The Effect of Digital Learning of Historical Comics on Students' Critical Thinking Skills

Rini Riris Setyowati*, Saefur Rochmat, and Aman

***Abstract*—Comics provide a visual, inventive, and sequential reading experience for students learning on their own. Both comics and history present narratives in chronological order. Students pay less attention to reading historical literature, requiring them to put more emphasis on their thinking skills. The author intends to determine how historical comic learning affects students' critical thinking skills. This quasi-experimental mixed-method design included pre- and post-tests and interview group. A total of 184 students were divided evenly between two groups, each consisting of N=92 members: a control group and an experimental group. While members of the control group were taught to read textbooks through online instruction, members of the experimental group read historical comics learning media. The N-Gain test showed the treatment group's critical thinking skills was 61.8% (Moderate) and the control group's was 38.2% (Low). The ANOVA findings demonstrated a statistically significant relationship between historical comics learning media and critical thinking skills (F = 49.749; p = 0.000). The results indicate that using historical comics makes reading material more enjoyable, adds intrigue to stories, and improves students' attention. In order to maximize critical thinking students' skills, it is important to pay greater attention to the provision of engaging, interactive, and appropriate learning media.**

***Index Terms*—Comic, critical thinking, history learning, learning media**

I. Introduction

The development of the world of technology demands the birth of design innovations and learning media be continuously updated. New technologies and media are claimed to be the future of running the education system [1]. Educational practitioners need to respond to the shift in the direction of education by presenting variations of design and technology-based learning media in the classroom [2]. Modern technology-based learning media involves multimodal platforms in one medium (audio, visual, text, 3D) [3, 4]. Research on the development of multimodal learning belongs to the category of the instructional field. Several studies on the development and use of digital multimedia platforms have been carried out, including the use of video [5], games [6], animation [7], virtual reality [8], augmented reality [9], and comics [10]. One media favored by teenagers aged 15-19 years is comics [11]. The wave of comic webtoon reading culture contributed to the increase in digital literacy [12, 13]; this condition has increased since the COVID-19 pandemic [14]. Comics are among the most popular media for high school students during online learning [15]. In addition to focusing on technological characteristics, the selection of learning media must also include students' cognitive, affective, and psychomotor aspects.

The learning process in the 21st century demands students with the critical skills to encounter the given situation and implement their knowledge to prevent and solve problems in real life [16]. Elements related to critical thinking skills include; analysis, synthesis, new knowledge, evaluation of new concepts, predictions, and ability to conclude [17]. High critical thinking skills are the basic goal of the main ideals of education [18]. Learning is part of the critical thinking process. The process of crisis thinking can be done when someone analyzes, synthesizes, and evaluates certain situations or phenomena [19]. Therefore, critical thinking involves obtaining accurate and reliable information to take action in solving a problem.

Comics are so close to the lives of young people in the modern era, but their development and use are still limited, especially in history learning [20, 21]. The visual narrative offered by this kind of comic can be used to provide stimulation in various psychological experiments. Sequential comic pictures have been proven to explore students' thinking skills [22, 23]. The presentation of light and entertaining comic narration gives the reader a relaxing effect in exploring the visual imagination [24]. At the same time, a comic reader has a role as a spectator, interpreter, and active agent in constructing various meanings that arise from visual elements [21–25]. The medium-specific approach to comics helps readers to remember them comprehensively [26].

The storytelling system in comics is in line with the chronological flow of history learning materials. Historical and theoretical material can be reduced by visualizing comic images. This composition can certainly be advantageous in conveying historical material in the classroom. Readers, as active agents, when reading comics, have the opportunity to stimulate thinking to think critically about the material presented in comics. The relationship between comics and history has been established mainly through the presentation of superhero stories [27]. References to the development of literacy and students' interest in reading comics are proven to improve the analysis, synthesis, and evaluation of students' understanding of stories [28]. According to research, comics can connect readers with writers so that they can improve a comprehensive critical thinking process [22, 29]. The visual (picture) components of comics as a means of communicating educational content stimulate investigation, which positively affects students' development of critical thinking skills [30–32]. This study aims to package historical

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material in the form of digital comics according to the demands of technological developments as a means of stimulating students' critical thinking skills in responding to learning.

II. Literature Review

A. Comic

Comics can be defined as the art of presenting sequential images [33] that can represent events [34], foster imagination [35], build memories and experiences [36] and provide a touch of humor for readers [24]. Comic represents three essential components: reality, language, and image design [37]. The particular emphasis of comics media is on the creative and interactive aspects of communicating stories [38]. Stories contained in comics are claimed to be able to accommodate in-depth content [39]. Therefore, using comic media can determine the effectiveness of the presentation of information.

