IJORER : International Journal of Recent Educational Education
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN: 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 2, No. 4, July 2021 : 477-488

Analysis of Students Critical Thinking using the Junior High School Student Online Module

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DOI : https://doi.org/10.46245/ijorer.v2i4.126

Sections Info

Article history:
Submitted: June 28, 2021
Final Revised: July 18, 2021
Accepted: July 29, 2021
Published Online: July 31, 2021

Keywords:
critical thinking skills
feasible
learning material
validation
online module

ABSTRACT

This study aims to describe the results of the feasibility of the learning tools applied in class VII SMP based on the validator's assessment, test results and student responses. In research with a quantitative approach and the learning device development model used is Research and Development (R and D). The data collection method used critical thinking skills tests in the form of pretest and posttest, observation sheets, and student response questionnaires to the development of online modules. In line with the objectives of the research, the results showed that the validation results were valid and reliable so that the learning devices were declared suitable for use. The results of the observation of students' critical thinking skills showed very good, and the results of the N-gain showed that the medium category was 15 students, the high category was 5 students, and the student response questionnaire to the online module was 92.50% with a very good category. SPPS test shows that online module gives influence for critical thinking students. All of teachers can use the online module for many learning model to increase critical thinking students.

INTRODUCTION

Critical thinking has important role in study in order to students have open minded. The development of the world of education requires teachers to know how to manage learning to be more interesting and the skills needed by students can be facilitated in the 21st century and the openness of the flow of globalization which allows information and technology to develop very rapidly which will have an impact on changes in all aspects of life. Critical thinking is one side of being a critical person where the mind must be open, clear, and based on facts. Critical thinking aims to reflect one's ability to analyze, synthesize, and evaluate information (Roksa et al., 2017). Critical thinking means reflective thinking which focuses on deciding that believed act or something done (Fuad et al., 2017). The students' skill to think critically is still lacking, because of the teacher's limited skill to develop, as is well known in physics is known as a lesson full of formulas that are considered difficult (Alvionita et al., 2020).

Module is solution to empower students critical thinking because it completed by activity, training, and self-assessment (Nawawi, 2017). The module is learning materials which arranged systematically with easy to understand language by students (Handayani, 2018). Electronic Module Web-based can be interpreted as module teaching materials that are presented in electronic form and in- publish via a web using Content Management System (CMS) tools to presenting material and the Quiz Management

System (QMS) as a practice tool with the system web-based automated assessment (Febrina et al., 2020). Module on line or electronic module is a digital medium whose display and systems The mathematical writing is intentionally made like a module that contains a series of learning activities interconnected by links and can be complemented by multimedia, and run with using a computer-based website (Arriany et al., 2020). Media that is integrated in educational technology when designed and used properly can improve the quality of learning outcomes.

One alternative that can be used to improve students' critical thinking skills in learning with heat material and its transfer is using online module learning tools. The purpose of this research is to produce an appropriate online module to cultivate students' critical thinking skills in learning with heat and its transfer material. Temperature and heat materials have a low level of mastery and high misconceptions (Nursyamsi et al., 2018). Mistakes occur when understanding several concepts, including (1) stating that specific heat is affected by mass, heat and temperature changes, (2) interpreting large specific heat as an object that easily experiences an increase in temperature, and (3) stating that heat capacity is affected by heat. and temperature rise (Taqwa et al., 2019). Module development is carried out for temperature and heat material because this material is a little difficult to learn because it is abstract which can cause various different thoughts for students (Hadiya et al., 2015).

RESEARCH METHOD

Learning instruments using online modules have been tested on a limited basis at Junior high school Al Ibrah Gresik class VII. The sample in this study was class VII as many as 20 students. The research design used was One Group Pretest Posttest Design, a descriptive quantitative approach. The data analysis used is to analyze critical thinking skills taken through pretest and posttest questions and the results are analyzed using the N-gain score. Analysis was also carried out on the implementation of learning with online modules, student activities in learning using online modules, and the validity of the media using descriptive analysis. Another data analysis is analyzing student responses at the end of the lesson by giving questionnaires to students.

