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The Development of Comic Learning Media on The Human Respiratory System Topic to Facilitate Student Health Literacy

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Abstract
Basic Health Research (Riskesdas) and the Global Youth Tobacco Survey (GYTS) identify an increase in the prevalence of smokers among teenagers, indicating low health literacy among junior high school students. To address this, interactive learning media were developed to facilitate student health literacy. This research focused on developing comics as a learning medium for the respiratory system to facilitate health literacy. It was a developmental research method using the ADDIE model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. The developed comic was validated by three experts using an expert judgment rubric. Data were collected from 34 students in 8th grade and four science teachers through questionnaires. Expert validation data were analyzed using Aiken's V formula, while questionnaires were analyzed by calculating the percentage of agreement. Expert judgment validation received a score of 0.88, indicating high validity. The questionnaire results showed a high percentage of agreement: 96.57% from students and 95.83% from teachers. These findings suggest that comics are highly effective as learning media for the respiratory system topic and effectively support students' health literacy efforts.

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INTRODUCTION

Health literacy refers to a person's ability to obtain health information to maintain his health for a better quality of life. Health literacy is crucial in protecting healthy behavior, which determines health and quality of life (Haugen et al., 2023; Suwono et al., 2023). According to Nutbeam (2019), health literacy refers to the literacy and numeracy skills that empower individuals to access, understand, and use the information to make decisions and take actions that affect their health status. Furthermore, health literacy represents the cognitive and social skills that determine an individual's motivation and ability to access, understand, and use the information for making appropriate health decisions in a way that promotes and maintains good health (Azevedo et al., 2020; Haugen et al., 2023; Matthijs Bakker et al., 2019; Morrison et al., 2019). People who are health literate are more likely to obtain sufficient health information from several sources. They are less likely to engage in risky smoking habits, drink alcohol regularly, or exercise less. Consequently, they are more likely to report good self-assessments of health.

The study conducted by Jafari et al. (2021) was a cross-sectional and experimental study with a focus on ongoing validated measures of health literacy in students. They concluded that the majority of ongoing school students had inadequate levels of health literacy skills. Rajah et al. (2019) - in systematic review- examined the available studies on health literacy in Southeast Asian countries and estimated its prevalence in this region. In short, an urgent strategy to improve and promote health literacy in this region is urgently needed.

Health education should focus on helping individuals develop decision-making skills that can

be applied in various situations rather than simply ensuring they comply with specific health goals. Providing fair access to high-quality health education and opportunities for lifelong learning are essential foundations of contemporary health promotion (Nutbeam, 2019). If health literacy is considered a demonstrable set of abilities, the approach concentrates on enhancing an individual's skills and capabilities through educational intervention. Previous research indicates a low level of health literacy and needs to be improved, especially in the education sector. Improving health literacy in the education sector is essential due to the rising number of smokers among students.

The data from the Basic Health Research (Riskesdas) in 2013 and 2018, there increase in the prevalence of smokers aged 10-18 (Kementrian Kesehatan RI, 2018). Riskesdas data in 2013 stated that the prevalence of smoking in the population aged 10-18 was 7.2%. Furthermore, Riskesdas in 2018 experienced an increase of 1.9%, reaching 9.1%. Meanwhile, the target of the National Medium-Term Development Plan for 2023 is 5.4%. Therefore, there is a need for strategies to control the use of tobacco products, especially among teenagers. The increase in the number of tobacco users among teenagers is further supported by research findings from The Global Youth Tobacco Survey (GYTS), which serves as a global standard for systematically monitoring youth tobacco use (smoking or smokeless). The GYTS results in Indonesia in 2014 showed a prevalence of 18.3% of current cigarette smokers, and there was a slight increase in the survey conducted in 2019, reaching 18.8% of current tobacco smokers (World Health Organization, & Asia, 2019; World Health Organization, 2015). This increase in percentage causes significant health problems among young people, including an increase in the number and severity of respiratory diseases, a decrease in physical fitness, and a potential effect on lung function. The education sector plays an important role in providing education to school-age children to provide health knowledge that will change students' health behavior. As the impact, students will decide whether to smoke or not after knowing the effects of smoking.

