

# Designer's log in planning the development of comics with socioscientific issues content: Case studies

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**Abstract:** The development of learning media research evolves rapidly in design-based research (DBR). However, most of the research in this area concentrated on media implementation and media format. In this paper, we explain one side rarely discussed: the process of designing media pre-implementation. This research uses the designer's log as core data that notes the essential things during the discussion between media designers and practitioners. This study depicts two case studies when researchers (as media designers) and teachers (as practitioners) were developing comics with socioscientific issues (SSI) content. This research employed a case studies approach, using the designer's log in three meetings with teachers. The data analysis of the designer's log focused on three criteria: analysis, comics-building, and teaching activities development. The main themes identified as results in this study were the student experience in comics, previous content related to SSI, comics form, SSI content in comics, and classroom activities. This study also presented designer log examples highlighting our discussion with teachers to explain teachers' consideration in designing comics with SSI content. From this study, we offer recommendations, especially regarding DBR. Firstly, future researchers need to be aware not only of the final DBR product but also of the product design process; secondly, in preparing media (in this paper, comics), determining content needs to be considered together between designers and teachers from student conditions, culture, and school background.

**Keywords:** comics; design-based research; designer's log; learning media; socioscientific issues

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## 1. Introduction

Learning media development research in design-based research (DBR) has been widespread in recent decades (Ada, 2018; Hoadley & Campos, 2022). Most studies on media development in the DBR context concentrate on maturing learning media intervention (Huang, 2022; Oppl et al., 2022; Tinoca et al., 2022). Based on the trend, most previous studies in DBR only emphasize the results of applying media in each cycle or final product (Valverde-Berrococo et al., 2020). It resulted in a gap visible in the pre-implementation media design process. This gap prompted us to conduct the study in this paper, which focuses on the media design process.

The concept of a designer's log (Power, 2009), which functions as a note from designers (in this context, we as media designers), needs to be explored in depth. It is because designer's logs contain important notes from designers during discussions with practitioners (in the context of this study, teachers) before carrying out interventions in the classroom. All of these notes contain important things related to the reasons for the media design scheme being developed. It can bring new insights into DBR research on how media is designed before being implemented in the classroom.

This paper highlights examples of the discussions of media designers and teachers in developing comics with socioscientific issues (SSI) content for elementary schools. SSI includes social issues related to the science field (Zeidler, 2014; Zeidler & Nichols, 2009). The designer's log provides an overview of how comics with SSI content are designed for students in elementary school. This study describes media designers' and teachers' perspectives throughout the discussion process in completing the comic prototype.

SSI is still relatively new approach for students in elementary school, and previous studies rarely discuss this topic (Gormley et al., 2019; Kahn, 2021; Ozden, 2020). Several studies report challenges in implementing SSI in elementary schools. For example, Ozden (2020) reports that elementary school students rarely use logical reasoning and use more intuitive reasoning. Kahn (2021) reports that the main challenge in implementation is that students struggle to transition from emotional to cognitive arguments related to socioscientific issues. In another study, Gormley et al. (2019) recommend awareness in selecting SSI content and media that emphasizes relevance to students' daily lives.

Responding to these challenges, our approach is to choose media and content appropriate to the context of elementary school students. In the use of media, usually for elementary schools, most media is a combination of visuals and text, one of which is comics (Farinella, 2018), where comics have been widely used in many previous studies as interventions in the classroom (Hermita et al., 2020; Riwanto & Budiarti, 2020). Apart from that, the selection of SSI content is based on collaborative discussions between media designers and teachers. This designer's log chronicles the media design process and explains the complex steps in designing media content. Specifically, it outlines how selected SSI content aligns with the curriculum and individual student characteristics in the classroom environment. Therefore, this paper details the mechanisms of comics design and covers the process of developing SSI-related content for educational purposes. This paper offers these details as novelties, where this study not only presents innovative comic content in the context of SSI but also describes how comic prototypes are discussed and developed, which is rarely highlighted in previous design-based research studies.

