), fairly good (2-<3), low (1-<2) (adapted from Nur,2013); c) the attitude and social skill data are based on scoring rubric with some categories; very good (4), good (3-<4), fairly good (2-<3), low (1-<2) (adapted from Nur, 2013); d) students' feedback data using questionnaire is obtained from the result of check list rubric from column "yes" or "no". Next, the answer "yes" is sum up and divided by the sum of indicators stated with percentage and categorized into; very good (85,01-100,00%), fairly good (70,01%-85,00%), low (50,01-70,00%) and bad (10,00-50,00%).

3. Results and Discussion

A. Expectation effectiveness

The expectation effectiveness is based on:

a. cognitive study result,

b. critical thinking skill,
c. personal attitude,
d. social skill,
e. students' feedback on small group test.

a. Students' study result

Table 1: Congnitive study result on small group test

No.	Name (initial)	Cognitive on Module					
		1	**2**	**3**	**4**	**5**	**6**
1	H	90	85	80	80	80	80
2	M	80	70	80	80	80	90
3	RR	80	80	80	80	80	90
4	RO	80	85	80	80	80	90
5	EW	80	80	80	80	70	90
6	HTW	90	80	80	90	90	90
	Classical accomplishment (%)	100	83,3	100	100	83,3	100

Note: minimum accomplishment criteria = 73, classical accomplishment 80%

Based on table 1, most students' cognitive on module is accomplished 100%, but on module 2 and 5 there is one student not accomplished yet while classical accomplishment exceeds 80%.

b. Critical thinking skill

The result of critical thinking skill on small group test is presented on table 2

Table 2: The result of critical thinking on small group test

No	Critical thiking skill	Module						Average	Category
		1	**2**	**3**	**4**	**5**	**6**		
1.	Formulating problems	3,5	3,5	4	4	4	4	3,83	Good
2.	Making hypothesis	4	4	4	3	4	4	4	Very good
3.	Designing experiment / observation	4	4	4	4	4	4	4	Very good
4.	Collecting data	4	4	4	4	4	4	4	Very good
5.	Analyzing data	4	4	3	4	4	4	3,83	Good
6.	concluding	3,5	3,5	3	3	4	4	3,5	Good
7.	Presenting experiment result	4	4	4	4	4	4	4	very good

Categories: 4 = very good; 2 - < 3 = fairly good; 3 - < 4 = good; 1 - < 2 = low (adapted from Nur, 2013)

Based on table 2, some indicators of students critical thinking skill is very good.

c. Personal attitude (honesty and responsibiliy)

The result of students' personal attitude is presented on table 3.

Table 3: Scoring result of personal attitude on small group test

No.	Name (initial)	Honesty		Responsibility	
		Score	Category	Score	Category
1	H	3,88	Good	3,75	Good
2	M	3,88	Good	3,88	Good
3	RR	4	Very good	4	Very good
4	RO	4	Very good	4	Very good
5	EW	4	Very good	4	Very good
6	HTW	4	Very good	4	Very good

Based on table 3, most students are very good at honesty and responsibility on small group test.

d. Students' social skill (cooperation and idea contribution)

The scoring result of students' social skill can be seen on table 4.

Table 4: The scoring result of social skill on small group test

No.	Name (initial)	Cooperation		Idea Contribution	
		Score	Category	Score	Category
1	H	4	Very good	4	Very good
2	M	4	Very good	4	Very good
3	RR	4	Very good	4	Very good
4	RO	4	Very good	3,88	Good
5	EW	4	Very good	4	Very good
6	HTW	4	Very good	4	Very good

Based on table 4, the social skill of most students on small group test is very good, it covers cooperation and idea contribution during group discussion.

e. Students' feedback

Students' feedback on small group test is presented on table 5.