Considering that junior high school-aged still lack health literacy, a learning strategy utilizing learning media is required to raise health awareness, which can enhance healthy living behavior and quality of life. Media health literacy empowers engagement and directs health information resources based on the required targets. Media plays an important role in building and changing attitudes, thoughts, and behavior of the public on health issues (Araya et al., 2021; Nazarnia et al., 2022). Thus, it needs to investigate and define the concepts and domains of media health literacy. In this case, it developed a comic-based learning media.

The development of comics may be an alternative solution because the comic's potential for learning will maximize the sense of sight (Munawwaroh et al., 2018; Mutia et al., 2020; S. A. Sari & Harahap, 2021; Udayani et al., 2021). Previous research has explored the use of comics as a learning medium for various purposes, such as enhancing students' understanding of concepts (Indayanti et al., 2022; Munawwaroh et al., 2018), fostering environmental awareness (Indayanti et al., 2022), improving learning outcomes and communication skills (Dewantara, 2020; Morrison et al., 2019), boosting creativity (F. P. Sari et al., 2020), promoting science competencies (Hidayat & Rostikawati, 2018), and encouraging critical thinking (Udayani et al., 2021). However, there is still a lack of development in using comic-based learning media to facilitate students' health literacy. Based on this background, this study aims to develop comic learning media on respiratory system topics to facilitate student health literacy.

RESEARCH METHOD

The research employed a developmental research design (Richey & Klein, 2005), using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) to create a comic-based learning medium to facilitate health literacy. According to Richey & Klein (2005), this developmental research is used to fulfill learning development and research for eLearning and distance learning innovations. The ADDIE model, the method to develop comic learning media, has five stages. First, the analysis stage analyzes the needs of the media, material analysis, user analysis, and software requirement analysis. Second, the design stage creates the storyline, flowchart, storyboard, and detailed drawing. Third, the development involved the process of validation by some experts and the revision based on some recommendations from the expert before implementing the comic in the learning activity. Fourth, at the implementation stage, it disseminated the comic learning media to science teachers and students and then collected the data using the questionnaire. And, evaluation was carried out by analyzing and reporting the data result.

The subjects consisted of experts, students, and teachers. The research invited three experts. The target population was those students who had learned about respiratory system topics. Then, students in 8th grade played as the population target. Meanwhile, teachers were those who teach science. So, 34 students were involved in this

research. The expert judgment was provided a rubric that involved some indicators with a 4-criteria judgment. The result of expert judgment was calculated using the Aiken variable to test the validity of the developed comic. The formula of the Aiken validity index is stated in the equation:

$$V = \frac{\sum s}{n(c-1)}$$

where V is the item validity index; s are the scores given by each validator minus the lowest score in the used category (s = r - lo, where r = rater category selection score, and lo = the lowest scores in the scoring category); n is the number of raters; and c is the number of categories that raters can choose (Aiken, 1980). The V index value ranges from 0 to 1. The item is better when closer to 1 because it is more relevant to the indicator. The questionnaire consisted 12 indicators using a dichotomy format. The teachers' and students' questionnaires went to the same analysis technique by calculating the percentage of agreement. According to (Arikunto, 2011), the feasibility of comic learning media is calculated using the following formula:

$$Percentage\ of\ feasibility = \frac{\sum gained\ score}{\sum maximum\ score} x100\%$$

RESULT AND DISCUSSION

The results of this research entitled "The Development of Comic Learning Media on The Human Respiratory System Topic to Facilitate Student Health Literacy" are analyzed and discussed. In general, the results to be discussed include the development of comic learning media on respiratory system topics to facilitate health literacy in each stage, elaborated with the expert judgment and the response of students and teachers to the use of comics as a learning media on the respiratory system topic to facilitate health literacy.

Analysis Stage

The analysis of learning media conducted for teaching the topic of the respiratory system is carried out through a literature review of previous research documents. The analysis involved four primary aspects. 1) Media analysis, where the specific needs and objectives of the comic learning media were identified. 2) Material analysis, focused on evaluating the content of the respiratory system was required in the development of comic learning media. 3) User analysis involved understanding the target audience to connect the media effectively. And, 4) software requirement analysis entailed determining the technological tools and platforms needed to develop the comic learning media.

The respiratory system was selected as the subject matter for the comic, which aims to promote health literacy. This choice was motivated by the growing prevalence of smoking among junior high school students. Addressing this issue aligns with the goals of the Kurikulum Merdeka, where one of the objectives of studying the respiratory system is to prevent smoking habits and enhance the overall quality of life. The chosen materials focus on the respiratory system and are typically taught in the second semester of 8th grade.