The instrument test made by the researcher consisted of 20 questions about heat and displacement in the form of multiple choice. Multiple choice questions will increase the variety of items that can be used in the assessment, so that the assessment instrument obtained can accommodate broad thinking skills (Hartini and Sukardjo, 2015). The validation results criteria are described in Table 1 and calculated by the following formula:

$$R = \frac{S}{N} \times 100\%$$

(Widoyoko, 2017)

Informations:
R = Average score
S = Number of scores obtained
N = Maximum number of scores

After knowing the validity value of each expert, then combining the results of expert validity and analyzing all expert validators using the following formula:

$$M_R = \frac{\sum R}{N}$$

(Sudijono, 2017)

Informations:
M_R = Average combined score
$\sum R$ = Number of scores obtained
N = The number of validators

The instrument has validly categorized if the instrument measures the mastery abilities in measured domain (Arifin, 2017). Instrument in this research has valid category after reaching more than 50% and the instrument is suitable for use (Riduwan, 2014).

Table 1. Criteria of validity coefficient.

Validity coefficient	Criteria
75 ≤ VC ≤ 100	Very valid
50 ≤ VC < 75	Valid
25 ≤ VC < 50	Enough Valid
0 ≤ VC < 25	Less Valid

(Riduwan, 2014)

The reliability of the problem solving test instrument uses a Likert scale. The formula for calculating expert reliability use Percentage of Agreement (R) analysis with reliable criteria if R 75% in the formula:

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

(Mustaming et al., 2015)

Informations:
R = Reliability
A = Behavioral frequency with high observation
B = The frequency of behavioral aspects observed by observers by giving low observations

Data on the implementation of lesson plans in learning using online modules is descriptive qualitative, that is, counting the number of learning stages carried out divided by the total number of learning stages. In this assessment, the scale is 1 to 4. The scores of the two observers are then averaged and interpreted in Table 2.

Table 2. Description of lesson plan validation scores.

Scala	Description
1,00 – 1,99	Not good
2,00 – 2,99	Pretty good
3,00 – 3,49	Good
3,50 – 4,00	Very good

The test is used to determine students' critical thinking skills on heat and displacement materials. Students are said to be completed if the value is greater than the minimum completeness criteria, which is 70. Student learning mastery for critical thinking skills tests can be calculated using the following equation:

$$\text{Mastery learning} = \frac{\text{total score obtained}}{\text{maximum score}} x100\%$$

The results of completeness can be used as supporting data to determine whether students are stimulated by critical thinking skills or not. From the results obtained, then analyzed using the N-gain score (normalized increase score) to determine the magnitude of the increase in students.

Table 3. N-Gain score criteria.

<g>	Information
g ≥ 0,7	High
0,3 < g < 0,7	Medium
g ≤ 0,3	Low

(Hake, 1999)

This learning outcome of students did statistic inferential test (normality, homogeneity, and Wilcoxon). Students are said to have grown critical thinking skills if students experience an increase in learning outcomes from the tests given even though they have not reached the minimum completeness criteria specified at school.

RESULTS AND DISCUSSION

The research was conducted to determine the validity of the online module. The validation results on the content aspect are 90% with a very valid category with 95% reliability, the construct aspect is 86% with a very valid category with 92% reliability, and the language aspect is 94% with a very valid category with 96% reliability detail in Table 4.

Table 4. Online module validation results.

Aspects	Validity	Reliability
Content	90%	95%
Construct	86%	92%
Language	94%	96%

The content aspect of the online module contains the validator's assessment of the material, introduction, learning scenarios, let's think, videos, worksheets, competency test questions. The online module on heat and its transfer is developed and structured contextually. This is in line with the constructivism view which states that knowledge cannot be transferred from teacher to student because the student's brain is not empty but already contains knowledge from previous experiences (Mujtahidin, 2014).

Contextual material that is in accordance with student experience will make it easier for students to construct their knowledge with newly received knowledge (Trianto, 2014). The online module developed by the author is expected to be able to motivate students in learning so that student learning outcomes will increase after using the online module on heat and movement material and can train students to learn independently.

The second aspect assessed by the validator is the construct. This aspect assesses the layout, images, videos, forms of writing, and colors. Textbooks generally do not discuss how to learn meaningful science. Many science textbooks today place an overemphasis on the product of scientific facts and mathematical formulations (logical plane). The relationship of scientific concepts to experience, society, and technology is rarely done by book authors. As a result, when students are given problems related to everyday experiences or natural phenomena, many of them cannot explain or solve them according to scientific conceptions (Djudin, 2017). By adding certain types of images to the subject matter will be able to help students understand the lesson. Based on the description, the selection of animations and images is designed to have an optimal role in increasing students' understanding. Pictures and animations have an important role to convey learning messages that usually seem abstract in textbooks.