Table 5: Students' feedback towards module on small group test

No.	Statement	Total of students	%	Category
1	Natural science learning using developed module is a new thing	6	100	Very good
2	The module supports learning activities	6	100	Very good
3	Module's packaging is interesting and enhances learning motivation	6	100	Very good
4	The content of the module is understandable.	5	83,33	Good
5	The practicum instruction is easy to follow	6	100	Very good
6	The module content is generally good	6	100	Very good

Category: 85 - < 100%= very good; 50 - < 70% = low; 70 - < 85% = good; 10 - < 50% = bad (adapted from Nur (2013))

Most students' feedback on small group test stated that Natural science module is ver good and interesting to be learned.

B. Actual Effectiveness

Actual effectiveness is obtained based on:

a. cognitive study result,
b. critical thinking skill,
c. personal attitude,
d. social skill, and
e. students' feedback during field test

a. Students' study result (cognitive)

Students' study result on field test is presented on table 6.

Table 6: Students' cognitive study result

Total of the students	Module	KKM	Accomplished	Not accomplished	Classical accomplishment (%)
22	1	73	21	1	95,5
22	2		19	3	86,4
22	3		20	2	90,9
22	4		19	3	86,4
22	5		18	4	81,8
22	6		22	0	100

Note: KKM = minimum accomplishment criteria; KKM = 73, classical accomplishment 80%

Based on table 6, the study results obtained from main discussion of six modules are stated accomplished classically, because the score is beyond classical accomplishment score 80%, however there are some students could not accomplish the learning target because their score is below the KKM (minimum accomplishment criteria) 73.

b. Group critical thinking skill on field test

Group critial thinking skill is presented on table 7.

Table 7: Group critical thinking skill

Critical thinking skill	Group name	Module						Average	Category
		1	2	3	4	5	6		
Formulating problem	Matahari	4	4	4	4	4	4	4	Very good
	Komet	4	4	4	4	4	4	4	
	Meteor	4	4	4	4	4	4	4	
	Bintang	4	4	4	4	4	4	4	
	Bulan	4	4	4	4	4	4	4	
	Average							4	
Critical thinking skill	Group name	Module						Average	Category
		1			4	5	6		
Making hypothesis	Matahari	4	4	4	4	4	4	4	Very good
	Komet	4	4	4	4	4	4	4	
	Meteor	4	4	4	4	4	4	4	
	Bintang	4	4	4	4	4	4	4	
	Bulan	4	4	4	4	4	4	4	
	Average							4	

Critical thinking skill	**Group name**	**Module**						**Average**	**Category**
		1	**2**	**3**	**4**	**5**	**6**		
Critical thinking skill	Group name	Module						Average	Category
		1	2	3	4	5	6		
Designing experiment/observation	Matahari	4	4	4	4	4	4	4	Very good
	Komet	4	4	4	4	4	4	4	
	Meteor	4	4	4	4	4	4	4	
	Bintang	4	4	4	4	4	4	4	
	Bulan	4	4	4	4	4	4	4	
	Average							4	
Critical thinking skill	Group name	Module						Average	Category
		1			4	5	6		
Collecting data	Matahari	4	4	4	4	4	4	4	Very good
	Komet	4	4	4	4	4	4	4	
	Meteor	4	4	4	4	4	4	4	
	Bintang	4	4	4	4	4	4	4	
	Bulan	4	4	4	4	4	4	4	
	Average							4	
Critical thinking skill	Group name	Module						Average	Category
		1	2		4	5	6		
Analyzing data	Matahari	4	4	4	4	4	4	4	Very good
	Komet	4	4	4	4	4	4	4	
	Meteor	4	4	4	4	4	4	4	
	Bintang	4	4	4	4	4	4	4	
	Bulan	4	4	4	4	4	4	4	
	Average							4	
Critical thinking skill	Group name	Module						Average	Category
		1		3	4	5	6		
Formulating conclusion	Matahari	3	3	4	3	4	4	3,38	Good
	Komet	3,5	3,5	4	3	4	4	3,63	
	Meteor	3,5	3,5	3	3	4	4	3,5	
	Bintang	3,5	3,5	3	3	4	4	3,5	
	Bulan	3,5	3,5	3	3	4	4	3,5	
	Average							3,5	
Critical thinking skill	Group name	Module						Average	Category
		1	2	3	4	5	6		
Presenting result of experiment/obsevation	Matahari	4	4	4	4	4	4	4	Very good
	Komet	4	4	4	4	4	4	4	
	Meteor	4	4	4	4	4	4	4	
	Bintang	4	4	4	4	4	4	4	
	Bulan	4	4	4	4	4	4	4	
	average							4	

