

## CONTENT ANALYSIS OF EDUCATIONAL COMIC STRIPS ABOUT SOCIO-SCIENTIFIC ISSUES: A CASE IN NORTH KALIMANTAN, INDONESIA

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**Abstract.** This study aims to investigate fifteen comic strips due to training activities conducted in North Kalimantan. The investigation was carried out through content analysis based on comic formats and socio-scientific issues in comic strips. The fifteen comics analysed are based on the comic format, which refers to the single gag or continuous strip style. Meanwhile, topics are grouped based on science disciplines. The findings imply that teachers prefer to develop single gag style comics rather than continuous strips. For topics, the majority of teachers prefer issues related to environmental science.

**Keywords.** Comic Strips; Content Analysis; Socio-scientific Issues

### A. INTRODUCTION

Comics as a media product have become a topic of serious investigation both in their use as entertainment media, social criticism, and education. Historically, investigations of comics from various aspects have been carried out since the early 1950s (Barshay, 1974; Spiegelman et al., 1953; Young, 1969); even nowadays, this is still a very potential topic to investigate (Laubrock & Dunst, 2020; Mameli et al., 2022).

In the past, many researchers analysed comics to interpret various comic representations. For example, Kasen (1979) studied the socio-economic conditions of the lower middle class in America. Another study by Kramer (1974) analysed the stereotypical sex of women in comics published in that era. Palmer (1979) also analysed comics for pornographic content. Even now, content analysis for interpreting comics is increasingly widespread, such as analysis of aspects of local wisdom (Ramadhan et al., 2019) and cross-cultural analysis of situational changes (Klomberg et al., 2022).

The development of content analysis in comics also needs to be conducted on specific comics with educational content. Educational comics in Indonesia have been widely developed by undergraduate students, graduate students, teachers and lecturers (Lesmono et al., 2018; Lubis, 2018; Ramadhan et al., 2019; Saputra & Pasha, 2021). Even specifically, content related to socioscientific issues in comics has also been developed by researchers (Aisyah et al., 2017; Sukri et al., 2020; Syarah et al., 2019). Socio-scientific issues can be interpreted as social issues that are controversial in society and related to science (Zeidler & Nichols, 2009). In contrast to the many comics that have been developed, there are still very few studies that analysed the content of comics related to socio-scientific issues, especially in comic strips. It is a gap that is answered in this study. We started with some comics developed by teachers in elementary and junior high schools in North Kalimantan.

This article explores a science comic strip with socio-scientific content developed by a teacher in North Kalimantan. In general, this article will discuss the design of educational comic

strips developed by the teacher based on the comic strip style. Furthermore, content analysis was also carried out to see the topic of socio-scientific issues in comic strips.

## B. METHODS

### 1. Sample

The comic strips used in this study were fifteen comic strips resulting from the training activities carried out by the first author. The training was called “Learning Technology Training: Blended Learning for Teachers”, and the first author conducted training on developing comic strips using a comic generator website. After training in making comics, the first author deepens the material to create content and illustrations independently of the teacher. The first author in this research also acts as an illustrator who revisualised the comic sketches that the teacher has developed so that the images have good quality (pixels and colouring). The comic strip consists of 1–3 panels containing content related to socio-scientific issues.

### 2. Procedure

The authors examined the fifteen comic strips used in this study to see the representation of the comics on the topic of socio-scientific issues. There are two aspects analysed in this research, namely: comic format and the topic of socio-scientific issues. The content analysis of these two aspects will be coded nominally (Neuendorf, 2018).

### 3. Categorisation

The first aspect of the analysis was the comic strip format. The comic strip format is divided into the single gag panel and the continuous strip style (Lefèvre, 2009). The single gag panel is a comic strip that only consists of 1 panel. Meanwhile, the continuous strip has two or more panels.

Next, the second aspect that is analysed is the topic of socio-scientific issues. Topics raised as socio-scientific issues are generally related to science. Therefore the coding will refer more to the leanings of certain disciplines (e.g. environmental science, genetics, fisheries). After that, the sub-code will be further detailed in the topics to be more specific (e.g., air pollution, genetically modified organisms, illegal fishing). This grouping of topics and subtopics refers to several examples from previous studies (Sadler & Zeidler, 2005; Zeidler & Sadler, 2007).

