

Development of science learning media-based local wisdom Batui to improve critical thinking ability

Muliati Supandi^{1,*}, Senam Senam²

¹Program Study Pendidikan Sains, Universitas Negeri Yogyakarta, Jln. Colombo 1, Karangmalang, Yogyakarta, Indonesia

²Program Study Pendidikan Kimia, Universitas Negeri Yogyakarta, Jln. Colombo 1, Karangmalang, Yogyakarta, Indonesia

*Corresponding author: muliasmantil@gmail.com

Abstract

The aim of this study was to develop product in the form of a Tumpe Ritual Game for Class VII junior high school students. The research used the research and development (R & D) method developed by Thiagarajan. The research refers to the 4D model: define, design, develop and disseminate. The result of the study indicates that learning media developed is valid or meet the eligibility criteria. The feasibility category obtained from media experts and also the teacher is highly valid. The implementation of learning media in the classroom can increase students' active participation so that it has an impact on improving critical thinking skill. Gain scores obtained at the pre-test and post-test in the experimental class showed significant differences. The gain score of experimental class was 0.67 and the control class was 0.54 with the medium category. The effectiveness of learning was done by Manova test with the acquisition of sig values. amounting to 0,000 (<0.05). These condition indicated that the media developed was valid, practical and effective to be used in the process of learning science in class VII SMP.

Keywords: Learning Media; Science; Batui Local Wisdom; Critical Thingking

Introduction

Tafano (2018) argued that increasingly sophisticated technological development becomes an important means of achieving more effective educational goals. This condition is a big demand for teachers and lecturers in developing the ability to master technology and learning media. Learning media is one of the factors that influence the learning process (Slavin, 2010). The role of learning media in the process of learning and teaching is very important to be carried out by educators nowadays. Learning media can be used to deliver messages to recipient and help explain something simpler (Ashyar, 2012).

The learning process will run effectively and efficiently if supporting media is available. Yusufhadi & Miarso (2004) explained that one of the factors causing the low quality of learning is the maximum use of learning resources, both by teachers and students. Putra et al., (2013) said that good learning media must be suitable to the stages of cognitive development of students. There are many learning media applied in the learning process, one of them is game. The game is a fun activity, inviting players to always try to be a winner in completing the game and going up to a higher level. The ability to solve a challenge will train

someone's critical thinking skill. This condition allows players to carry out critical thinking activities in pleasant conditions (Prasetyo, 2017).

The selection of *game* as learning media is supported by several previous studies. Chee et al., (2011) & Chichino (2015) have applied media game in learning. The result obtained by using game have a positive influence on student learning outcomes. *Game* media can improve the understanding of concepts and critical thinking skills needed in facing the challenges of the 21st century. Learning systems using *game* can make science learning interesting, not monotonous, and facilitate the delivery of messages because of image, sound, writing, and animation (Honiotes, 2011) . Students can learn the material independently by using a computer or cellphone they have.

Game as learning media is not something new. Gros (2007) interpreted that at present, *game* has been widely adopted as supporting media in facilitating and streamlining the learning process. In recent years, educational computer *game* has received increasing attention from researchers and educators but fewer than the gaming industry. In the presentation of content, the *game* currently available has not provided contextual learning. (Rini, 2014) explained that the use of learning materials that are in accordance with the characteristics and learning environment of students is one of the keys to the success of science learning.

The game will be more contextual if it is integrated with the local wisdom of the area where the students live. Based on the result of Suastra's research (2009), the cultural background of students and brought into the classroom during the learning process, plays an important role in the process of mastering the material. Cultural background brought by teachers and students is crucial in creating or conditioning learning processes that is meaningful and contextual. Learning that does not facilitate students to connect and see their relevance to their daily environment tends to result in lack of participation, and difficulty achieving or maintaining the information presented (Anderson & Pellicer, 1998; Campbell & Harris, 2001; Hootstein, 1994; Wood & Jones, 1994).

Batui, Banggai regency of Central Sulawesi province has a local wisdom called the *tumpe ritual*. The *tumpe* ritual is an annual traditional ceremony that is often held by the community as a form of devotion to their ancestor. The ritual of *tumpe* itself is a ritual for delivering Maleo birds to the proud kingdom which includes the process of collecting, praying, delivering, and *monsawe tumpe* which is the closing of the ritual.

The *tumpe* ritual stage carried out by the Batui community can explain the concepts of temperature and heat in science learning in class VII SMP with basic competency 3.4,

namely understanding the concepts of temperature, expansion, heat, heat transfer, and its application in everyday life human and animal bodies.