Category: very good (4), good (3 - < 4), fairly good (2 - < 3), low (1 - < 2). (adapted from Nur, 2013)

Table 7 shows that students' critical thinking skill are mostly very good, however the formulating conclusion skill reaches category 'good' even though students has been informed about how to make good conclusion.

c. Students' personal attitude (honesty and responsibility)

The result of attitude scoring on field test can be seen on table 8.

Table 8: The result of attitude scoring on field test

No.	Name (Initial)	Honesty		Responsibility	
		Score	Category	Score	Category
1	AH	3,88	Good	4	Very good
2	AN	3,88	Good	4	Very good
3	AFR	4	Very good	4	Very good
4	AVR	4	Very good	4	Very good
5	DAA	4	Very good	4	Very good
6	EP	4	Very good	4	Very good
7	GMF	4	Very good	3,75	Good
8	IW	4	Very good	4	Very good
9	MJ	4	Very good	3,75	Good
10	MNAF	4	Very good	4	Very good
11	MRAM	4	Very good	4	Very good
12	MZ	4	Very good	4	Very good
13	M	4	Very good	4	Very good
14	MI	4	Very good	4	Very good
15	NM	4	Very good	4	Very good
16	NZNR	4	Very good	4	Very good
17	R	4	Very good	4	Very good
18	RNS	3,88	Good	4	Very good
19	RND	3,88	Good	4	Very good
20	S	4	Very good	4	Very good
21.	SA	4	Very good	4	Very good
22.	UN	4	Very good	4	Very good

Category: very good (4), good (3 - < 4), fairly good (2 - < 3), low (1 - < 2). (adapted from Nur, 2013

Based on table 8, the average students' attitude (honesty and responsibility) on field test has been very good.

d. Students' social skill (cooperating and contributing ideas)

The result of students' social skill scoring is presented on table 9.

Table 9: The result of social skill scoring on field test

No.	Name (initial)	Cooperation		Idea contribution	
		Score	Category	Score	Category
1	AH	3,88	Good	3,88	Good
2	AN	4	Very good	3,88	Good
3	AFR	4	Very good	3,75	Good
4	AVR	3,88	Good	3,88	Good
5	DAA	4	Very good	4	Very good
6	EP	4	Very good	4	Very good
7	GMF	3,88	Good	3,88	Good
8	IW	4	Very good	4	Very good
9	MJ	4	Very good	4	Very good
10	MNAF	4	Very good	4	Very good
11	MRAM	4	Very good	3,75	Good
12	MZ	3,88	Good	4	Very good
13	M	4	Very good	3,88	Good
14	MI	4	Very good	3,88	Good

15	NM	4	Very good	4	Very good
16	NZNR	4	Very good	3,88	Good
17	R	4	Very good	4	Very good
18	RNS	4	Very good	4	Very good
19	RND	4	Very good	3,88	Good
20	S	4	Very good	4	Very good
21.	SA	4	Very good	3,88	Good
22.	UN	4	Very good	4	Very good

Category: very good (4), good (3 - < 4), fairly good (2 - < 3), low (1 - < 2). (adapted from Nur, 2013

Based on table 9 the students' social skill on cooperation is mostly very good, while on contributing ideas some students are good. Therefore, students should perform more exercise on contributin ideas.

e. Students' feedback on field test

Students' feedback on field test towards module can be seen on table 10.