The main objective of this paper is to depict the insight from the discussion between designers and practitioners in the designer's log as part of data collection in DBR. We describe two examples of our case studies with Indonesian teachers. This paper also provides an overview of how the curriculum and student characteristics influence media development. We hope this paper can contribute to other research related to DBR by illustrating important insights into the pre-implementation media design stage, which still needs to be explored in further study.

## 2. Materials and Methods

### 2.1 Context of Study

This study is part of the construction stage of our long-term design-based research (Akker et al., 2006), conducted with teachers in Indonesia. It highlights the role of the designer's log as a result of collaboration between designers and practitioners in developing comics design and content. In this study, our role is designers, and the teachers' role is practitioners. Designers are tasked with developing stories and visualizing comics. Meanwhile, practitioners are idea conceptors who determine the content in comics.

### 2.2 Designer's log in case studies

Designer's log in this study refers to our notes as designers recording important things during the discussion process with the teacher (Power, 2009). These notes include insights obtained from teachers for developing comic prototypes. Using a case study approach (Yin, 2003, 2009) as our methodological foundation, we dive deep into every important note in the designer's log. According to Yin (2003), the case study context comprises three principles: exploration, description, and explanation. This study focuses on descriptive principles, emphasizing narrative and descriptive explanations with the teacher during the meeting process.

### 2.3 Participants

In this study, five teachers participated in the DBR that we conducted. Two teachers are from East Java, and three are from North Kalimantan, Indonesia. However, in this paper, for the sake of depth of discussion, we chose two teachers as case studies. These two teachers come from different geographical locations, teach at different grades, and

have different teaching experiences. The first teacher (pseudonym: Ixora) is a teacher from North Kalimantan, has three years of teaching experience, and teaches in grade 5 of an elementary school. The second teacher (pseudonym: Verbena) is an East Java teacher with eighteen years of teaching experience and teaches grade 4 elementary school. Table 1 summarizes the data from the two teachers. Apart from that, these two teachers have different academic backgrounds. Ixora has a bachelor's degree in biology education, and Verbena has a bachelor's degree in elementary school teacher education.

Table 1. Teacher participants

Name (Pseudonym)	Origin	Grade	Experience (in years)	Educational background
Ixora	North Kalimantan	5 <sup>th</sup>	3 years	Biology Education degree
Verbena	East Java	4 <sup>th</sup>	18 years	Elementary school teacher education degree

2.4 Data Collection

Data collection centered on a series of meetings we had with teachers. Each teacher participated in 3 discussion meetings, each lasting 30-45 minutes. We refer to Power's (2009) book *A Designer's Logs: Case Studies in Instructional Design* for the designer's log recording. Power has six criteria for the designer's log. However, we focus on three criteria because this study concentrates on how design and content are developed in comics with SSI content. Criteria include analysis, comics-building, and development of teaching activities. The analysis consists of students' experiences using comics and SSI-related content introduced in class. Comics-building is a detailed plan for the comic design process regarding format and content. Lastly, the developing teaching activities contain plans for how comics will be used in classroom learning activities.

Table 2. Main questions in meetings

Criteria	Questions
Analysis	<ul style="list-style-type: none"> <li>- Have you previously incorporated comic-based learning materials in your classroom teaching or witnessed your students using such resources?</li> <li>- Have you introduced educational content encompassing socioscientific issues to your students during your teaching sessions?</li> </ul>
Comics-building	<ul style="list-style-type: none"> <li>- When envisioning the design of comics tailored for your classroom, what specific format or style of comics are you inclined towards utilizing?</li> <li>- Could you elaborate on the socioscientific issue content you envision integrating into the comic material you intend to use?</li> </ul>
Teaching activities development	<ul style="list-style-type: none"> <li>- In what specific aspects of your teaching curriculum or lesson plans do you foresee integrating comics as a learning tool in your classroom?</li> </ul>

The meetings were carried out via the Zoom meeting platform using Indonesian. The teachers were asked several main questions in Table 2 during the meetings. These questions refer to the three main criteria in the designer's log. The core questions were broken down into several prompt questions to further comprehend the teacher's perspective.

