The Development of a Local Wisdom-Based Natural Science Comic Through a Webtoon to Improve Students' Critical Thinking Skills

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ABSTRACT

Critical thinking is a needed basic skill in the 21st century. This study aims to produce a local wisdom-based natural science learning medium with a theme of the story of an eclipse of Batara Kala through a Webtoon to develop critical thinking skills. The medium development employs an ADDIE development procedure that consists of analysis, design, development, implementation, and evaluation. The result of validation from a media expert is 4.15, whereas the content expert validation is 4.1 and both are in a valid category. The result of the N-gain test in the pretest-posttest generates an N-gain score of 0.63 or a moderate category. The result of the questionnaire for teachers and students are 4.75 and 4.35, respectively, or both are in an excellent category. The study concludes that the developed natural science learning medium is feasible to be used in improving students' critical thinking skills in natural science learning. Recommendation from the research according to the experts and teachers' assessment is to develop the comic so that it can accommodate content in the basic competencies in detail.

Keywords: learning media, webtoon comic, batara kala, critical thinking

INTRODUCTION

The 21st century and the 4.0 revolution era are characterized by the rapid development of technology and information distribution (Sopian, 2015). Therefore, 21st-century human resources are required to master the era skills that are grouped into four, namely way of thinking, way of working, tool of work, and living in the world (Binkley et al., 2014). One of the skills that need to be developed is critical thinking skill since it is an essential basic skill in life (Zubaidah, 2010), especially in one's daily decision making (Muhlisin et al., 2021).

Critical thinking skill development is important for students (Wagner, 2010). Through critical thinking skills, students are trained to be skilful in analyzing, synthesizing, implementing, and evaluating information obtained and are capable of making a decision problem solving independently, creatively, and responsibly (Wahyuni, 2015). An ideal educational process becomes a success indicator of critical thinking skill development. This is because the ideal learning process encourages student activity in achieving learning objectives (Jamilah, 2020). The statement was consistent with the characteristics of natural science learning aiming at developing process skills in acquiring natural science concepts and cultivating scientific attitudes in students that support the development of students' critical thinking skills (Lestari et al., 2016).

The results of observation in natural science subject in eclipse content found symptoms indicating that the student's critical thinking skills are low. The result was based on interview results conducted on December 30, 2020, with three natural science teachers in SMPN 13 Magelang.

The observation also indicated that critical thinking skills had not been optimally taught in the learning process. This was due to the learning media used that had not integrated critical thinking skills. In online learning, students encounter another issue, which is the limited access to learning aids of video conferences due to a large internet network needed for smooth access. This problem is contrary to the opinion Ula et al. (2021) that the difficulty of access to learning during the pandemic greatly affects the success of learning achievement.

A solution that can be carried out is by developing learning media in the form of Webtoon comics based on local wisdom of a story of the Batara Kala that are capable of developing students' critical thinking skills in the eclipse content. The combination of webtoon comics and the local wisdom of the Batara Kala story is expected to produce a medium that attracts and motivates students in learning, therefore, it will facilitate critical thinking skill training (Annisa, 2018; Nanda & Kustijono, 2017). Likewise, Saputro (2016) states that comics that are used in learning that integrate examples of problems can enhance critical thinking skills.

Various studies support the development of the learning medium of webtoon comics to improve students' critical thinking skills. For example, Saputra & Pasha (2021) concluded that comics could be developed as an online and offline learning medium during the Covid-19 pandemic. A study by Damayanti & Kuswanto (2020) generated data that the utilization of android-based physics comics could enhance students' critical thinking skills. The data were calculated using N-gain with an average score of Class A was 0.4 and Class B was 0.3 that included in a moderate category. Another research by Fauziah & Kuswanto (2021) on the utilization of Android Comic based on the Local Potential of Embung Tambakboyo to improve critical thinking skills concluded that the N-gain result was in a high category in the experimental class.