The software used to develop the comic learning media on respiratory system topics to facilitate health literacy is MediBang Paint. The advantage of MediBang Paint is that the user can still use it even without subscribing to the premium version. The available tools are also very diverse compared to other free digital drawing applications. The MediBang Paint usually informs international competitions through its website. Finally, MediBang Paint is chosen for digital drawing because it offers convenience, the abundance of features accessible even without a subscription, and the diverse tools that greatly help in producing high-quality artwork.

Design Stage

The design stage included creating the storyline, followed by making a flowchart, then developing a storyboard, and finally creating a detailed drawing. The steps for making the detailed drawing include making a sketch, lining/line art, coloring, shading, adding background, finishing, and adding the text. The sketching stage is presented in Figure 1.

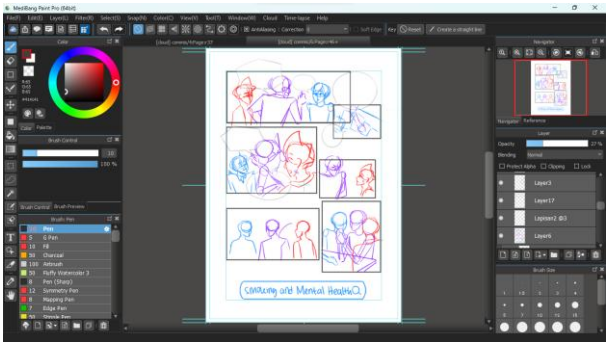

Figure 1. Sketch Stage in Developing Comic

In this stage, the process begins with paneling, or creating the comic frames, followed by sketching rough scenes within the story, and concludes with placing text balloons. The next stage is the lining stage, which is presented in Figure 2.

Figure 2. Lining Stage in Developing Comic

The Lining or Line Art stage involves defining the scene's lines in the comic. The rough lines created during the sketching phase will be refined in this Lining stage. This stage was followed by coloring, presented in Figure 3.

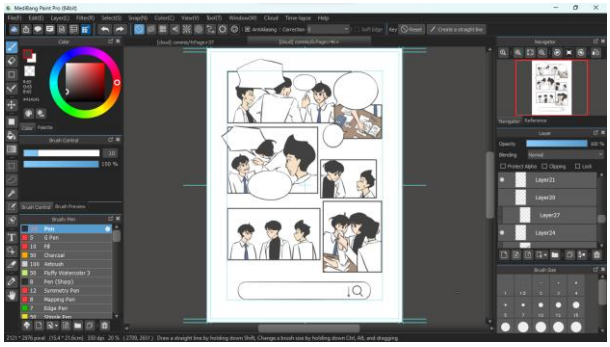

Figure 3. Coloring in Developing Comic

The next stage is the coloring stage, where the artwork is colored using basic colors. This stage was followed by the shading stage, presented in Figure 4.

Figure 4. Shading in Developing Comic

The next stage is the shading stage, where the artwork is given highlights and shadows. Additional dark and light colors are added to the original colors to create the impression of light and shadow and determine the direction of the light source. This stage was followed by adding a background, presented in Figure 5.

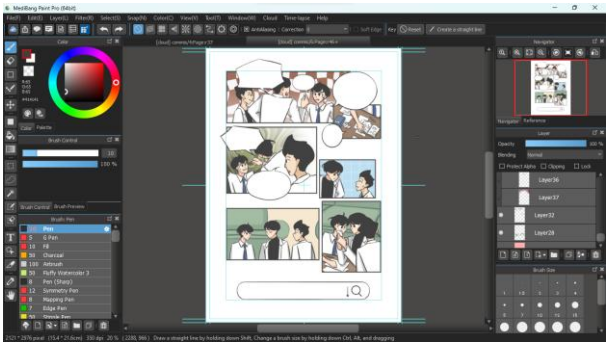

Figure 5. Adding Background in Developing Comic

By intentionally drawing the background or scenery towards the end, it has the flexibility to align the mood and atmosphere with the unfolding scenes in the comic.

Figure 6. Finishing

The finishing stage is usually used to add detail to the image. Starting from the effects of motion on the characters, gradations to support emotions, or other small things to make the picture more interesting.

Figure 7. Adding Text

The final stage in creating a comic is adding or inserting text into the artwork or pages.