The use of comic media in education has many positive impacts. The combination of text and comic images has the potential to make the learning atmosphere more enjoyable [40]. Comics are included in transmedia storytelling because they can package multimodal platforms (visual and textual) in telling learning materials [41, 42]. A concise comic narration with the support of appropriate images can increase students' focus on reading [43]. Comics can also be used as an alternative media that is recommended to help the learning process of students with special needs [44].

B. Critical Thinking Skills

The three highest hierarchical levels typically serve as a representation of critical thinking (CT): analyze, evaluate, and create [45]. In its development, CT is part of thinking activities in understanding arguments, processing, assessing or evaluating, and transmitting information as a reference for problem-solving and understanding experiences and ideas [46, 47]. CT can be seen through an approach related to how to do something (thoughts) or actions arising from a will [48]. The inner incentive of the subject to understand, be aware of, and actively respond to the arguments or material offered drives critical thinking awareness [49]. Thus, the CT drive is related to one's curiosity, the desire to get more in-depth information that allows using logic in finding solutions to problems.

Education is one of the means to train CT skills. Academic motivation significantly affects critical thinking and predicts student development [50]. The skills of CT allows a significant impact on increasing students creativity [19], participation [51], focus, and improving academic performance [52]. Several studies also show that involving students in activities such as simulations, oral or visual presentations, reenactments, and multiple text analyses can increase CT skills [53]. Theoretical materials are advantageous to use in practicing CT skills, such as social materials [54]. Critical thinking skills apply in various contexts, while social relations play an essential role in the assessment process to considering decisions to be made [55].

Two of the most important components of critical thinking skills are the frame of mind and particular mental activities. While learning can be described as linear and hierarchical, if it is dynamic and iterative, especially when critical thinking is engaged, it is more accurately described as dynamic and iterative [56]. The cognitive domains identified by Bloom's taxonomy [57] are: 1) knowledge, 2) comprehension, 3) application), 4) analysis, 5) synthesis, and 6) evaluation. Knowledge in learning is obtained at the most fundamental level, namely through recalling previously acquired information [58]. The level of comprehension directs the steps necessary to comprehend the acquired knowledge, the additional knowledge and understanding proposed to solve problems, followed by solving relevant evidence and not through analysis [59], so that in the final stage an evaluation based on evidence or criteria can be conducted [60]. Based on these indicators, there are suitable indicators for improving students' critical thinking skills in historical material using comic media: 1) remember, 2) understand, 3) analyze, and 4) evaluate.

C. Historical Comic on History Subject and Critical Thinking Skills

World War II saw the widespread development of historical comics through the creation of heroic tales [61]. The skills to generalize, adapt, summarize, and even develop stories makes comics a learning medium that can promise readers an easy understanding of concepts [62]. Using comics as a history lesson is one of the new teaching approaches to explain history visually more dynamically [21]. Comic stories that chronologically benefit the reconstruction of historical narratives so that readers can understand them comprehensively. The similarity of the comic story delivery line with the chronological history allows the reader to focus more on reading and visual observation. Reading comics requires a process of analysis, making judgments, and evaluating the truth of the story's facts that can pique readers' curiosity [63].

Focus on chronological reading comics that involves process of remembering, understanding, analyzing, and evaluating activities in line with critical thinking activities [64]. The ability to think critically is a significant ability that must be possessed in learning social sciences, which consists of cultural, regional, community, and individual studies [65]. Moreover, comics can combine text and images to create the reader's imagination chronologically, dynamically, in the past, present, and even the future, requiring a whole reading process to foster critical thinking skills.

D. Research Hypothesis

In quantitative analysis, it is necessary to formulate hypotheses [66].

H_0 : There is no difference between students' critical thinking who uses historical comics media with students who use textbooks as learning media

H_1 : The critical thinking skills of students who utilize historical comics and those who use textbooks are distinct.

III. Methodology

A. Research Design

Many researchers use parts of both qualitative and quantitative methods (multimethod research) to address differences in how research is thought about and presented

[66]. The experimental design of a quasi-experimental study is concerned with giving treatment or treatment to a subject within a specific time [67]. Through observational studies with randomized controlled trials, two groups can be distinguished and evaluated the treated (experimental) group and the untreated (control) group. In the research and development of this comic, the dependent variable is critical thinking skills, which are divided into two study groups, as indicated in Table I.