RESEARCH METHOD

Research Design

The research and development design employed an EDDIE development model that included five stages, namely analysis, design, development, implementation, and evaluation (Sugiyono, 2014). The development procedures of the learning media in this research can be seen in Figure 1.
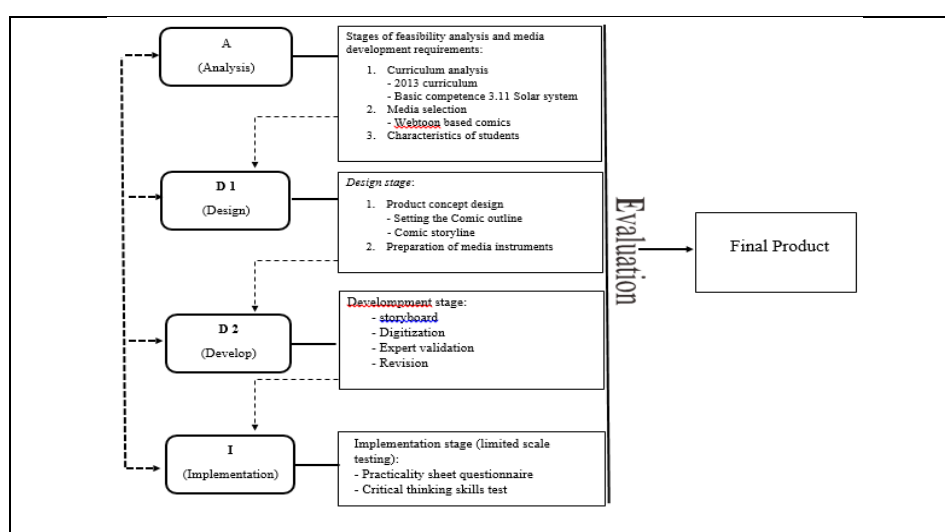

Figure 1. Development of ADDIE in the research

The implementation stage used a research design of one group pretest-posttest. The research design measured the improvement of students' critical thinking

skills based on the development of applied learning media. The implementation of the webtoon comic learning medium of unravelling the mystery of the Batara Kala was carried out using structured online learning as presented in Table 1.

Table1. Learning Activities

Learning Phase	Learning Operational Step	
Apperception	Teachers provide apperception of the Batara Kala local wisdom	Students respond independently
Pretest	Teachers provide pretest questions on critical thinking skills.	Students answer the pretest questions independently.
Stimulation & problem statement	Teachers instruct students to read episode 1 of the comic	Students discuss episode 1 of the comic collectively
Data collection	Teachers instruct students to read episode 2 of the comic	Students discuss episode 2 of the comic collectively
Posttest	Teachers provide posttest questions on critical thinking skills.	Students answer the posttest questions independently.
Conclusion	Teachers and students conclude the content studied.	

Sampling

The research subjects were 30 students of Grade VII in Semester II in SMPN 13 Magelang. The selection of the research subjects was conducted using a purposive sampling technique with the following criteria (1) have a compatible Smartphone, (2) have used or read comics, and (3) have a high activity level.

Instrument

The data collection techniques in the research consisted of 1) instruments of expert validation, 2) test instruments, and 3) practicality and documentation instruments. The measurement of critical thinking skills employed indicators from Facione (2015) that were broken down into six including interpretation, analysis, inference, evaluation, explanation, and self-

regulation (Facione, 2015).

Table 2. Example of critical thinking skill questions for inference indicator

Critical thinking indicator	Question Indicator	
Explanation	Explain the relationship between a lunar eclipse and its impacts on life on earth	During the lunar eclipse phenomenon, fishermen do not go to the sea since they are concerned about their ships that will sink due to high waves. What is the relationship between the eclipse phenomenon and the high tidal waves in the ocean?

Two content experts performed the validity test on question items before implementing them on the research subjects. Of the 10 items on the tested critical thinking skill questions, the result of assessment accumulation indicated that eight questions were in a very valid category, whereas two other questions were in a valid category. Media validity was based on the result of experts' assessment processed using the Likert Scale. The validity results are presented in Table 3.