### 2.5. Data Analysis

Data analysis of the designer's log utilized the thematic analysis (Neuendorf, 2019). The designer's log is a transcript of the summary discussion results, where each note was analyzed for codes. Similar codes are then collected into a theme. To ensure the reliability of the thematic analysis results, we were also assisted by an external coder who helped us to identify the coding of the designer's log.

### 3. Results

This section describes the thematic analysis results in the designer's log, depicted in Figure 1. Themes are grouped into three categories based on three main criteria in the designer's log: analysis, comics-building, and development of learning activities. In the analysis criteria, two main themes are students' previous experiences using comics and previous content related to SSI. The theme group in the comics-building criteria consists of comics forms and SSI content in comics. Finally, the criteria for developing learning activities consist of only one theme: classroom activities.

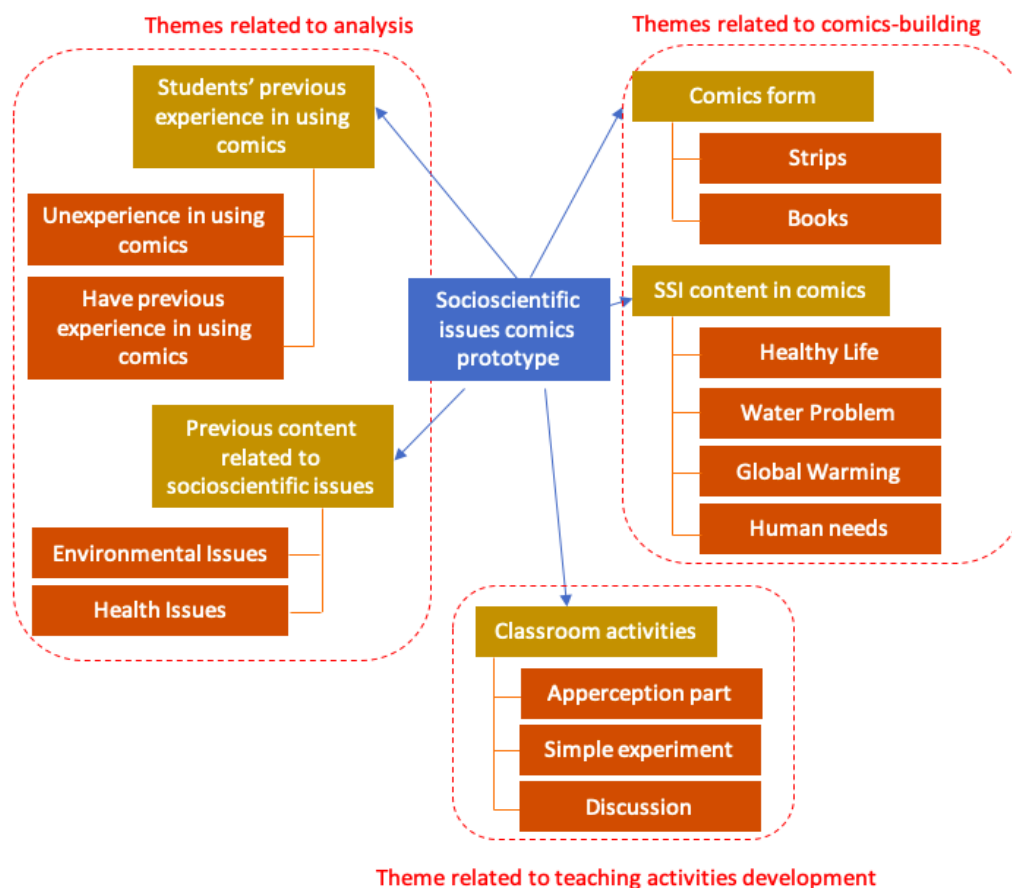


Figure 1. Themes (brown box) and codes (orange box) from the designer's log

For themes in the criteria analysis, the first theme about students' previous experience using comics has two codes highlighting students' experiences. The first code is "in-experienced in using comics," and the second is "having previous experience using comics." The second theme related to previous content related to SSI refers to previous learning content introduced by the teacher, whether there is anything associated with SSI. From this theme, two codes describe SSI topics teachers have introduced in class: environmental and health issues.