TABLE I: QUASI-EXPERIMENTAL DESIGN GROUP

Group		Teaching Learning Media	
Control Group	Pre–Test	Learning media without using Historical Comic	Post–Test
Treatment Group	Post–Test	Learning media with using Historical Comic	Post– Test

B. Sampling Design

The sample in this quasi-experimental group involves at least 80-90% of the population [68]. The research was conducted at a senior high school in Yogyakarta. The study samples are selected by enabling a subset of the population or non-probability samples to serve as representatives [69]. The non-probability sampling technique aims to determine certain abilities, traits, or characteristics in a population [70]. The number of control groups in this study (N = 92) students did learning with textbook media. In the experimental class, as many as (N=92) students did learning with historical comic media.

IV. RESULT AND DISCUSSION

A. Analysis Data Result

Based on the analysis of the influence of the sample demographics through the independent sample t-test, it shows that the gender and age of students do not affect students' critical thinking skills. Table II reveals p-values > 0.05, indicating that gender and age have no effect based on the experimental data demographic characteristics of participants on Table III. The background analysis of students' majors according to the sample t-test did not show any influence on students' critical thinking skills.

TABLE II: RANDOMIZATION TEST RESULTS

	Independent sample t-test	
Main channel	t	sig
Gender	0.287	0.865
Age	0.731	0.512
Background of School	−1.687	0.119

TABLE III: DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

Description	Amount	%
Gender		
-Male	48	26
-Female	136	73.9
Total	184	100
Age		
- < 17 years old	147	79.8
- 17-18 years old	28	15.2
- > 18 years old	9	4.8
Total	100	100

TABLE IV: DESCRIPTIVE STATISTICAL RESULTS

Dependent Variable: Individual Learning Outcomes						
Media	Treatment	Mean	Min	Max	Std. Deviation	N
Textbook	Pre–Test	4.2761	3.3	7.33	0.68772	37
	Post–Test	5.3678	3.3	7.33	1.19118	55
Comic	Pre–Test	5.4241	3.3	8.67	0.97883	45
	Post–Test	6.8259	4.0	8.67	1.28578	47
Total	Textbook	4.8219	3.3	7.33	1.19118	92
	Comic	6.1300	3.3	8.67	1.28578	92
	Total	5.4759	3.3	8.67	1.23848	184

Hypothesis H_1 states that the critical thinking skills of students who use historical comics differ from those of students who use textbooks. An analysis of the variance (ANOVA) test was conducted to check the reliability of the hypothesis. The findings of the ANOVA are presented in Table V. Show that the influence of learning media on students' critical thinking skills is significant (F = 49,749; p = 0.000), with the average critical thinking ability of students in Table IV, namely learning materials using historical comics (6.1300) higher than students' critical thinking skills using textbook learning media (4.8219). The conclusion that hypothesis H_1 is accepted and H_0 is rejected can be drawn from the outcomes of the data analysis and comparisons.

TABLE V: HYPOTHESIS ANOVA TEST RESULT

	Dependent Variable: Critical Thinking Skills				
Source	*Type III Sum of Squares*	*df*	*Mean Square*	*f*	*Sig*
Corrected Model	104.651[a]	3	36.872	33.134	0.000
Intercept	6115.302	1	6115.302	59785.02	0.000
MEDIA	58.178	1	58.178	52.163	0.000
MATERIAL	50.389	1	50.389	49.749	0.000
MEDIA*MATERIAL	1.607	1	1.607	1.581	0.316
Eror	173.856	176	1.126		
Total	6235.518	184			
Corrected Total	323.479	181			

[a] *R Squared = 0.*378 (*Adjusted R Squared= 0.*361)

The n-gain score is used to determine the learning improvement of students. The Mann-Whitney U test was applied as the nonparametric analysis [71]. The following criteria in Table VI are used to come up with a hypothesis [72, 73]:

TABLE VI: MANN-WHITNEY TEST N-GAIN CATEGORY

Range Score	Category
80% < p ≤ 100%	Excellent
60%<p ≤ 80%	High
40% <p ≤ 60%	Moderate
20%<p ≤ 40%	Low
0% ≤ p ≤ 20%	Poor

The experimental class scored 61.8% ≤ 70%, for their N-gain, which places them in the moderate category. In contrast, the N-gain of the control class is 38.2% ≤ 40%, which belongs to a lower category. The N-gain result indicates that the experimental class utilized the comic far more than the control class. The students in the experimental class that use the comics tend to experience a significant improvement in their critical thinking capability compared to those who do not use the same equipment in the control class.