Table 1. Topics description in sosio-scientific issues

Categories by topics	Description
Genetics	This issue group is related to genetic engineering, a debatable issue that is developing in society.
Fisheries	This issue is related to the impact of problems in fisheries, especially concerning the reduced biodiversity diversity and fishermen's socio-economic problems.
Environmental Science	The scope of this issue is quite broad and related to biotic and abiotic, including pollution, global warming, and the threat of extinction of flora and fauna.
Health	Issue groups include social phenomena related to health that are debated in society.
Food Science	Food science issues include the study of nutrition, sociocultural studies of people about food, and the latest trends in food issues.

### 4. Triangulation of Data

Triangulation of data in this study used interviews with teachers to determine the teacher's background in selecting the topic of socio-scientific issues in the developed comics.

## C. RESULT & DISCUSSION

### 1. Comic strip style

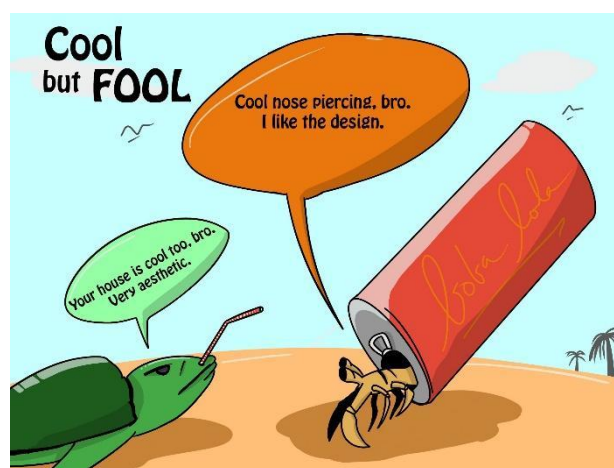
Table 2 shows the frequency of comic strip styles developed by teachers in North Kalimantan. A brief description of the comic strip style used is described in the section below.

*Single gag panels.* This style is a comic strip format that generally consists of one image in one panel or several parts of the image but still in one panel. An example of a single gag panel that contains one picture of one panel in a comic developed by the teacher is the comic with the title *Cool but Fool*, which describes the impact of pollution from non-biodegradable waste on coastal biodiversity (Figure 1). Meanwhile, the single gag panel with several parts of the image in 1 panel in the comic with the title *Sweet potato is the key to food security* describes the use of sweet potato as an alternative to rice (Figure 2).

*Continuous strips.* This style usually has two or more panels. Each panel contains a sequential story. Generally, it contains a short dialogue between the characters in the comic. For example, in the comic strip, *Can Mammoths ever exist again?* tells about genetics using a continuous strip with 3 panels containing sequential stories between panels (Figure 3).

Table 1. Frequencies of comic style

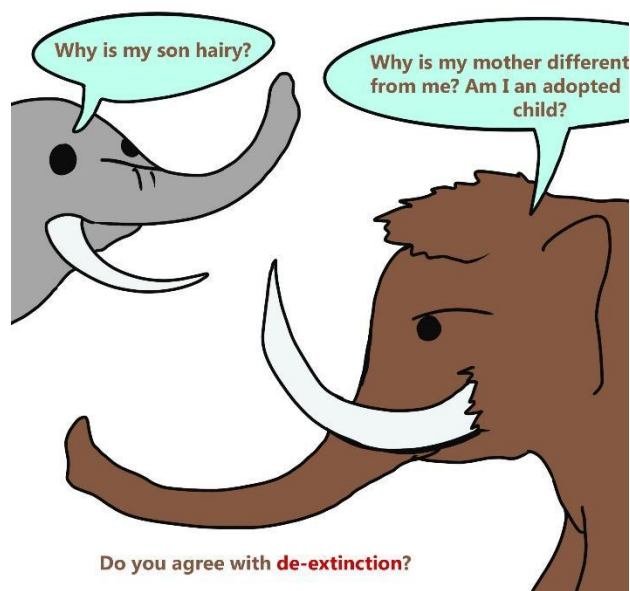
Comic strip style		Frequencies
Single gag panel	One picture one panel	7
	Several pictures one panel	5
Continuous strip		3



**Figure 1.** Cool but Fool, single gag style (one picture in one panel) (Source: Researchers' Personal Document)



**Figure 2.** Sweet potato is the key to food security, single gag style (several image in one panel)  
(Source : Researchers' Personal Document)