In themes related to comics building, the theme covers two essential themes, namely comics forms and SSI content in comics. Comics forms refer to what comic forms the teacher plans to use in class. Meanwhile, SSI content in comics refers to the SSI content the

teacher chooses to develop in the comic. For comic forms, teachers choose two forms of comics: comic strips (consisting of several panels) and comic books (covering many panels on several pages). Furthermore, for SSI content, the teacher plans to use four topics: healthy life, water problems, global warming, and human needs.

The theme related to the development of learning activities only consists of one theme, namely classroom activities. In this theme, three codes consist of activities teachers want to use in comics implementation: apperception, simple experiment, and discussion.

The following sub-sections elaborate on mapping codes and themes from our designer's log. These sub-sections explain the insights gained through discussions with teachers regarding planning and designing comics with SSI content. We highlighted several essential things from the designer's log during the meeting.

### 3.1 Case 1: Designer's log based on discussion with Ixora

This section portrays the study case extracted from the designer's log during the discussion with Ixora. At the first meeting, our discussion revolved around students' experiences using comics and learning content related to SSI that had been introduced in Ixora's class. As an illustration, in Figure 2, we provide an instance of a designer's log in Indonesian, and for the English translation, we place it next to it. We highlight some essential parts in yellow, which act as codes. At the first meeting, based on discussions with Ixora, she stated that her students had no previous experience in using comics, and she thought it might be necessary to adapt the students first to comics.

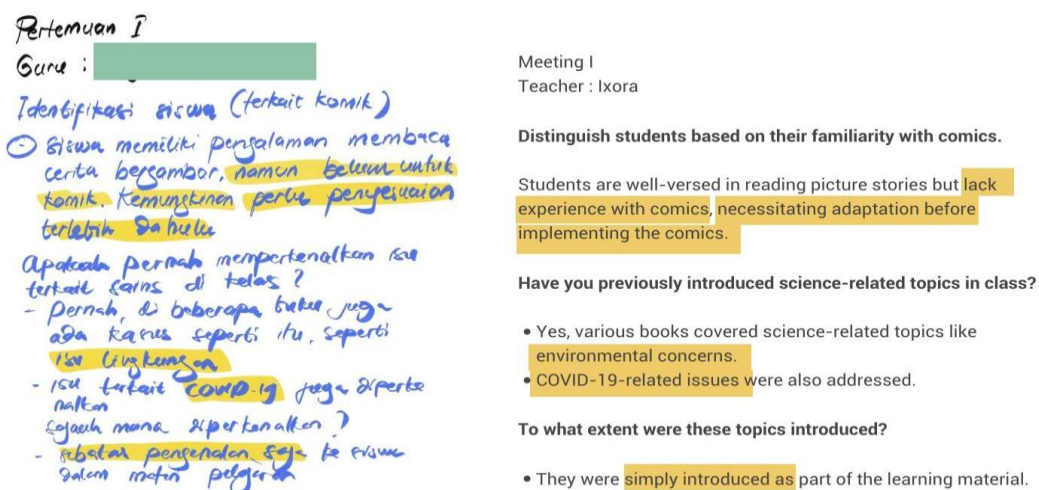


Figure 2. Designer's log of the first meeting with Ixora

Furthermore, in the same meeting, SSI-related content introduced to students in the class was also discussed. Based on information obtained from Ixora, two topics related to SSI have been introduced. The first topic is a topic related to environmental issues. Furthermore, topics related to health issues surrounding COVID-19 were also introduced to students.

At the second meeting, the discussion concentrated on the comic design plan, see Figure 3. Ixora preferred to develop comics with a small number of panels in the form of comic strips. It is based on the consideration that students need to gain experience using comics. She plans to use two comic strips in two different meeting lessons. The topics raised are related to healthy lifestyle. After students get used to comics, Ixora planned to use comics with more panels, like a comic book. The topic planned to be raised in the comic is water-related, which will be used in three meetings. From this design, considering student experiences influences teacher considerations in developing media.