The third aspect assessed by the validator is the language aspect. The language aspect assesses the use of language in the online module of heat and its transfer. Verbal language, both spoken and written, must have a semantic code, grammar, and sentences with the right meaning. The language in the online module of heat and its transfer is a language that is easily understood by students and has a simple sentence structure. Language is also arranged communicatively so that students seem to be invited to interact with the online module.

Electronic Module Web-based can be interpreted as module teaching materials that are presented in electronic form and in- publish via a web using Content Management System (CMS) tools to presenting material and the Quiz Management System (QMS) as a practice tool with the system web-based automated assessment (Febrina et al., 2020). Module on line or electronic module is a digital medium whose display and systems The mathematical writing is intentionally made like a module that contains a series of learning activities interconnected by links and can be complemented by multimedia, and run with using a computer-based website (Arriany et al., 2020).

Table 5. Results of validation of learning implementation plans.

Aspect of estimation	Validity	Reliability
Format	88%	93%
Content	83%	95%
Language	92%	91%

The validator assesses the lesson plans from 3 aspects, namely the format, content, and language in the lesson plans. The results of the validation on the format aspect are 88% with a very valid category with 93% reliability, the content aspect is 83% with a very valid category with 95% reliability, and the language aspect is 92% with a very valid

category with 91% reliability. The expert's assessment shows that the models, methods, and learning media are chosen appropriately so that it allows students to be active in online learning. The phases of the learning model are clearly written. Based on this, it can be stated that the prepared lesson plan is feasible to use.

The lesson plan developed by the author begins with motivation. This motivation aims to increase students' intrinsic motivation. Mujtahidin (2014) explained that lessons in class should increase students' intrinsic motivation. In this case, the teacher must improve the way of teaching so as to foster interest in learning and maintain student curiosity. The use of online modules is also an important part of the lesson plans prepared by the author. In online learning so that in conducting experiments, they experience difficulties both in terms of time, assistance, and tools and materials. However, students can gain virtual experience using online modules. The lesson plan developed by the author uses a problem-based learning model or Problem Based Instruction (PBI). This model aims to help students learn various skills and think critically according to experiences in everyday life (Mujtahidin, 2014). The PBI model is suitable for teaching heat material and its transfer using an online module compiled by the researcher. The teacher only provides a little guidance because all knowledge and activities for tests and learning activities have been included in the online module that can be applied on a mobile basis so that it can be used anywhere and anytime according to student needs.

Table 6. Validation results of student activity sheets.

Aspect	Validity	Reliability
Didactic Terms	87%	92%
Construction Terms	93%	95%
Technical Terms	87%	94%

The student worksheet developed by the author is then reviewed by the validator with the aim of producing a proper student worksheet. The validator assesses the online module of heat material and its transfer from 3 criteria, namely tactical requirements, construction requirements, and technical requirements. The results of the validation on the didactic requirements aspect is 87% with a very valid category with 92% reliability, the construction requirements aspect is 93% with a very valid category with 95% reliability, the technical requirement aspect is 87% with a very valid category with 94% reliability. Thus, student worksheet is very feasible to use. This is in accordance with one of the student work-sheet functions according to Djudin (2017), namely the material is easy for students to understand by using teaching materials.

Overall, the worksheets on heat materials and their transfers are in accordance with the requirements for the preparation of a good worksheet based on didactic, construction and technical requirements. Science textbook writers pay attention to stylistics, place emphasis on verbal argumentation, and reduce the number of new terms introduced. Definitions should be presented briefly and easily understood by students. Instead, explanations of concepts and principles are presented in a long and complete manner. Science textbooks should also contain existing and emerging technologies along with suggestions for how these technologies can be used in society. textbooks need to

implement constructivism and conceptual change models that consider students' initial conceptions (Djudin, 2017).