**Figure 3.** Can Mammoths ever exist again? continuous strips style (Source: Researchers' Personal Document)

## 2. Socio-scientific issues topics

The topics of socio-scientific issues chosen by the teachers were varied; in total, five major topics were chosen. From the five topics, they were reduced to subtopics. The topics chosen by the teacher in comic strips are shown in Table 3. Based on the table, the topics in comic strips are mostly about environmental science (7 comics), with details on the sub-topics of coastal pollution 4 comics, global warming 2 comics and endangered animals 1 comic. The next topic was genetics with 3 comics and followed by the topic of health and food science (2 comics each). The last topic is fisheries, as much as 1 comic. The description of each topic is explained in the next paragraph.

*Genetics.* Issues in genetics are debatable in public. For example, the comic *Choose cheap GMOs or expensive organics?* is one of the issues that raises the phenomenon of genetically modified food is cheaper than organic food (Figure 4). Several studies have raised this issue (Chestnut, 2014; Taheri et al., 2017). The impact of this certainly leads people to prefer cheaper Genetically Modified Organisms (GMOs). The thing that the teacher wants to highlight is actually whether the cheapness

of GMOs will have an impact on our health. Although several studies have described this as a myth (Barak et al., 2010; Rodríguez et al., 2022), this issue is quite interesting to be raised in a comic. The next subtopic selected was genetics engineering on the de-extinction of resurrecting Mammoths (Figure 3). De-extinction is the process of reviving an extinct species (Martinelli et al., 2014). This issue is *hot* in the fields of genetics, evolution, and biotechnology. The teacher chose this topic to introduce new studies in the genetics field and related to its ethics.

Table 2. Socio-scientific issues topic in comic strips

No	Topics	Sub-topics	Frequencies
1	Genetics	GMO	2
		Genetics Engineering	1
2	Fisheries	Illegal fishing	1
3	Environmental Science	Coastal Pollution	4
		Global Warming	2
		Endangered animals	1
4	Health	COVID-19	2
5	Food Science	Food security	1
		Junk Food	1



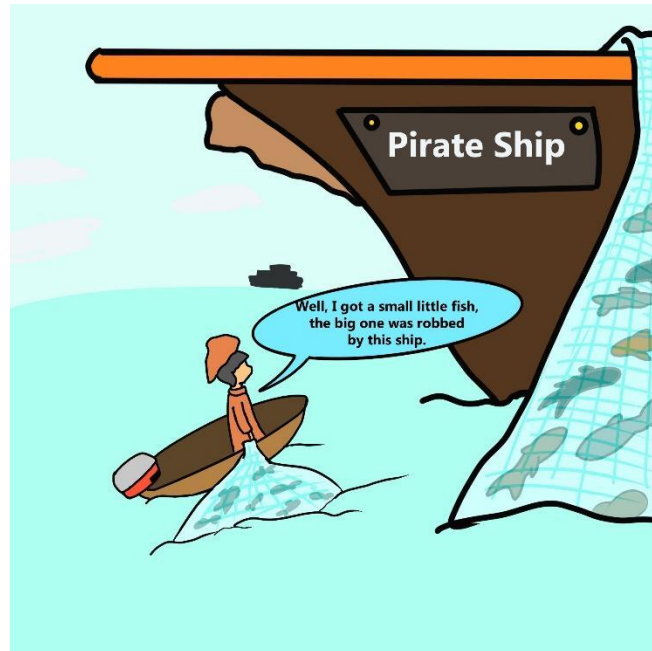
**Figure 4.** Choose cheap GMOs or expensive organics, a comic about genetics (Source: Researchers' Personal Document)

*Fisheries.* In recent years, the most booming issue related to fisheries in Indonesia has been illegal fishing (Chapsos & Hamilton, 2019; Febriyanto & Setiaji, 2022; Jaelani, 2014). The teachers chose this topic to raise the topic of reduced aquatic fauna biodiversity and its economic impact on local fishermen. In Figure 5, it can be seen that the comic contrasts the comparison of fish caught between large illegal boats and local fishermen who only use simple equipment.