**Pertemuan I**

Perencanaan untuk komik

- Mungkin uji coba dulu ada topik pertama terkait "Hidup Sehat", mungkin bisa diperkenalkan dengan komik satu panel di bagian awal. Bisa difokuskan untuk 2 meeting. Meeting kedua mungkin panel ditambah kalau sudah terbiasa, kita bisa fokus membuat komik tentang "Air" dalam 3 pertemuan

Meeting II

Planning for comics development

- Consider a trial to adapt to the comics before actual implementation. The "Healthy lifestyle" topic could be introduced using a one-panel comic, explicitly targeting the initial part of learning [the apperception section]. It could be the focus across two meetings. Subsequently, the second meeting might incorporate an additional panel.
- If the students become comfortable with it, we can strategize to develop a comic [comic book] centered around water topics in three meetings.

Figure 3. Designer's log of the second meeting with Ixora

The third meeting centered on designing illustrations for comics (Figure 4). Of the three types of comics planned by Ixora, there are three comics consisting of two comic strips and one comic book. The first comic strips contain topics about healthy lifestyles, telling about two activities of small children. The first child is a child who likes sports, while the second child does not like sports. Comic strips are created in one panel. The second comic strip carries four panels of Yonkoma style (2x2 panel strips). The story's content is still about the topic of a healthy lifestyle, where the story emphasizes the bad habit of littering. The two comics will be used in the apperception section's opening part of the lesson.

**Pertemuan II**  
**Desain Komik**

**Meeting III**  
**Comics Design**

Healthy life topics, using in apperception part child playing sport child playing game	eating a snack throwing the snack's package littering pile of rubbish	
comics with water topics, using in discussion section water scarcity case of water scarcity in Tarakan	plastics waste in water [sea/river] data in chart picture of plastic waste	acid rain water cycle factories as a cause of acid rain

Figure 4. Designer's log of the third meeting with Ixora

The third comic, on a water-related topic, presents three SSI cases related to water problems. The first case raised was about a water scarcity problem in one of the regions of Indonesia. The second case concerns plastic waste in waters like the sea or rivers. The third case is related to acid rain. These three cases were focused on discussion activities in three lesson meetings, where each case was introduced at each lesson meeting.

From discussions with Ixora, it can be seen that the variations in comic forms that she planned to use in the classroom are based on students' experiences. Introducing comic

strips first is an interesting way to introduce students to comics. SSI content is also diverse; Ixora could plan several different SSI-related cases even on the same topic.

### 3.2 Case 2: Designer's log based on discussion with Verbena

The first meeting with Verbena revealed that the student had experience in using comics as a learning medium, see Figure 5. She had previous experience developing comics and using them in class. The case differs from the case in the Ixora class. In Verbena's class, the students have more experience using comics. She also stated that he had introduced several materials for the SSI topic, such as waste problems or other environmental issues.