Table 3. Validation of test instruments of the critical thinking skills

Critical thinking indicator	Question Number	Average Validator Assessment	Category
Interpretation	1	4.5	Very Valid
	2	3.5	Valid
Analysis	3	5	Very Valid
	4	4	Very Valid
Inference	5	4	Very Valid
	6	4	Very Valid
	7	4.5	Very Valid

Evaluation	8	4.5	Very Valid
Explanation	9	3	Valid
Self-regulation	10	4.5	Very Valid

Data Analysis Techniques

The data analysis technique employed a parametric test by performing a pre-requisite test of a normality test. The result of the normality test carried out using Ms. Excel program with the Liliefors method generated Lo ≤ L table score of $0.157 \leq 0.161$. The result was according to the categories of the Liliefors critical table and it can be inferred that the data were normally distributed and the parametric test can be performed.

The analysis of the media validity test was conducted to assess the feasibility of the media using assessment categories of five-standard score intervals as presented in Table 4.

Table 4. Five-Standard Score Intervals

Score Interval	Category
X > 4,2	Very Valid
3,4 < X ≤ 4,2	Valid
2,6 < X ≤ 3,4	Fairly valid
1,8 < X ≤ 2,6	Less valid
X ≤ 1,8	Invalid

(Source: Widoyoko, 2016)

The analysis test of media effectiveness used hypothesis testing (t-test and N-Gain). The t-test is significant if the t table < t value; thus accepting Ho and rejecting Ha. The N-gain test was employed to observe the degree of improvement in critical thinking skills before and after the application of the learning medium. The N-gain categories can be seen in Table 5.

Table 5. N-gain Categories

N-gain Categories	
g > 0.7	High
0,3 ≤ g ≤ 0.7	Moderate
g < 0.3	Low

(Source: Hake, 1998, h. 65)

The practicality test was utilized in evaluating the easiness of the media based on the assessment result from the teachers and students as the subject. The validity of the media practicality was processed using the Likert scale which is represented using the percentage scale of the end score. The practical standard categories can be seen in Table 6.

Table 6. Practicality Scale

Score Interval	Category
X > 4,2	Excellent
3,4 < X ≤ 4,2	Good
2,6 < X ≤ 3,4	Fair
1,8 < X ≤ 2,6	Poor
X ≤ 1,8	Bad

RESULT AND DISCUSSION

Following are the results of the research and development.
1. Validity of the local wisdom-based natural science learning media

The data analysis results according to the media validation and content validation results of the development of the webtoon comic learning medium of unravelling the mystery of the Batara Kala are presented as follows.
a. Results of Media Validation

The results of media validation can be seen in Table 7.

Table 7. Results of media expert validation

No	Assessment Aspect	Average
1	Technical Quality Aspect	4.08
2	Display Quality Aspect	4.2
3	Ease of Use Aspect	4.16
	Total Average	4.15

Table 7 indicates that the score of the technical quality aspect was 4.08, the display quality aspect was 4.2, and the ease of use aspect was 4.16 resulting in a total average score of the media validation was 4.15 with a valid category. The result, however, suggested the need for improvement based on the suggestion and

inputs from the validators that referred to the lowest score obtained from each aspect.