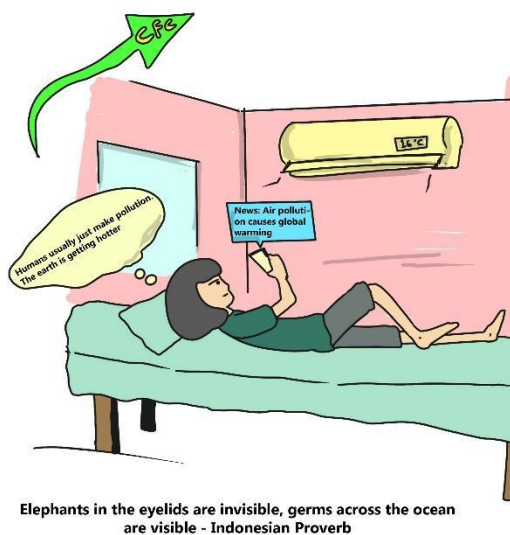
*Environmental science.* Seven comics carry this topic with various issues: coastal pollution, global warming, and endangered animals. The topic related to coastal pollution has been described in the comic "Cool but Fool" (Figure 1). The comic represents the impact of garbage on the coast in the form of satire. In the comic, Hermit Crab uses used cans as a house, and turtles whose noses are pricked because of plastic straws are common due to garbage in coastal areas (Grijseels, 2020; Haziqah, 2020). The next topic is related to global warming; one comic also carries a satire style related to this in Figure 6a, where a teenager comments on posts related to air pollution as a result of global warming and complains that the world is getting hotter. Even in the comic, s/he uses an Air Conditioner, which is the main cause of global warming (di Filippo et al., 2022; Sand et al.,



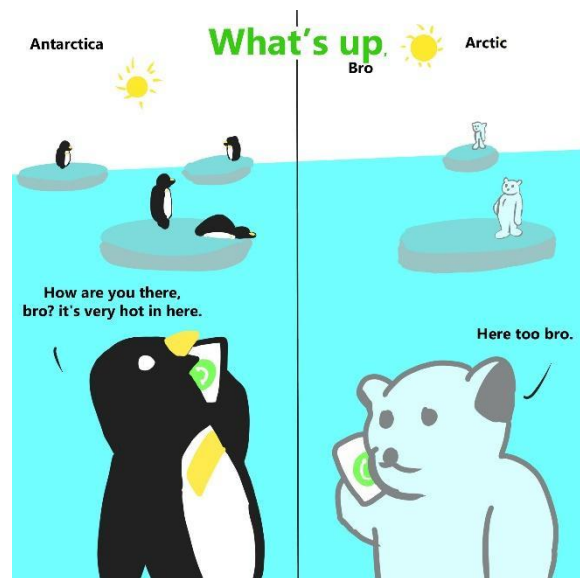
1997). There is also a similar comic with the theme of global warming, which is quite interesting, namely “What’s up, Bro”, which is also a satirical theme that tells the impact of global warming on the Arctic and Antarctic (Figure 6b). The last topic in environmental science is related to endangered animals, where the comic “Save Me” describes the White Rhino poaching that only leaves a few numbers in the world (Figure 7). The teacher chose the subject of the Northern White Rhinoceros (*Ceratotherium simum cottoni*) because it is one of the only 4 rhinos left in the world due to poaching (CNN Indonesia, 2021).



**Figure 5.** Untitled Comic strip represents illegal fishing (Source: Researchers’ Personal Document)



**A**



**b**

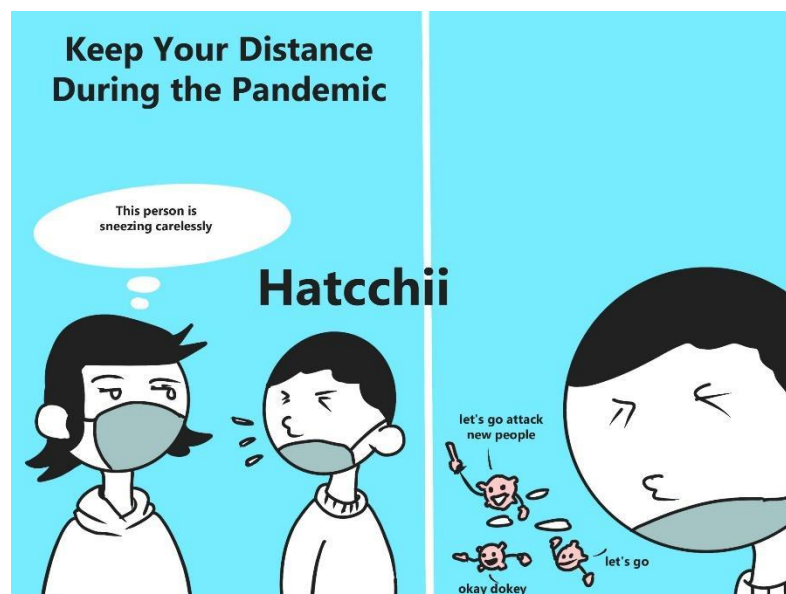
**Figure 6.** Comic strips represent global Warming (Source: Researchers’ Personal Document)