Table 10: Students' feedback towards module on field test

No.	Statement	Total students	%	Category
1	The natural science learning using developed module is a new thing	22	100	Very good
2	The module supports learning activities	20	90,90	Very good
3	Module's packaging isinteresting and enhances learning motivation	17	77,27	Good
4	Module content is understandable	21	95,45	Very good
5	Practicum istruction is easy to follow	20	90,90	Very good
6	The module content is generally good	19	86,36	Very good

Category: very good (85,01–100,00%), fairly good (70,01–85,00%), low (50,01–70,00%), and bad (10,00–50,00 %).

Based on students' feedback towards module on field test above, it is seen that the module is acceptable and help the students to learn, but the module's packaging is still need improvement.

Effectiveness is when an intended effect happens from one action. Module effectiveness is obtained from students' cognitive study result, critical thinking skill, personal attitude,social skill, and students' feedback. The KKM (minimum accomplishment criteria) stated by the school for science subject on grade 8 is 73 and the classical accomplishment limit is 80%.

From study result data on table 4.9, students' study result by using module in learning process is stated accomplished classically, however, there are some students can not accomplish the targeted criteria because their scores are below KKM. Students' classical accomplishment during the use of module 1 is 95,5%, module two reaches 86,4%, module 3 hits 90,9%, module four is on 86,4%, module 5 is on 81,8%, and module 6 hits 100%. This result is in line with the former research (Rosyidah, 2013; Atmojo, 2012) which stated that students' study result increases.

From critical thinking skill data on table 7, it is obtained tha the critical thinking skill (formulating problem, making hypothesis, designing experiment/observation, collecting data, analysing data, formulating conclusion and presenting experiment result) through axperiment activities is in 'very good' category, however, more exercise is needed to make relevant conclusion for learning target. This is in line with the former research, Wahyuni (2015) reported that the developed science practicum istruction can be properly used and it increases students' critical thinking skill. Beck (2010) stated that learning process using experiment method can enrich inovative learning method implemented by the teacher. The basic science principles reflect on experiment activities (Bozdogan, 2009). While for Chabalengula (2012), students acquire experience to polish scientific process skill through experient activities.

The infrequency of students conducting experiment activities creates students' low science processing skill. Scriven and Paul (2013) explained that critical thinking skill is more important to develop because it increases thinking quality of a person to be skillful on anayzing, evaluating, and reconstructing to solve problems. Based on Riggs and Hellyer (2014) there are some relations among development issues and critical thinking. One challenge for a thinker is the awareness of thinking definite role in life and its relation with problems on daily basis.

Based on students' attitude data, the students showed honesty and most of the students were very responsible. Students' social skill data shows good cooperation, while on contributing ideas, students need more training even though they have performed well. This finding is in line with the former research (Yunita, 2016; Diawati et al., 2016). Based on Welch & Douglas (2011) students will learn to behave humble, honest, and open-minded in accepting knowledge development. This scientific behavior grown by the students is one indicator that shows positive attitude towards knowledge. Learning module is very positive and thus it can be applied in other classes. This is supported by the former research Dewi et al. (2014) which concludes that the data of students' feedback towards developed module is positive, interested, understandable, and it facilitates students to learn.

Based on the discussion, it can be concluded that the developed module is effective and can be used or applied on learning activites in classes SMPN 1 Paringin. While the effectiveness of this module in other school still needs more research. According to Pharakhruvisitpattanaporn (2012), the effectiveness of one teaching method is able to develop students' critical thinking skill.

One advantage of using developed module by teacher is that the content of the module can be adapted with school environment so that it is easier to be used by the students, and thus the students read more and practice scientific literacy. While the weakness is that it is high-cost and takes much time to make and develop suitable teaching material like module.

4. Conclusion

The result of research conducted has answered the problem stated on science developed module grade 8 is categorized 'proper' based on module effectiveness. The effectiveness is based on cognitive study result with 'very good' category result, critical thinking skill with 'very good' category, students' attitude with 'very good' category, social skill with 'very good' category, and students' feedback with 'good' category.

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