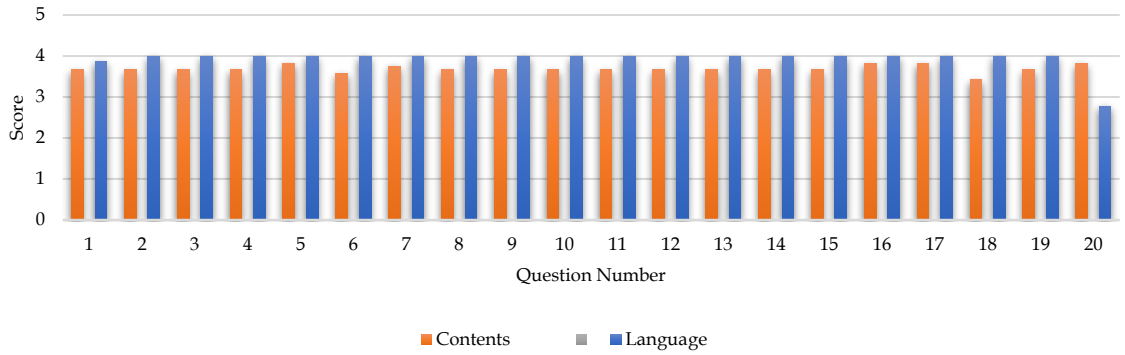

Figure 1. Question validation results diagram.

The critical thinking skills test developed by the author is a written test that aims to measure students' cognitive. This test consists of 20 multiple choice questions and can be done directly in the online module. Aspects that are assessed on the test questions are aspects of content, construction, and language. These aspects are reviewed and assessed as validators. The results of the validation of the test items are presented in Table 7. The results of the validator's assessment determine whether the items developed by the author can be used without revision, used with revisions or cannot be used. The results of the validation of the learning outcomes test compiled by the author concluded that the questions could be used with a few revisions. Of the 20 questions in accordance with the cognitive level aimed at measuring students' ability to understand the concept of heat material and its displacement.

Table 8. Observation results of critical thinking ability.

Student activity	Meet.1	Meet.2	Meet.3	Average
1. Students try to know the information well	87,50%	92,25%	87,50%	89,00%
2. Students behave systematically and regularly with parts of the whole problem.	87,50%	87,50%	81,25%	85,50%
3. Students seek explanations as much as possible if possible	87,50%	75,00%	81,25%	81,25%
4. Students' ability to find a clear statement of each question	93,75%	90,75%	93,75%	92,75%

Table 8 shows the observational data on critical thinking skills in learning. The average in three meetings of student activities trying to find out information well is 89.00%, student activities behave systematically and regularly with parts of the whole problem at 85.50%, student activities seek explanations as much as possible if possible by 81 .25%, and activity the ability of students to find a clear statement of each question is

92.75%. The use of online modules has an important role in the learning activities carried out by the authors. Learning using the online module of heat and its transfer directs students to study hard. With online modules, students can view videos and read material repeatedly according to student needs. Electronic teaching materials also support open learning and can be owned by students because they are easy to share (share) for example through social media such as Facebook, WhatsApp, Telegram and the like (Yulaika et al., 2020). Teachers are expected to be able to design and compile teaching materials that play a role in determining the success of the learning and learning process (Kusumam et al., 2016). The results of observations of students ' critical thinking skills show that they are very good at learning with the help of online modules.

The explanation of the material is done using an online module so that students get information visually and auditory. Humans have separate channels in processing information for visual and auditory material. When the media presents information in the form of illustrations, animations, videos, and texts, the information will be processed by students into the visual channel while the ear goes to the auditory channel. Increased learning outcomes due to the interaction of students with the material shows the learning process is running as it should (Arozaq et al., 2017). While the written test is a test given to students at the same time and place for certain questions. Student learning outcomes are categorized as complete if students reach the minimum completeness criteria that have been determined by the school for science subjects, which is 70. The results of the analysis of pretest, posttest, and N-gain score can be seen in Table 9.

Table 9. Completeness of student learning outcomes.