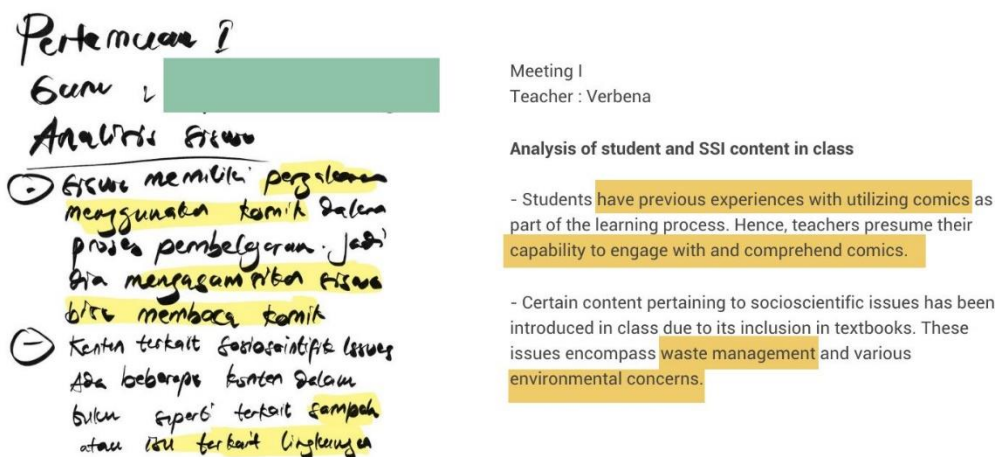


Figure 5. Designer's log of the first meeting with Verbena

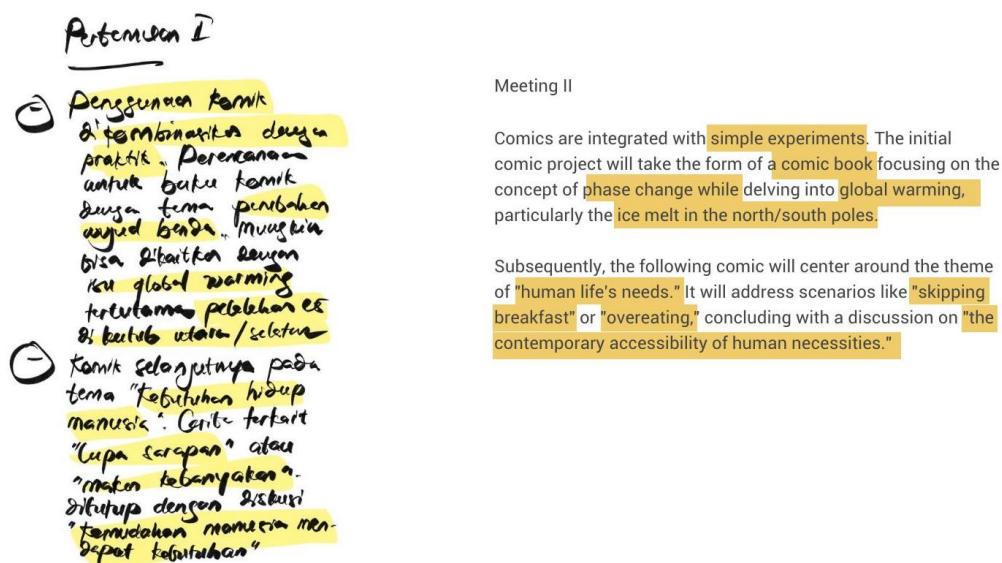


Figure 6. Designer's log of the second meeting with Verbena

At the second meeting, there was a discussion about comic forms because students in Verbena's class already had experience in using comics. Verbena planned to use comics in the form of comic books directly. The approach differs from the case in Ixora's class, which started with comic strips. Verbena planned two topics based on the designer's log (Figure 6): phase change and human needs. For phase change, because the topic is more inclined toward physics, she planned to connect it with the case of global warming, which is about environmental issues. She also planned that the comic would have a part that would serve as a guide for conducting experiments in class. For the topic of human needs,

she wanted to raise several cases regarding SSI: skipping breakfast, overeating, and the accessibility of human needs in the current era.

At the third meeting, we discussed the draft content for the comic. In Figure 7, it can be seen that Verbena wants to design the introduction part first before going into the main content. As an example of phase change, she wants to take a story about “why ice melts in drinks” before going into phase change, emphasizing changes in the state of objects from solid-liquid-gas and vice versa. The last part of the SSI case is related to global warming. Another example of human needs is the introduction part, which introduces three primary human needs: clothing, food, and housing. After that, he planned to go into SSI examples, such as skipping breakfast and overeating, which are related to food needs. Finally, it closed with the SSI case regarding the accessibility of human needs in the current era.