Based on the facts above, the need for learning media that integrates local wisdom is considered very necessary to be developed to improve the critical thinking skill of junior high school students.

Based on the explanation above, the questions in this study can be formulated as follows.

1. How is the feasibility of science learning media based on local wisdom to improve critical thinking?
2. How is the effectiveness of science learning media in improving students' critical thinking?

Materials and Methods

The research method used is a 4D research and development (R & D) model (Thiagarajan et al., 1974). The 4D model consists of four main stages, those are defining, designing, developing, and disseminating. At the define stage, it includes analysis, assignments and concept analysis. The needs analysis is done by classroom observation and interview with several science teachers. Analysis of task and concept was find out by matching the material with the science curriculum (kurikulum 2013) in Indonesia.

The *design* and *prototype* phase produce computer program that is ready to develop stages through several evaluations and tests. The development stage was initiated by the expert's assessment. An expert in science and an expert in computer-based learning. The evaluation was also carried out by two science teachers. The results of evaluations from science experts and teachers are a consideration for revision of product development.

After the experts' assessment and evaluation of the science teachers, the products developed were tested by students. Preliminary testing was carried out for smaller group of 9 students. Student response in small scale trials was used as a consideration for improving the learning media developed. After several revisions, the product developed was tested in a larger group consisting of 60 junior high school students. The researcher in this study use one experimental group and pre-test and post-test controls in field testing. Finally, from the testing field in a larger group of students, students provide a response to the computer program they are using. The response was used as a consideration for the final revision.

Results Instrument

The quality of the Ritual Tumpe game developed is determined through expert judgment, teacher evaluation and student responses. The instrument used to gather expert judgment, teacher evaluation and student responses are questionnaire. Questionnaire was developed using the Likert scale (1-4). The questionnaire for evaluation by material experts includes five aspects, those are truth, breadth and depth of concept, linguistic, benefit, and implementation. The questionnaire for evaluation by instructional media experts includes three aspects, namely ease, language, attractiveness.

The questionnaire for evaluation by science teachers includes seven aspects, those aspects are suitability / relevance, truth, linguistic, usefulness, implementation, convenience and attractiveness. The responses of students were collected through instrument with a Likert scale 1-4. The instrument contains several statements that really gather students' responses about language, usefulness, convenience and attractiveness.

Instrument for measuring the effectiveness of learning products in learning science is critical thinking essay question consisting of 10 items given at the pre-test and post-test before and after using the development product.

Data analysis

The study used descriptive technique in data analysis. Learning media evaluation scores obtained by science experts and teachers through questionnaire were averaged. The average score of each aspect is classified into the level of conformity based on the criteria in Table 1. Sukardi (2013) made a classification by comparison with the ideal average score (X_i) and the ideal standard deviation score (SD_i) as a basis. The qualification level is divided into four categories with the criteria as in Table 1.

Table 1. Validation criteria

Average	Validation Criteria
4.00-3.75	Highly Valid
3.75-3.00	Valid
3.00-2.25	Less
2.25-1.50	Very Invalid

(Sukardi, 2013)

To measure the increase in critical thinking, gain score categorization was used that obtained at the pre-test and post-test in the control class and experimental class as in Table 2. After the gain score is obtained, the data is tested with *Statistic Manova Test* to see the effect caused by the product development.

Table 2. Criteria for Gain Score

Average	Gain Score
> 0.7	High
0.3 – 0.7	Moderate
< 0.3	Low

Results and Discussion

The *Tumpe ritual game* developed for science learning in this study was considered valid. The game which developed gained an average of 3.43 (Highly valid) by material experts and 3.58 (highly valid) by media experts.

Table 4. Results of Material Feasibility assessment

Aspect	Score average	Percentage	Category
Validity	3.70	92.50	Highly valid
breadth and depth of concept	3.00	75.00	Valid
Linguistic	4.00	100.00	Highly valid
Usefulness	3.00	75.00	Valid
Implementation	3.50	87.50	Highly valid
Average	3.43	86.00	Highly valid

The table above shows that science learning game-based on local wisdom is developed in accordance with main competency, basic competency, indicator and learning objective to be achieved.

After going through the revision stage, an assessment of the game is conducted. The result of the assessment provides the initial results of this media direction which was developed to get score of 3.43 with a very good category. Based on these assessments, 5 aspects of material feasibility have been fulfilled.