The findings of the N-gain score are presented in Table VII, and the fraction is portrayed in Fig. 1.

TABLE VII: N-GAIN TEST OF CRITICAL THINKING IN THE EXPERIMENTAL CLASS AND CONTROL CLASS RESULT

Class	N-Gain	Criteria
Experimental	61.8	Moderate
Control	38.2	Low

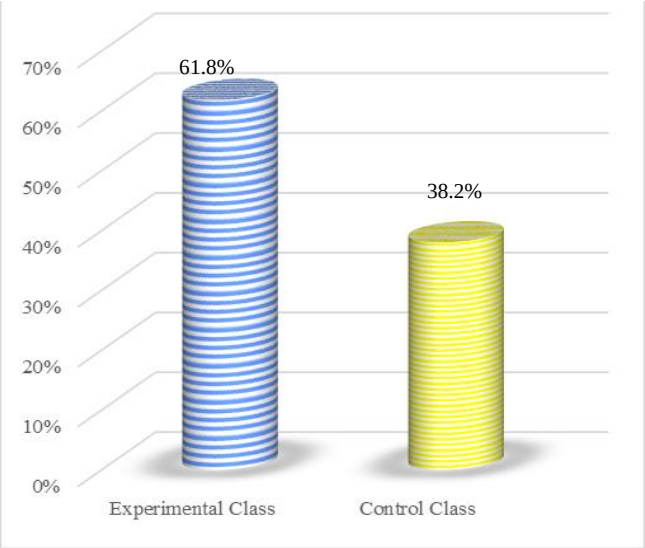

Fig. 1. N-gain experimental and control class.

Fig. 2. Cover historical comic Mataram Kuno Kingdom.

B. Historical Comic Design Result

This historical comic tells the history of Hindu-Buddhist Indonesia about the History of the Ancient Mataram Kingdom. The material about the history of the Ancient Mataram Kingdom is very interesting because the kingdom is still related to the Islamic Mataram Kingdom, which still exists today. This comic illustration can help represent and reconstruct the story of the Mataram kingdom. Due to the lack of visual sources in this material, the comics developed can be an alternative reading for students in class learning. Visual comics that are drawn according to the facts of the royal heritage that still exists today can indirectly train students' critical analytical processes. This comic consists of 17 pages, some of which can be seen in Fig. 2 to Fig. 5.

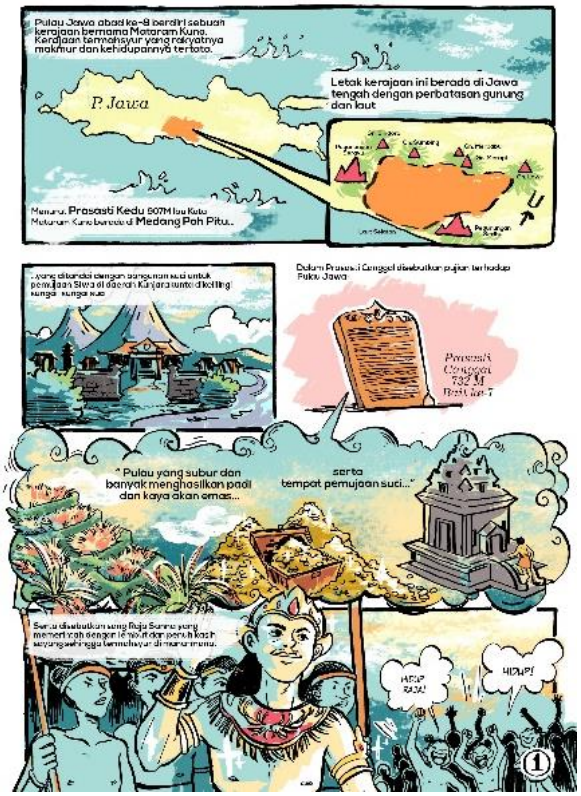

Fig. 3. First page of historical comic Mataram Kuno Kingdom.

Fig. 4. Visualization the condition of war in Mataram Kuno Kingdom.