Student	Pre-Test		Post-Test		Gain Score	Category
	Score	Criteria	Score	Criteria		
A1	65	TT	85	T	0,57	Medium
A2	60	TT	90	T	0,75	High
A3	55	TT	90	T	0,77	High
A4	55	TT	85	T	0,56	Medium
A5	55	TT	70	T	0,33	Medium
A6	50	TT	80	T	0,60	Medium
A7	50	TT	70	T	0,40	Medium
A8	50	TT	70	T	0,40	Medium
A9	45	TT	90	T	0,82	High
A10	45	TT	90	T	0,82	High
A11	45	TT	80	T	0,64	Medium
A12	45	TT	80	T	0,64	Medium
A13	45	TT	80	T	0,64	Medium
A14	45	TT	75	T	0,55	Medium
A15	45	TT	70	T	0,46	Medium
A16	45	TT	70	T	0,46	Medium
A17	40	TT	80	T	0,67	Medium

Student	Pre-Test		Post-Test		Gain Score	Category
	Score	Criteria	Score	Criteria		
A18	35	TT	85	T	0,77	High
A19	25	TT	65	TT	0,53	Medium
A20	10	TT	65	TT	0,61	Medium
Average	45,50	TT	78,50	T	0, 61	Medium

Information:
T = finished
TT = not finished

Table 9 shows that from the pretest data, there are no students who can achieve the individual mastery determined by the school, which is 70. The low mastery score is because students are not clear about the heat and transfer material taught by the previous teacher. Science teachers learn textbook-oriented and acquire initial teaching practices from textbooks. The teacher teaches based on textbooks and emphasizes the process of memorizing scientific facts in a rhetoric of continuous information delivery (Djudin, 2017).

In learning, all plans are determined by the teacher and then conveyed to the students. In all these situations, students are not much involved and involved. Such teaching can hinder students' thinking processes. Students do not have the opportunity to manifest their potential and abilities. The number of students who reached the minimum completeness criteria after receiving learning using the online module on heat and transfer material based on the posttest results were 18 students (90.00%), 2 students did not complete (10.00%) because they are not optimal in absorbing the concepts in the online module and are not used to online learning. The students' average test scores increased from 45.50 to 78.50. N-gain score analysis showed an increase of 0.61 students and included in the medium category. Students who experienced an increase in the medium category were 15 students (75.00%), while students who experienced an increase in the high category were 5 students (25.00%). These results indicate that learning activities using online modules can foster critical thinking skills. Students learning outcome did SPSS test to know the normality, homogeneity, and Wilcoxon. The normality test in Table 10 has significance abnormal but the homogeneity test in Table 11 shows homogeneous. The test statistics in Table 12 use Wilcoxon signed ranks test shows that accepted significance and it shows module online can increase critical thinking.

Table 10. Tests of normality.

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest	0.283	20	0.000	0.866	20	0.010
Post-test	0.189	20	0.061	0.900	20	0.042

a = Lilliefors Significance Correction

Table 11. Test of homogeneity of variance.

	Levene Statistic	df1	df2	Sig.

data	Based on Mean	0.018	1	38	0.895
	Based on Median	0.045	1	38	0.833
	Based on Median and with adjusted df	0.045	1	29.142	0.833
	Based on trimmed mean	0.050	1	38	0.824

Table 12. Test statistics (b) (Wilcoxon).

	posttest - pretest
Z	-3.929(a)
Asymp. Sig. (2-tailed)	0.000

Success in improving student learning outcomes related to critical thinking skills should not be viewed as a result of online module assistance alone. The success of learning is the result of collaboration between technologies (online modules), student activities, learning objectives, learning implementation plans, and the role of the teacher contribute to the success of a learning. The results of the expert validation, teacher questionnaire, and student questionnaire showed that the interactive multimedia courseware is feasible for use in learning and effective in strengthening students' characters (Septiani et al., 2020). Multimedia is not just delivering information to students but multimedia must also be able to move students' cognitive abilities to actively construct their knowledge in learning and learning activities. Learning tools developed according to student needs will help students improve student learning outcomes, including learning media. Student responses to the online module developed by the author get a very good response. Based on the results of student response questionnaires, learning activities using interactive media can help students understand heat material and its transfer. Computers can provide a display that allows users to freely choose, synthesize, and elaborate the knowledge they want to understand so that computers will be very helpful if used as learning media (Munadi, 2012).

CONCLUSIONS

The results of the validation of the learning devices obtained varied validator assessment results as well as reliability. The results of the validation and reliability as a whole are in the very valid and reliable category so that the learning device is declared suitable for use. The results of observations of students' critical thinking abilities trying to find out information well with student activities behave systematically and regularly with parts of the whole problem, student activities seek explanations as much as possible if possible, and activity The ability of students to find a clear statement of each question is and the N-gain results show that the medium category is 15 students, the high category is 5 students. Limitation off this study was so difficult to invite students on online learning. All of the teachers can use this module online to increase critical thinking skills.

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