Tabel 3. Result of Game Media Feasibility

Aspect	Score average	Percentage	Category
Easiness	3.50	87.50	Highly Valid
Linguistic	3.67	91.75	Highly Valid
Attractiveness	3.57	89.25	Highly Valid
Average	3.58	89.50	Highly Valid

Based on the table above, it can be seen that the local wisdom-based science learning game developed includes very good categories with an average score of 3.58 and 89.50% of the assessment percentage. Some unfulfilled aspects are given input / suggestions from media expert lecturers.

The practicality of learning devices in this study was assessed based on the feasibility of learning using development products.

Table 4. Teacher responses

Aspect	Score	Percentage (%)	Category
Feasibility/Relevance	4.00	100.00	Excellent
Validity	3.32	83.00	Excellent
linguistic	3.50	87.50	Excellent
Usefulness	3.67	91.75	Excellent
Implementation	3.57	89.25	Excellent
Easiness	3.58	89.50	Good
Attractiveness	3.35	83.75	Excellent
Average	3.59	89.25	Excellent

After practicing the practicality carried out by two teachers, the products developed need to be measured by students' readability and the results obtained in table 5 are obtained.

Table 5. Recapitulation of Readability of Student Game

Aspect	Score average	Percentage (%)	category
Linguistic	3.35	83.75	excellent
Usefulness	3.32	83.00	Good
Easiness	3.10	77.50	Good
Attractiveness	3.22	80.50	Good
Average	3.25	81.19	excellent

It can be seen that the average observation score for the implementation of learning in the field trial is 3.24 in the good category. Based on the established criteria, development product is included in the practical criteria, because Sr is in the range of $2.5 \leq Sr < 3.5$ (Table 5). Data on student responses was filled by nine students in a limited trial. At the time of the limited trial, it was seen that the average score of students' responses to the game developed in the field trial was in a very good category. The result of the response analysis of students from limited trials, the game was stated good in all aspects, both aspects of language, usefulness, ease and attractiveness. Game developed is worthwhile for being used as learning media and it is appropriate for the needs of students.

The implementation of learning media on a large scale, obtained an increase in student learning outcomes after using learning media of RPG Ritual Tumpe. The result of differences in pre-test and post-test can be presented in table 6.

Table 6. Result of analysis of critical thinking skills

Component	Experimental class		Control class	
	<i>Pre-test</i>	<i>Post-test</i>	<i>Pre-test</i>	<i>Post-test</i>
Score average	36.92	79.14	32,07	69,96
<i>Gain Score</i>	0.67		0.54	
Category	Moderate		Moderate	

The average gain score of critical thinking skills of students in SMP N 1 Batui in the experimental class is 0.67 which is in the moderate category and in the control class is 0.54 which is in the moderate category.

The gain score obtained was then analyzed using the Manova test to prove that the increased mastery of critical thinking skills in the experimental class was caused by the science learning game developed. The game developed integrates the local wisdom of the community so that students are interested and easy to understand because it fits with the context of everyday life. This is in line with Kearsley (2011) said that learning is a function of the activities, context and culture of the local community.

Table 7. Manova Test

	<i>Effect</i>	<i>Sig.</i>
Class	<i>Pillai's Trace</i>	0.000
	<i>WiRPP 'Lambda</i>	0.000
	<i>Hotelling's Trace</i>	0.000
	<i>Roy's Largest Root</i>	0.000

Based on the table above, critical thinking skills get a sig value of 0,000. If the significance level is set at 0.05, the sig value obtained must be less than 0.05. This condition explains that there are differences in critical thinking caused by the use of science learning products developed. The result of this study is in line with previous study conducted by Sari (2014), the use of computer-based game in learning have better effectiveness than conventional learning in terms of mastering concepts and students' critical thinking skills.

Jacquelyn (2010) stated that the strategies used to teach critical thinking skills include *higher order questioning, cooperative learning, enrichment, modeling, real-life applications, and fostering affective domains*. In this study, the strategy used is *higher order questioning* problem in the form of critical thinking, *active learning* by making students independently active learning, and *enrichment* by exposing students to problem solving in quizzes, material and understanding material with audiovisual and heat transfer process through animation in the *game*.

This condition is in accordance with the study of Fitriana & Husna (2011), interpreting that learning using game is an alternative strategy for developing critical thinking skills. Learning by applying the game allows students not only to sit listening to lectures from the teacher. Activities in learning with this method allow students to develop their critical thinking skills, those the problem solving and evaluation components. Learning by using this game can also attract students because of fun game activities. Rudiyanto (2010) concluded the same thing that computer-based game can improve mastery of concepts and critical thinking skills.

