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# FOSTERING INDONESIAN READING LITERACY THROUGH DIGITAL COMICS: A DESIGN THINKING APPROACH WITH LOCAL CULTURAL INTEGRATION

Kusmajid<sup>1\*</sup>, Nani Solihati<sup>2</sup>, Siti Zuhaiha<sup>3</sup>

<sup>1</sup>John Molson School of Education, Concordia University, Canada

<sup>2</sup>Faculty of Cultural Studies, University of Rijeka, Croatia

<sup>3</sup>John Molson School of Education, Concordia University, Canada

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Corresponding Author: Author Kusmajid  
(Kusmajid)

## ABSTRACT

*The decline in Indonesia's reading literacy performance, as evidenced by recent PISA results, underscores the urgent need for innovative pedagogical strategies that foster student reading interest and comprehension. Employing a Research and Development (R&D) methodology with a design thinking approach, this study aims to develop and evaluate a culturally relevant digital comic as an educational medium to improve reading literacy skills of Indonesian elementary students in urban Muhammadiyah schools. Expert validations were performed to assess the quality of the developed product, achieving high scores across media (86%), content (92%), and language (95%), with an overall validation score of 91%, categorized as "Very Good". Quantitative analysis of pre- and post-intervention reading tests showed significant improvements in students' literacy skills with a large effect size (Cohen's  $d = 0.8$ ). These findings demonstrate that culturally relevant digital comics can effectively enhance literacy skills and student motivation. The study contributes to the growing body of knowledge on culturally responsive pedagogy and multimodal literacy, reinforcing the view that literacy is both a cognitive and sociocultural process.*

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**KEYWORDS:** Reading Literacy; R&D; Design Thinking; Digital Comic; Local Culture.

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## 1. INTRODUCTION

Reading literacy has emerged as an essential capacity for lifelong learning, critical thinking, and making worthwhile contributions to a global society. Beyond the ability to decode words and recognize letters, reading literacy includes the ability to comprehend, analyze, and apply written words in various contexts (Smith *et al.*, 2021; Abernathy, 2024). Particularly at the elementary school level, reading literacy has a significant impact on students' ability to process knowledge across topics, organize their thoughts, and effectively articulate ideas. In short, it is critical not only for academic success but also for the development of the cognitive and communicative skills required in daily life.

Despite its recognized magnitude, international assessments continue to reveal ongoing literacy challenges, particularly in Indonesia. Multiple evaluations, including the Programme for International Student Assessment (PISA), have annually revealed that Indonesian learners score lower than the global average in reading literacy (Nugrahanto & Zuchdy, 2019). As quoted by Pitri and Sofia (2022), Indonesian students received an average reading literacy score of 371, compared to the OECD average of 487 in the PISA 2018 evaluation. As a result, Indonesia was listed among the lower-ranked nations that participated. Although Indonesia's percentile ranking increased by 5–6 spots in the most recent PISA 2022 results, only approximately 25% of Indonesian students achieved Level 2 or higher in reading, which is significantly lower than the OECD average of 74% (Nugrahanto & Zuchdy, 2019; OECD, 2023). Level 2 is typically regarded as the foundational competency required to engage properly in society.

According to research, this low reading literacy in Indonesia is caused by several factors. Key problems have been identified as restricted access to high-quality reading materials (Pitoyo, 2020; Mu'alimah *et al.*, 2024) and a lack of enthusiasm for reading in general (Diana & Markhamah, 2023; Katrunnada *et al.*, 2023). Other significant factors include socioeconomic status, poor learning facilities, and low student confidence (Santi *et al.*, 2025). Moreover, many Indonesian students rarely spend time reading for entertainment or personal growth (Pitoyo, 2020), and even if they do, digital distractions tend to prevail (Wijayanti, 2020). Furthermore, family environments do not always encourage early reading (Nurcahyoko *et al.*, 2024). These patterns are reflected both in schools and at home, where the reading culture is often not deeply embedded.

To remedy these deficiencies, the Indonesian government and education sector have made

concentrated efforts. For instance, the government established a program called Gerakan Literasi Sekolah (School Literacy Movement), in which students were mandated to read for 15 minutes prior to class to foster reading habits and literacy skills (Nugrahanto & Zuchdy, 2019; Pantiwati *et al.*, 2020). However, even with this program and some encouraging developments in resilience rankings, particularly during pandemic-related learning interruptions, Mayuni *et al.* (2020) maintained that Indonesian reading literacy levels remain low compared to their international peers (OECD, 2023; Cahyani *et al.*, 2025). This alarming trend points to the inadequacy of current literacy instruction and highlights the urgent need for learning interventions that are engaging and contextually relevant.

Current research highlights the need for engaging and culturally relevant pedagogical models, in addition to effective ones. In this regard, Design Thinking has become a viable learner-centered approach. Patrício *et al.* (2020) claimed that it encourages teamwork, empathy, and creativity—qualities that are particularly beneficial when dealing with challenging educational issues. The process typically includes five stages: empathy, definition, ideation, prototyping, and testing. This method helps teachers create content that speaks to the identities and experiences of their students when integrated into instructional design.