Aspect with the lowest assessment score, namely display quality, received suggestions and inputs of separating the conversation balloons between the characters and it had been revised as indicated in Figure 2.
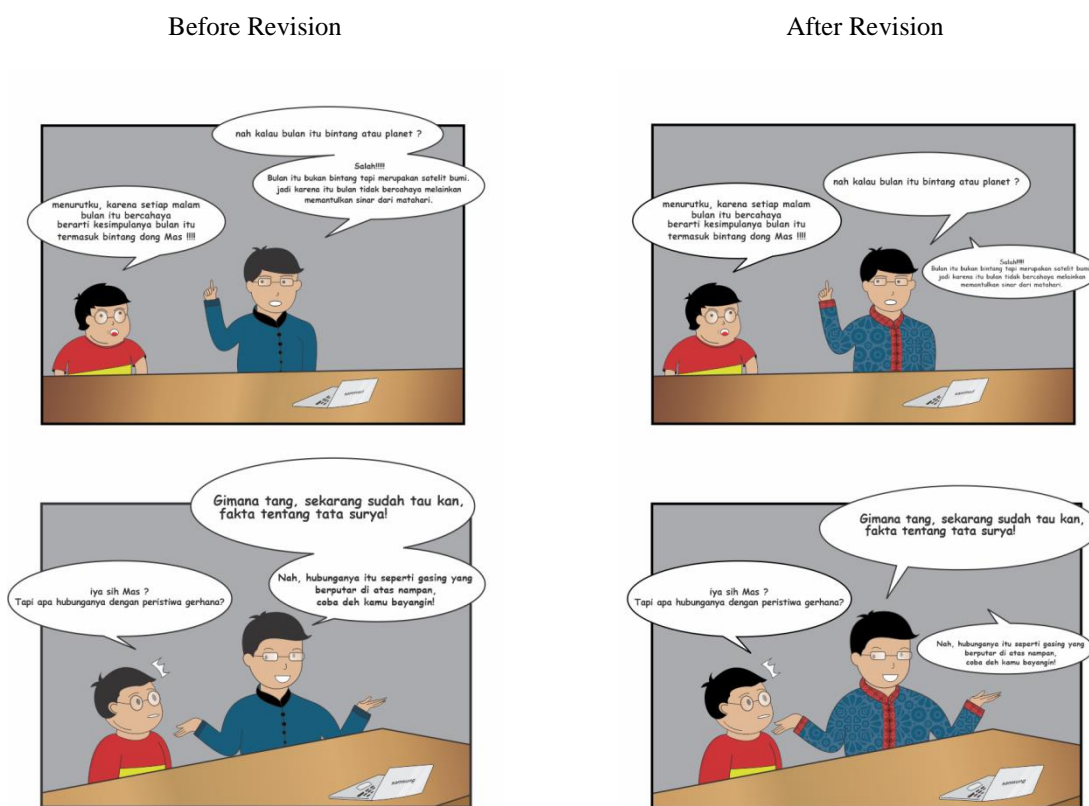
Before Revision

After Revision

Figure 2. Revision of the conversation balloons

Improvements to speech bubbles and comics make comics easier to read and understand. The improvement is following the criteria for the composition of visual media according Sulistyono (2016) where the presentation of visual works must pay attention to aspects of readability, composition, ease to understand and ease to see. The aspect of text readability in visual learning media is an important thing that must be considered, this is because the level of media readability affects learning outcomes (Rusyati et al., 2019).

a. Results of Content Validation

Results of the content validation are presented in Table 8.

Table 8. Results of content validation expert

No	Assessment Aspect	Average
1	Relevance	4.1
2	Accuracy	4.5
3	Presentation Completeness	3.66
4	Language Suitability	4.25
5	Components of critical thinking skills	3.91
Total Average		4.1

Based on Table 8 on the results of learning media validation, it can be seen that the result of content expert validation generated an average total score of 4.1, which was in the valid category. The results consisted of scores for the relevance aspect of 4.1, accuracy aspect of 4.5, presentation completeness aspect of 3.66, language suitability aspect of 4.25, and the aspect of components of critical thinking skills of 3.91. The results still received revision or

improvement that referred to the lowest score obtained in the assessment aspect categories. The table also indicated that the display completeness aspect had the lowest assessment score.