Development Stage

The development stage of this comic learning media involved the process of validation by experts. The judgment sheets evaluated five indicators, which developed into 18 items. Each of the indicators is material suitability, user experience, health literacy, visual appeal, and text quality. The

expert judgment was analyzed using Aiken's index. The result is presented in Table 1.

Table 1. Expert Judgement Result Using Aiken Index

Indicator	Sub-Indicator	V	$V_{average}$
Material Suitability	Learning Outcome	1.00	0.96
	Learning Objective	0.89	
	Material Depth	1.00	
User Experience	Coherence	0.89	0.86
	Interactivity	0.67	
	Enhancement	1.00	
	Content Flow	0.89	
Health Literacy	Access	0.78	0.89
	Understanding	1.00	
	Use	0.89	
Visual Appeal	Panels	1.00	0.89
	Character and Dialogue	0.67	
	Color Matching	1.00	
	Design Attractiveness	0.89	
	Media Appeal	0.89	
Text Quality	Text Clarity	0.78	0.82
	Font Size Suitability	0.67	
	Font Type Suitability	1.00	
	Total		0.88

These judgments are further presented in the histograms in Figure 8.

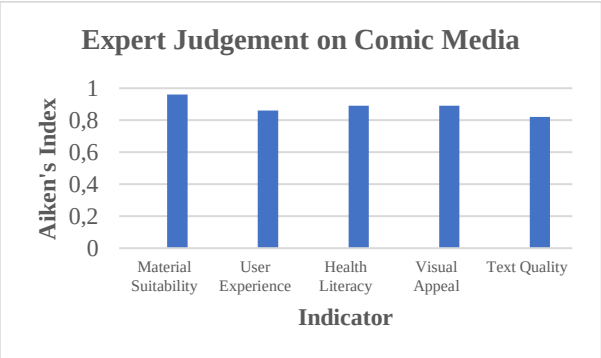

Figure 8. Expert Judgement on Comic Media

Based on the expert judgment provided in Figure 8, the material suitability indicator has the highest validity index, followed by the health literacy indicator, visual appeal indicator, user experience, and text quality. However, all indicators obtain an Aiken index above 0.8, which indicates each indicator in comic learning media has high validity (Aiken, 1980). Then, it interpreted that indicator in the development of comics as a learning medium for the topic of the respiratory system to facilitate health literacy has a potentially useful resource for middle school students (Reis et al., 2022). The previous study by (F. P. Sari et al., 2020) showed the comics that they developed and tested for their validity have high validity, making it possible for learning media in the right category for use in physics learning activities and applied anywhere and at any time.

Implementation Stage

After the development stage, the next step was the implementation stage, where the researcher asked teachers and students to read the comic and then fill out questionnaires for both groups. The questionnaires were designed to collect feedback and insights from teachers and students about their experiences with the comic, its effectiveness as learning media, and any areas for further improvement (Liniasari et al., 2021; F. P. Sari et al., 2020; Udayani et al., 2021; Ulviah et al., 2021). The comic learning media was tested by four science teachers and 34 students in 8th grade in two junior high schools in Bandung. The teachers and students tested the comic through the completion of a questionnaire. The questionnaire consisted of 12 statements, categorized as dichotomy questions, where each statement had only two answer choices; Yes/No. The teachers and students had to select one of the two options that best matched the given statement.

Evaluation Stage

The data collected through the questionnaires from students and teachers were then analyzed, and the percentage of agreement was calculated. The analysis results and the percentage of agreement were used for evaluation and creating recommendations for future research. The percentage of agreement for science teachers is presented in Figure 9.