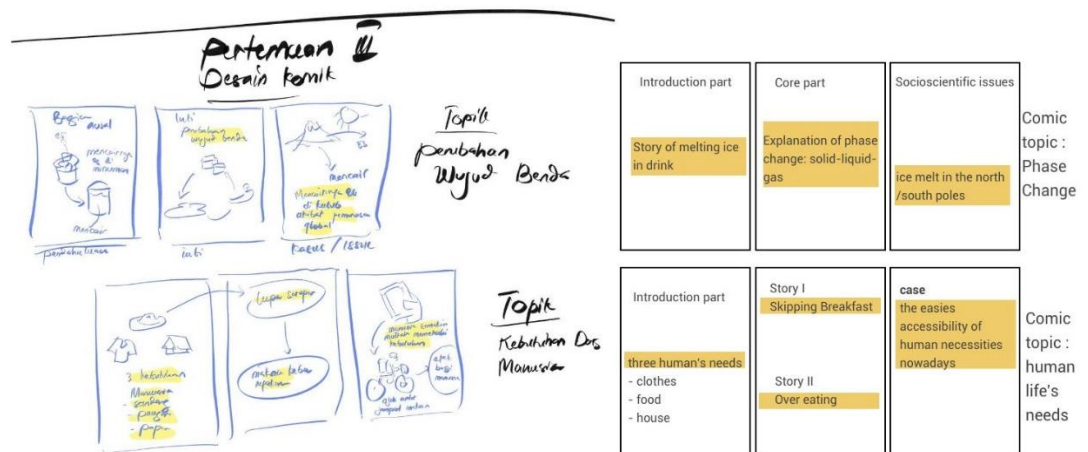


Figure 7. Designer's log of the third meeting with Verbena

From discussions with Verbena, we got the new insight that the conditions of the students in her class are different from those of Ixora's class. Her decision to use comic books directly is one of the interesting things because she wants to emphasize the story directly for students who have experience using comics. Her decision to select SSI topics linked to science content is also interesting, for example, the phase change topic, which is connected to the case of global warming.

#### 4. Discussion

The results of this study reveal interesting things discussed in this section. Three sections highlight interesting aspects worth discussing. The first part is a different approach to using comics based on student experiences. The second part relates to aligning SSI content with the curriculum in Indonesia. Finally, the third part is related to the teacher's decision to implement comics in learning activities. This section is explained in detail in the next subsections.

##### 4.1 Diverse students' experiences with comics yield different pedagogical approaches

Students' experiences shape teacher preferences in selecting learning media. It can be seen from the difference between Ixora and Verbena in choosing comics. Ixora chose to start with comic strips, while Verbena immediately used comic books. Ixora's students have no experience with comics, while Verbena's students have previous experience with comics.

Although no literature in previous studies shows teacher preferences in using comics, several studies highlight this phenomenon in other forms of learning media. For example, Espino et al. (2020) compared variations in video formats used by secondary school teachers and college lecturers. The results they got were that secondary school teachers



tend to use a variety of videos because they adapt to student characteristics. At the same time, college lecturers focus more on just a few formats. [Thaariq \(2023\)](#) also reported a similar thing, describing teachers' adaptation of technology in the learning process according to students' conditions. Previous studies align with what happened in the Ixora and Verbena decisions.

#### 4.2 How do the teachers connect the SSI to the Indonesian curriculum?

One of the things that was the focus of the discussion was the alignment of SSI content with the curriculum in Indonesia. As an illustration, Indonesia's curriculum is changing from the previous curriculum (called the *Kurikulum 2013*) to the new curriculum (called the *Kurikulum Merdeka*) ([Kemendikbud, 2023](#)). There are slight changes from the previous curriculum to the new curriculum for the elementary school level. *Kurikulum 2013* places on integrative thematic learning. In contrast, *Kurikulum merdeka* places more emphasis on flexibility. *Kurikulum Merdeka* allows for a subject-based, thematic or integration organizing process ([Kemendikbud, 2023](#)). As an illustration, there is an integration between natural science and social science to form natural and social science lessons, called IPAS (*Ilmu Pengetahuan Alam dan Sosial*) in Indonesian terms.