Suggestions and inputs provided by the content experts regarding the content validation results were in the aspect of display completeness, namely strengthening the content depth contained in the comic. The result of the revision can be seen in Figure 3.
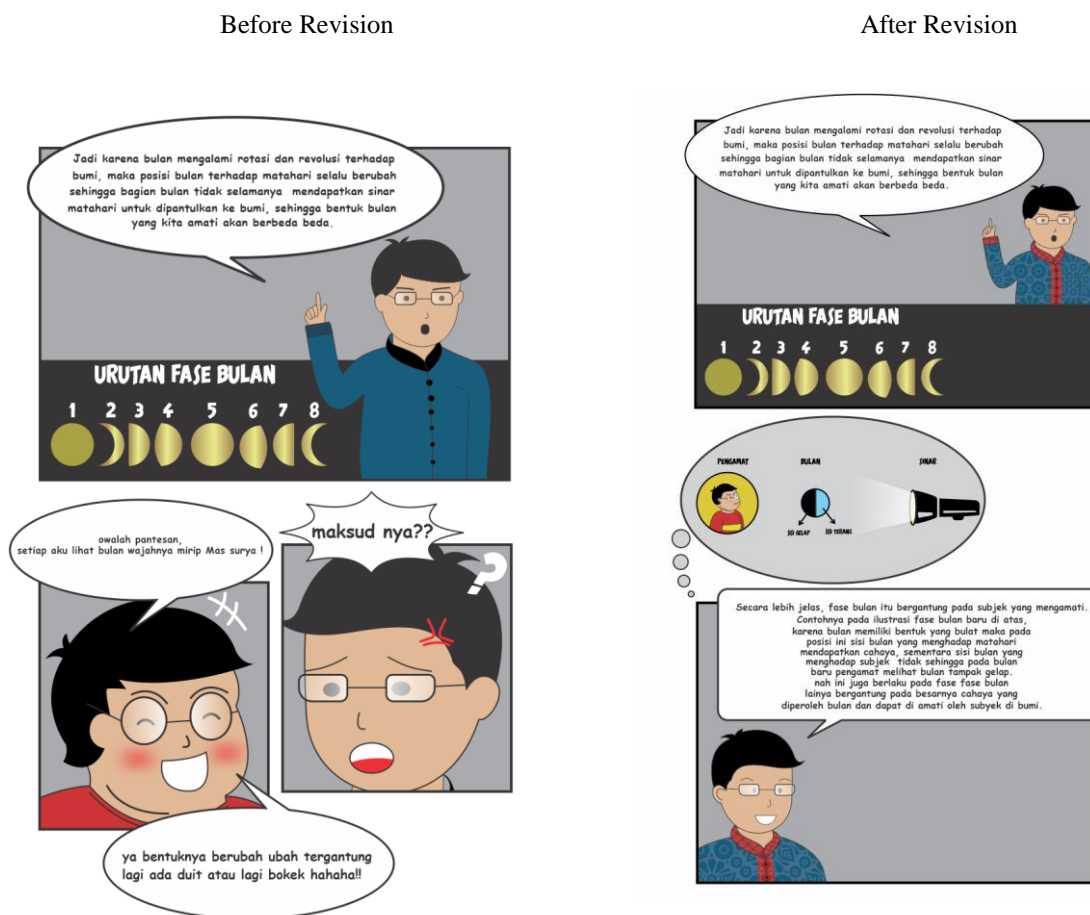
Before Revision

After Revision

Figure 3. Strengthening the explanation of the moon phases

Based on Figure 3, the addition of dialogue and illustrations contained in the learning media is very important because it encourages students to better understand the lesson. in line with this opinion Wahid (2018) illustrations or visual images help students in remembering and understanding information. Pictures or illustrations contained in the learning media also serve to practice critical thinking skills (Amalia & Kustijono, 2017).

2. Effectiveness of The Unraveling the Mystery of the Batara Kala Comic

The effectiveness of the learning medium was identified based on the implementation of the learning media in the research subjects, which were 30 students of Grade VII SMPN 13 Magelang. The assessment was conducted using the instruments of the critical thinking skill test that had passed the stage of expert lecturer validation.