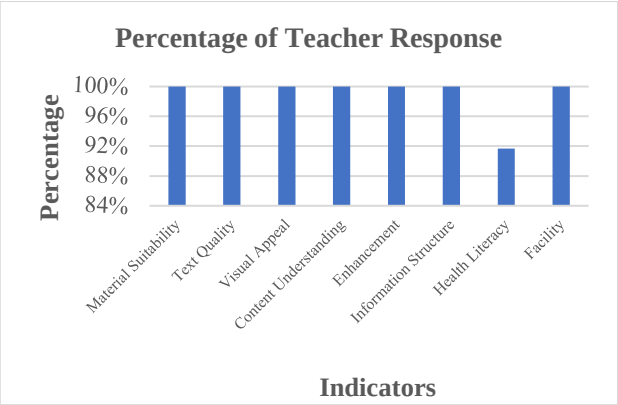

Figure 9. Percentage of Teacher Response

Based on Figure 9, the percentage of teachers' responses to comic learning media is relatively high of 95.83%. It indicates all teachers approve of this comic as a learning media in respiratory system topic to facilitate students' health literacy. All four science teachers agreed that the material, text, visual appeal, content understanding, enhancement, information structure, health literacy, and facility have been presented well in the comic. However, one of four teachers disagree with statements about enhancement tools and access to health information. The statements are "Enhancements, such as QR codes enrich the learning experience" and "The comic provides access to health information from various resources." Although QR codes were provided to facilitate readers' access to health information, allowing them to delve deeper into the health-related content of the comic by scanning them. Some of the QR codes were found to be invalid due to expiration. As a result, the author has recreated new QR codes that do not have an expiration date. Furthermore, the analysis result of the student questionnaire in the form of percentage of agreement is presented in Figure 10.

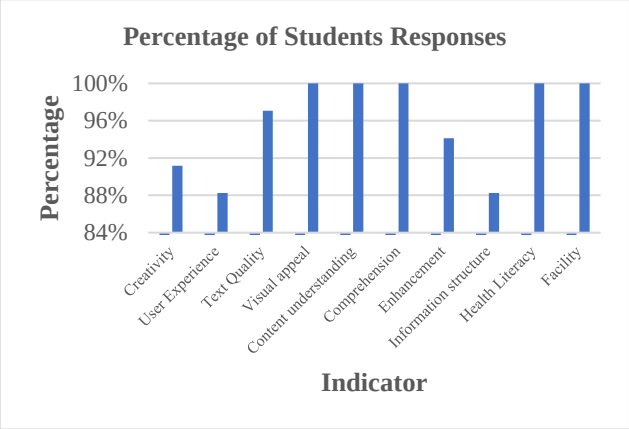

Figure 10. Percentage of Student Response

All of the students agreed that the visual appeal, content understanding, comprehension, health literacy, and facility indicators were presented well in the comic learning media. The obtained average percentage of students' responses is 96.57%. It indicates all students agree that comic learning media is suitable for learning respiratory system topics to facilitate health literacy. Supported with previous research that the interconnected illustrative images convey a coherent and clear narrative, facilitates students' understanding of media content (Suryatin & Sugiman, 2019; Octaviana et al., 2021; Narestuti et al., 2021).

Araya et al. (2021) show that conveying visual stories through comics increases student engagement and retention of complex scientific concepts and making the learning process more enjoyable and effective. Also, S. A. Sari & Harahap (2021) found that comics can simplify difficult topics through visual metaphors and narrative techniques, which helps students understand and remember the material better. This emphasizes that the use of comics in education not only improves understanding but also increases motivation and interest. Thereby, it contributes to a more dynamic and interactive learning environment. In the context of health literacy, the use of comic-based learning media is very effective.

Research shows that health topics are more interested for students in comic format because comics can break down complex health concepts into simpler and more relevant scenarios, which make the information is easier to access and understand (Harmawati et al., 2020). Therefore, the positive response to comic learning media is supported by a large number of studies that emphasize the benefits of using comics as an educational tool. These findings confirm that comic-based learning media is not only suitable but also very effective for teaching the respiratory system and increasing health literacy in students.

CONCLUSION

In conclusion, this research aimed to develop comic-based learning media for the respiratory system to facilitate health literacy, employing the ADDIE method with five stages: analysis, design, development, implementation, and evaluation. From the expert's judgment, it was found that material suitability has the highest Aiken index of 0.96, health literacy indicator, and visual appeal with an Aiken index of 0.89, user experience 0.86, and the lowest is text quality with Aiken index 0.82. The average Aiken Index was 0.88, which could indicate high validity. The comic was then reviewed by four science teachers and 34 students in 8th grade, with both groups showing overwhelmingly positive responses and a percentage of agreement of 95.83% from the teachers and 96.57% from the

students. These results demonstrate that the developed comic is an effective learning tool for facilitating health literacy in the respiratory system topic, making it suitable for use in educational settings for both teachers and students. However, the effectiveness of the developed comic learning media cannot be conclusively determined. It presents an opportunity for future research to evaluate its efficacy.

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