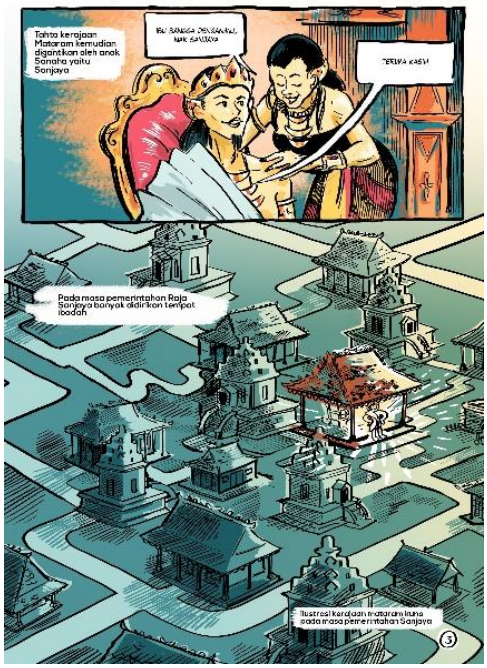

Fig. 5. Visualization live in Mataram Kuno Kingdom.

C. Digital Comic for Critical Thinking Skills

The level of students' critical thinking skills was measured using a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = moderately agree, 4 = agree, 5 = strongly agree). Descriptive analysis of min reading scores used indicators that were divided into three levels, namely low (1.00–2.33), medium (2.33–3.66), and high (3.67–5.10). The following Table VIII shows the result of an analysis of the level of students' critical thinking skills using historical comic learning media.

TABLE VIII: STUDENT'S CRITICAL THINKING SKILLS USING COMICS

Indicator	Item	Mean Score	Category
Remember	Remembering: Reading comic books helps me remember historical events.	4.4211	High
	Remembering: I recall the sequence of events and the names of the characters in the comic.	4.2136	High
Understand	Interpreting: I have the ability to interpret comic books.	4.3309	High
	Classifying: I am capable at classifying historical evidence.	3.3769	Medium
	Summarizing: I can summarize the tale based on what I've learned from reading comic books.	4.2201	High
	Explain: I can retell historical stories chronologically.	4.5108	High
Analyze	Distinguish: I can tell the difference between historical facts and myths.	4.4734	High
	Attributing: I comprehend the characters and actions of historical figures in comic books.	4.2640	High
Evaluate	Checking: Using historical comics, I am able to determine the sequence of events as they transpired.	4.4302	High
	Criticism: I can provide criticism on comic book stories based on historical evidence I can discover today.	3.0769	Medium

All respondents gave high marks for all items based on the average score. In history learning, students who use comic media have a critical thinking skills level in the medium to high category. The highest item is on an "understanding" indicator (4.5108). Comic media can help students to re-explain historical events chronologically. This condition is a positive impact on understanding knowledge due to the increased long-term memory of students' memory.In comparison, the lowest average is in the "evaluation" item (3.0769) in criticizing historical facts with historical evidence found in the surrounding environment. The level of critical thinking on evaluation items in the category can be understood because students have never done direct learning at the location of historical heritage evidence. So that students' understanding of the evidence of historical heritage around their environment is limited.

The results of this study indicate that historical comic media can influence students' critical thinking levels on four important indicators: remember, understand, analyze, and evaluate. The special difference found in research on the impact of comic media on learning history is the level of students' critical thinking skills, which are influenced by chronological thinking skills. The ability to think chronologically is needed in history to build a comprehensive logic of thinking and understanding of the material. In addition, indicators of students' critical thinking skills are part of the process of chronological thinking in history, characterized by the ability to remember sequentially. Comics with a sequential presentation of images support the delivery requirements for chronological historical material and indicators of critical thinking skills.

V. CONCLUSION

Based on the literature studies, data analysis, and discussion above, the implementation of the Ancient Mataram Kingdom's historical comic can affect the students' critical thinking ability. The visuals in the comic can stimulate the student on how they depicted the condition of the Ancient Mataram Kingdom in its current era. Considering critical thinking is seen as the best way to solve society's problems, handle unexpected situations, make tough decisions, and think critically about multiple issues, teaching it using digital comics on history subject has garnered attention.

Implementing the historical comic of the Ancient Mataram Kingdom towards the students' CT skills has received a positive response both from the students and the teacher. Using historical comic media on students' critical thinking skills improves their CT skills to remember, understand, analyze, and evaluate historical learning content chronologically. Therefore, the media the writer develops become an alternative to conducting a learning session in a class. The writer hopes that the existence of this media will help the teacher to accomplish the teaching objectives.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Rini Riris Setyowati contributed to establishing the research title, producing the plot, and leading the design team to visualize according to the material analysis results. Saefur Rochmat's role is to conduct reviews related to the theoretical framework, comic analysis, and discussion. It is safe to process statistical data, review articles, and add conclusions. All authors had approved the final version.

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