In both curricula at the elementary school level, SSI content is not explicitly introduced. However, the textbooks contain some content, such as environmental or health issues. However, it is only limited to an introduction to the issues, not to the extent of improving students' reasoning skills regarding this issue. Discussions with teachers illustrate an exciting perspective, where teachers wisely chose SSI content that matched the content in the curriculum. The content in the curriculum is what leads students to an introduction to SSI. For example, Verbena planned to connect SSI related to global warming with phase change as the main content. It is interesting because the phase change explanation about changes in the state of objects from solid-liquid-gas relates to the context of melting ice at the north/south pole.

Like Verbena, Ixora, in connecting SSI content related to water (water scarcity, plastic pollution in rivers/seas, and acid rain), intended to explain the main content first, such as an explanation of water and the water cycle. Another example is that Ixora arranged to connect SSI as an introduction to the core content, where SSI is used as an apperception. In the comic strips, she wanted first to give examples of healthy life problems, such as children rarely exercising or harmful littering habits, before explaining a healthy life.

This example highlights that SSI content can be connected to the curriculum's core content. SSI content can play a role at the end to facilitate linkage to the main content. It is linked with previous studies that stated that students need to get some basic scientific concepts to face problems in the SSI ([Leung & Cheng, 2020](#); [Lewis & Leach, 2006](#); [Macalalag et al., 2020](#)). On the other hand, the SSI can also be used as an introduction that can lead to the main content. Some research also uses this approach by introducing the simple SSI that relates to students' daily lives as a catalyst in the course's opening ([Byrne et al., 2014](#); [Ke et al., 2021](#)).

#### 4.3 The use of SSI comics in learning activities diversity

Exploring the use of comics in an educational context is interesting, considering that comics were historically very controversial because they were considered entertainment junk ([Lo et al., 2019](#); [Upson & Hall, 2013](#)). However, nowadays, comics are widely used in learning ([Koutníková, 2017](#)). Conventionally, comics act as informational reading media ([Lo et al., 2019](#)). In discussions with Ixora and Verbena, we discovered something interesting. Ixora and Verbena prepared to design comics as discussion material for SSI content. It is interesting to familiarize students with the reasoning behind SSI. This progressive approach could be used as a reference that comics are not only limited to reading material but also function as a stimulant in the discussion process as a more advanced form of learning.

Apart from discussions, Verbena arranged to use comics as a guide for classroom experiments, illustrating a new way of using comics in the classroom. [Affeldt et al. \(2018\)](#)

also used a similar method, which used comics as a guide in laboratory experiments. Apart from that, Ixora's planned implementation of comic strips as part of apperception is interesting in acclimatizing students. It can also help students in meaning-making from comic strip plots that need interpretation. This strategy also aligns with previous studies (Grennan, 2011; Skedsmo, 2021), which conducted research highlighting the distinctive nature of meaning-making in comics.

The diversity of teachers' ways of planning the use of comics in the classroom can provide new insights into other research on the use of comics in the learning process, especially in SSI contexts that require long-term intervention. Apart from providing insight, several examples in this study can provide opportunities for other researchers to see the advantages and disadvantages of using comics beyond their functionality as reading material.

## 5. Conclusions

In brief, this study provides an overview of the use of the designer's log to highlight insights from teachers in planning the development of comic media with SSI content for elementary schools. Both teachers (Ixora and Verbena) have unique perspectives that show parallels or discrepancies. Both consider the development of comics based on the students' conditions. Moreover, the diversity of comic forms and content topics in the comics they plan are part of the exciting insight in this study. Lastly, the varied implementation planning of comics in learning activities shows the versatility of comics.

This research has limitations that cannot be refused. First, because of the case study approach, the results cannot be generalized because they depend on a country's geographical and educational conditions. Second, because the teacher's background is different, other factors, such as the teacher's experience, may also influence the teacher's planning in media development.

Future suggestions to other researchers who want to draw on experiences from this study need to consider some factors, such as student conditions, culture, and school background. Many things can be explored in further research, such as the impact of teacher considerations in comic design on learning efficiency in the classroom.

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