**Health.** Health issues have been the most discussed recently due to the COVID-19 pandemic (Daniel, 2020; Pokhrel & Chhetri, 2021). Two comics carry this topic. One example is the comic in Figure 8. Comics on health issues that are developed are usually in the form of health promotions or invitations to avoid the spread of COVID-19. Comics also present phenomena that often occur in society regarding the lack of awareness of using masks and social distancing problems.

*Food Science.* There are 2 sub-topics related to food science that the teacher chose in the comics that were developed. The first sub-topic is related to food security. This issue has become popular in Indonesia because of the lack of a variety of staple foods consumed by the community (Timmer, 2004), and people consume more rice (Arif et al., 2020; Hadiprayitno, 2010). In Figure 2, it can be seen that the teacher wants to promote a food substitute for rice which is also rich in carbohydrates, namely sweet potatoes. The next topic chosen is the problem of junk food which is more liked by the public (Figure 9). Consumption of junk food, especially among young children in Indonesia, is an issue that causes obesity at an early age (Nurwanti et al., 2016). The teacher chose this to describe a phenomenon in big cities where children feel junk food is more delicious than home-cooked food.



**Figure 7.** Save Me, comics about an endangered animal (Source: Researchers' Personal Document)



**Figure 8.** Keep Your Distance During the Pandemic, comic strips about health promotion during a pandemic (Source: Researchers' Personal Document)



**Figure 9.** Comic strip represents issues in food science (Source: Researchers' Personal Document)

### 3. Discussion

Conducting comic strip development training with socio-scientific issues is challenging because guiding teachers to find debatable issues also needs to adjust to the curriculum. For example, in the training process, the first author tried to familiarize teachers with comic format through comic generator websites such as *Pixton* ([www.pixton.com](http://www.pixton.com)) and *Canva* ([www.canva.com](http://www.canva.com)). The most challenging part is transitioning from using a comic generator to independently creating illustrations. Teachers still do not have adequate skills in the illustration process, especially in digital illustrations. In this case, the first author helped revise the teacher's draft into a digital format for the next teacher to provide narration on digital images. For example, draft drawings and drawing revisualisation are shown in Figure 10.

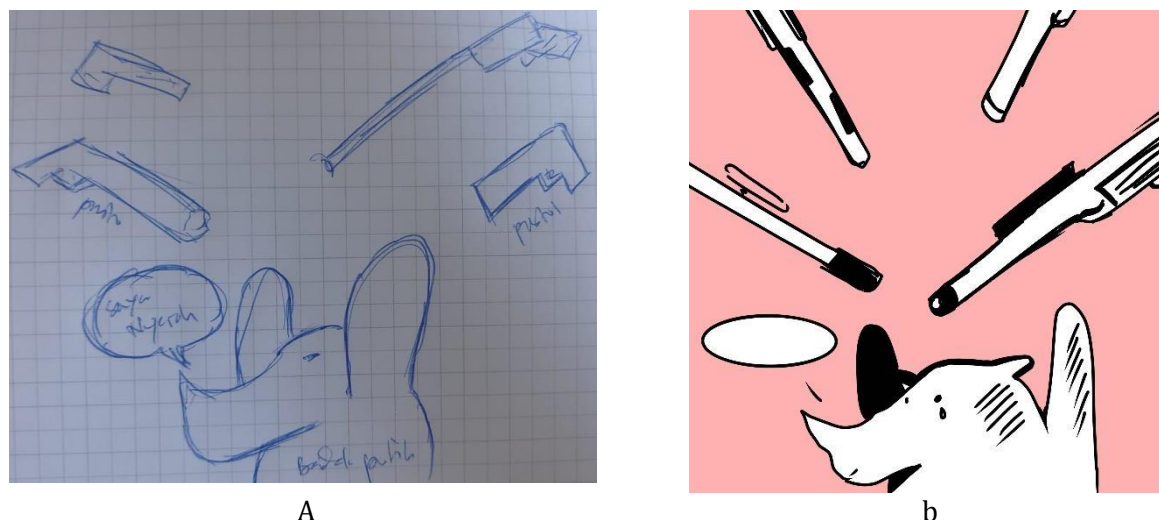
The interesting thing that became the finding in the analysis of this comic is that teachers prefer to develop a single gag style rather than continuous strips. Based on the results of interviews conducted with their teachers, they think a single gag is easier. Teachers said they only need to simply represent something to create this style. In contrast, continuous strips require a storyline, and they think it is more difficult. The following are some transcripts from teachers stating their difficulties in making storylines (names in these transcripts are pseudonyms):