Conclusion

A study has been conducted to develop individual learning resources in the form of Game-based RPG Ritual Tumpe. Based on the finding and discussion, it can be concluded that: (1) the game media developed in the temperature and heat material in this study proved to be very valid by experts. The media can be concluded to be highly suitable to use in the process of learning science in junior high school. Students provided positive response to the use of the Game of Tumpe Ritual RPG, and the implementation of learning using the Game of RPG Tumpe Ritual was considered very good; (2) Critical thinking skills of students in experimental class before and after post-test experienced significant differences. The gain score obtained at post-test was 0.67. The Gain score was then tested using the Manova test with a sig value of 0,000 (<0.05). These conditions indicate that the media developed is effective in improving the critical thinking skills of junior high school students.

References

- Ashyar, R. (2012). *Kreatif Mengembangkan Media Pembelajaran*. Jakarta: Gaung Persada.
- Anderson, L. & Pellicer, L. (1998). Towards an understanding of unusually successful programs for economically disadvantaged students. *Journal of Education for Students Placed At-Risk*, 3(3),237-263.
- Campbell, D. & Harris, L. (2001). *Collaborative theme building: How teachers write integrated curriculum*. Boston: Allyn & Bacon.
- Cicchino, M. I. (2015). Using game-based learning to foster critical thinking in student discourse. *Interdisciplinary Journal of Problem-Based Learning*, 9 (2), 1–19.
- Chee, Y. S., Tan, K. C. D., Tan, E. M., & Jan, M. (2011). Learning Chemistry Through Inquiry With the Game Legends of Alkhimia An Evaluation of Learning Outcomes.

- Proceedings of the 5th European Conference on Games Based Learning, Singapore.* (20), pp. 98-105. Retrieved from doi: 10.1007/978-94-007-3980-2_16.
- Gros, B. (2007). Digital Games in Education: The Design of Games-Based Learning Environments. *Journal of Research on Technology in Education*. Retrieved from <https://pdfs.semanticscholar.org/9403/b205dbc60967483fcdc7e5ae834aa9e2a712.pdf>
- Honiotes, J. (2011). *Theories of Thematic Instruction*. Retrieved from http://www.ehow.com/info_8552033_theories-thematic-instruction.html.
- Hootstein, E. (1994). Motivating middle school students to learn. *Middle School Journal*. 25(5), 31-34.
- Kearsley, G. (2011). *The theory into practice database*. Retrieved from <http://tip.psychology.org>
- Prasetyo, A. D. (2017). Pengembangan Multimedia Pembelajaran Interaktif Mata Pelajaran IPA Pokok Bahasan Bumi dan Alam Semesta Kelas VI SD Negeri Ngringin Depoksleman. 6 (7), pp.684-697. *E-Jurnal Prodi Teknologi Pendidikan*.
- Rini, Tangkas, I. M., & Said, I. (2014). Meningkatkan Hasil Belajar Siswa Melalui Penggunaan Metode Demonstrasi Pada Mata Pelajaran IPADi Kelas III SDN Inpres Tunggaling. *Jurnal Kreatif Tadulako Online*. 2 (1), pp.67-81.
- Slavin, R. E. (2010). *Cooperative Learning Teori, Riset dan Praktik*. Bandung: Nusa Media
- Suastra, I W. (2009). *Pembelajaran Sains Terkini: Mendekatkan Peserta didik dengan Lingkungan Alamiah dan Sosial Budayanya*. Singaraja: Universitas Pendidikan Ganesha.
- Sukardi. (2013). *Metodologi Penelitian Pendidikan: Kompetensi dan Praktiknya*. Jakarta: PT Bumi Aksara.
- Tafonao, T. (2018). Peranan Media Pembelajaran dalam Meningkatkan Minat Belajar Mahasiswa. *Jurnal Komunikasi Pendidikan*. 2 (2), pp.103-114.
- Thiagarajan, S., Semmel, D. S. & Semmel, M. I. (1974). *Instructional Development for Training Teachers of Exceptional Children*. Washinton DC: National Center for Improvement Educational System.
- Yusufhadi & Miarso. (2004). *Teknologi Komunikasi Pendidikan*. Jakarta: Pustekom Dikbud dan CV Rajawali.
- Wood, K. & Jones, J. (1994). Integrating collaborative. *Middle School Journal*. 25(3), 19-23.