The implementation was carried out on May 22-23, 2021 using a one-group pretest-posttest trial test generated data as illustrated in Figure 4.
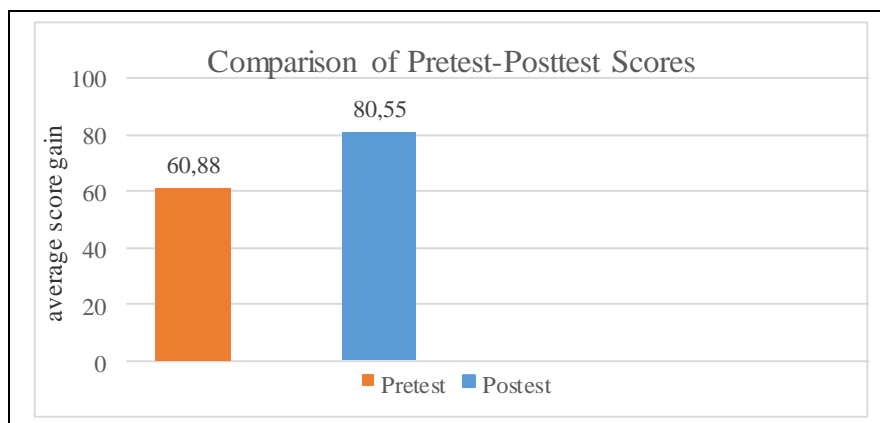
Figure 4. Graph of Comparison of Students' Pretest and Posttest Scores

Evaluation of the effectiveness of the learning media utilized data of the students' pretest-posttest scores as indicated in Figure 4. Steps were taken to appraise the media effectiveness level by analyzing the students' pretest-posttest scores by employing the following analysis techniques.

a. T-test

The results of the t-test conducted using Ms. Excel and employed α of 5% and a degree of freedom of 29 (30-1) suggested a t-table of 2.001717 and t-value of -10.7051. The results were not in the area between the t-table and –t-table; thus, rejecting Ho and accepting Ha. The t-test results indicated that there was a difference in the results of the critical thinking skills before and after the implementation of the learning medium of the webtoon comic of Unraveling the Mystery of the Batara Kala in the SMP N 13 Magelang.

b. N-Gain Test

The N-gain test was also carried out using Ms. Excel to assess the extent of improvement in the students' critical thinking skills according to the results of the pretest-posttest scores. The calculation of the pretest and posttest scores in the N-gain test generated a score of 0.63, which was in the moderate improvement category. The category was based on the N-gain categories as indicated in Table 6.

The N-gain results were good yet less optimum. Several factors affected the results, namely, five students received N-gain with low category and two of them experienced no improvement; moreover, 11 students experienced an improvement in a moderate category and 15 students were in the high category. These conditions were due to the limited roles of teachers during the online learning process. The teachers' roles were in terms of direction and supervision. Hence, several students were pay less attention to the direction. This is in line with the opinion Buchari (2018) that the teacher's role in managing and organizing the learning process affects the effectiveness and success of learning outcomes. The limited role of the teacher in supervising students directly has an impact on the low level of discipline they have (Harfiani et al., 2021).

3. The practicality of the Unraveling the Mystery of the Batara Kala Comic

The practicality of the learning medium was obtained according to the results of teachers and students responses. Overall, the practicality aspect of the learning medium assessed by the teachers and students gained a total score of 4.88 and 4.35, respectively included in the excellent category. The scores suggested that the practicality level of the learning medium of the comic webtoon "Unravelling the Mystery of the Batara Kala" for teachers and students was very practical. This practicality is evidenced by an increase in students' critical thinking skills after using instructional media, this proves that the learning media developed are compatible

with students. In line with Nuryana & Munsi (2021) State that the factors that support the effectiveness of online learning are the ease of use of media in facilitating the learning process. Tables 9 and 10 present the results of the learning medium practicality.