**Mawar:** *making a one-panel comic with one picture is fairly difficult because we need to depict complex issues in a simple picture. However, I can still do this, and I get much inspiration from the billboards on the side of the road. However, creating multiple panels is more challenging because I need to make a storyline. This is my weakness. That is why I prefer comics with one panel.*

**Melati:** *I see one-panel comics like making posters. I need to see more posters to get some inspiration. Moreover, in my opinion, this is easier than making comics with many panels because we need to create a sequence connecting one panel to another.*



The interview results indicate that the problem in making comics for teachers is not the concept but how to package the concept in a continuous storyline. The storyline in comics is an important part because the storyline is very influential on the delivery of content and messages in comics (Amresh et al., 2015; Hill, 2020). In addition, in several studies that look at the quality of educational comics, the storyline is the part that is most highlighted and criticised (Murti, 2020; Syaflita et al., 2022; Tsai, 2017)..



**Figure 10.** Image revisualisation process. a) sketch draft; b) final image (Source: Researchers' Personal Document)

The teacher's consideration of choosing the single gag style is reasonable because the teachers are still beginners in developing this media. However, using a single gag needs to be rethought because this kind of comic needs interpretation from students. For example, in Figure 1, because this comic uses a satirical style, it is necessary for students first to analyze the meaning of this comic. However, several single gags are described quite clearly (Figure 2), and most of the single gags developed by the teacher need to be interpreted. Another risk in developing a single gag is misrepresentation. Not only in single-gag comics, but even some comic books with many pages are sometimes misrepresented (Cobo, 2020). The impact of misrepresentation is a misinterpretation, so the use of comics is not optimal in class.

Regarding the variety of topics on socio-scientific issues, teachers have chosen various topics. Most of the topics are related to the environment. There is one thing that we highlight in choosing a topic. Some topics are sometimes less familiar because they are still "new" to the science learning content in Indonesia. For example, Figure 3 describes the de-extinction Mammoth. This concept is still very new; even some researchers are still trying to introduce it to the public to reduce debate about de-extinction (Katz, 2022; Valdez et al., 2019). Although in junior high school, the basic concepts of genetics have been taught, the use of this example is still too complex to teach because it is also indirectly related to biotechnology and evolution. However, we applaud the teacher for trying to introduce new things to students by providing up-to-date topics related to the implementation of genetics.

#### D. CONCLUSION

The content analysis results related to the format and topic of socio-scientific issues in comic strips, and it was concluded that the tendency of teachers to prefer single gag style (n=12) over continuous strip style (n=3). The teacher's preference for single gag is based on their lack of experience in making storylines in comics. Based on the topic, the majority of the teachers chose issues about environmental science (n=7). Overall, there are 5 major topics chosen by the teacher: genetics, fisheries, environmental science, health, and food science.

This study has many limitations because it only focuses on teachers in North Kalimantan. In addition, this study only investigates the comic format based on the socio-scientific style and topic of the issue, even though several things can be developed further, such as looking at the issue's complexity, the suitability of issues in curriculum, and other aspects.

In this study, we found several things that might be applied in future research. First, there is a need for training in making storyline frameworks for teachers so that the comic strips are more varied. Second, comics that have been developed need to be tested on students to see if comics are feasible to use in the learning process.

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