Table 9. Results of teacher practicality

No	Assessment Aspect	Average score
1	Display	5
2	Content	4.55
3	Language	4.55
4	Learning Media	4.88
	Total Average	4.75 (Excellent)

Table 10. Results of Student Practicality

No	Assessment Aspect	Average score
1	Display	4.37
2	Content	4.33
3	Language	4.45
4	Learning Media	4.42
	Total Average	4.35 (Excellent)

Overall the developed natural science learning medium in an eclipse theme has various advantages, namely, it contains local wisdom of the Batara Kala, questions on the evaluation of critical thinking skills, and comic characteristics as the natural science learning medium. Another advantage is that it requires no large internet connection to access the medium smoothly during the online learning process.

The learning medium, however, also has a weakness, namely the lack of control or supervision of students who have a low level of learning independence; thus, the developed critical thinking skills are less optimal. Another weakness is related to its inability to accommodate learning indicators broadly.

The overall data resulted in the research demonstrate that the development of the learning medium of the comic webtoon of unravelling the mystery of the Batara Kala fulfils the aspects of the learning media development that is congruent with the research goals. The development performed met the media feasibility, effectiveness, and practicality aspects to improve students' critical thinking skills.

The feasibility of the Webtoon comic learning medium in the media aspect is passable since it has the characteristics of the basic elements of comic formation that consist of space, image, text, point, line, and colour (Gumelar, 2011). On a whole, the elements bring image illustration and media content in the comic that encourages readers in discussion; therefore, it can develop critical thinking skills. Likewise, Lestari et al. (2021) state that comics could drive discussion that stimulates critical thinking since, in the discussion, students are not only expressing ideas, but they will listen and assess others' opinions. The reason could raise cognitive of interpretation, analysis, evaluation, explanation, and inference.

The advantage of the comic webtoon as a learning medium is that it contains elements of stories, images, and conversations that are capable of developing the critical thinking skills of students. Nanda & Kustijono (2017) description supports this by stating that the relationship between comic and critical thinking skills is that comics can insist students interpret the meaning of images and texts in the comic, analyze the relationship between images and dialogues, evaluate or assess statements in the comic, and infer the storyline and re-explain the understood concept after reading the comic.

The characteristic of the development of the comic learning medium of "Unraveling the Mystery of the Batara Kala" is the presentation of the comic that contains local wisdom. The Batara Kala story is one of the local wisdom in the form of mythology and has become a culture in Indonesia. Hence, the combination of the developing myths and culture and learning content can be used to train students'

critical thinking skills in capturing information (Annisa, 2018). These varied advantages make the developed webtoon comic effective in improving critical thinking skills.

Comic as a learning medium has favourable attraction elements, such as the image display and content presentation that are easy to understand; thus, it can motivate students, especially students of junior high school (SMP), to study hard (Risdawati et al., 2014). Nanda & Kustijono (2017) further explain that a learning medium that has attractiveness and that encourages students to read will facilitate the students to train their critical thinking skills.

CONCLUSION

The development of the webtoon comic medium of "Unraveling the Mystery of the Batara Kala" applied in the SMP N 13 Magelang was stated as feasible with a score of 4.15 in the media validation and 4.1 in the content validation. Whereas, the effectiveness level of the learning medium was effective in the moderate category with an N-gain score of 0.63. Moreover, the practicality level of the learning medium was very practical based on the results of teacher and students' responses with a practicality score of 4.75 and 4.35, respectively.

Suggestions offered from the research are regarding the effectiveness level of the learning medium. Based on the effectiveness level of the learning medium in developing critical thinking skills, the development of similar media is expected that can accommodate other basic competencies; thus, it can be a learning media innovation that continues to grow. Referring to the validation results from the experts and teachers in terms of the comic presentation completeness, the authors look forward to follow-up studies that can overcome issues, one of them, being the ability of the comic to completely accommodate indicators containing in the basic competencies.

The researcher recommends the use of the Bataraka Science comics learning media in the face-to-face learning process. Through this application, it is hoped that the effectiveness of improving students' critical thinking skills can be higher.

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