In an attempt to develop such a design, this study plans to utilize digital comics. Blending text and visual storytelling, Kirchoff (2017) stated that digital comics are especially useful for young readers or people who have trouble with traditional reading formats. In contrast to traditional print media, Al-Faruque (2023) added that digital comics can be interactive and culturally flexible, enabling the integration of cultural knowledge and values into instructional materials. However, while some research has addressed the role of digital media in literacy (Sukma *et al.*, 2018; Ansari & Khan, 2020; Putri & Sukasih, 2025), few have examined the relationship between design thinking, digital literacy tools, and local cultural content, particularly at the elementary school level. In addition, despite comic-based media's known ability to increase reading engagement through visual storytelling, their implementation is still underutilized in Indonesian literacy education programs.

This study addresses these gaps by proposing an innovative instructional model that merges design thinking methodology with the development of digital comics based on local cultural values. By offering novel, context-sensitive learning media, the findings intend to offer a practical contribution to

enhance students' early literacy, as well as a theoretical one by expanding the body of knowledge on culturally responsive literacy and design thinking. Overall, this study aids Indonesia's attempts to improve adequate elementary education and meet 21st-century learning targets.

## 2. METHOD

This study employed a Research and Development (R&D) approach using the Design Thinking model, which includes five stages: empathize, define, ideate, prototype, and test. This model was chosen because it focuses on a thorough understanding of students' requirements and iteratively builds solutions based on those needs. This approach facilitates the creation of user-centered and contextually appropriate educational media. The study was conducted at three Muhammadiyah elementary schools in Jakarta: SD Muhammadiyah 11 Jakarta, SD Muhammadiyah 02 Plus, and SD Muhammadiyah 24 Rawamangun. The participants were fifth-grade students selected purposively based on the results of an initial reading literacy assessment that indicated low performance. The main goal of this study was to create and use a digital comic that incorporates local cultural knowledge as a teaching tool to improve students' reading comprehension and literacy.

To collect the data, expert validation sheets were utilized to evaluate the designed media's content and visual appropriateness, and questionnaires were distributed to both teachers and students to capture their inputs regarding usability, appeal, and effectiveness. Additionally, to assess the increase in students' reading skills, a reading literacy exam consisting of 30 multiple-choice questions was administered both before (pretest) and after (posttest) the digital comic was implemented.

Data analysis combined descriptive and inferential statistics. The questionnaire data and validation results were interpreted using descriptive statistics. The effectiveness of the media was investigated using inferential analysis, which included tests for the instruments' validity and reliability, as well as tests for the normality and homogeneity of the pretest and posttest data. Additionally, a hypothesis test was performed using a one-way ANOVA to identify significant differences between schools. The influence of the developed media on students' growth in reading literacy was evaluated using Cohen's *d* effect size analysis.

## 3. RESULTS AND DISCUSSION

This study employed the Design Thinking

framework to develop a local culture-based digital comic as an innovative learning medium to improve reading literacy among Grade 5 students in Muhammadiyah elementary schools in Jakarta. The findings are presented below according to the five stages of Design Thinking.

## 4. RESULTS

### *a. Empathize: Identifying Student Needs and Literacy Challenges*

In the initial empathize stage, students demonstrated low motivation and interest in reading, along with difficulties in comprehending and evaluating texts through direct observation, interviews, and preliminary assessments. These challenges were attributed to two primary factors: 1) lack of parental support in reading activities at home and 2) conducive learning environments that distracted students and hindered their concentration during reading.

These problems align with broader literacy challenges at the national and global levels. Indonesia's PISA reading literacy score dropped from 371 (2018) to 359 (2022) (OECD, 2023), suggesting a recurring problem at the national level. This issue is exacerbated by traditional teaching strategies that prioritize passive learning, preventing students from critically interacting with texts (Laksono & Retnaningdyah, 2018).

### *b. Define: Framing The Problem in Reading Literacy Education*

Based on the empathize phase, the key problem was defined as the need to increase students' motivation to read and their ability to understand and evaluate the reading materials. The study identified the following systemic factors: 1) minimal student engagement in reading activities during class; 2) teacher-centered instruction, where students mostly listen without interaction; 3) lack of technological integration in learning materials and limited innovation in media use; and 4) inadequate school support for fostering students' reading motivation.

Because these challenges negatively impact students' cognitive and academic development, pedagogical modifications and the strategic use of digital media are necessary to address them (Aguayo-Télez & Martínez-Rodríguez, 2020; Abildina et al., 2024; Ludewig et al., 2025).

### *c. Ideate: Developing A Solution Through Local Digital Comics*

To address the identified issues, the ideation phase produced a solution in the form of a local culture-based digital comic book.

**This approach was guided by the belief that:**

- 1) Digital media combined with culturally relevant storytelling increases student interest and engagement (Ariya 2025).
- 2) Students become more emotionally and cognitively invested when the learning materials are visually rich and culturally familiar.
- 3) Teachers act as facilitators, and parents play a supportive role in building reading habits in their children.

As mentioned previously, the media is intended for fifth-grade students (ages 10-11) in urban Islamic educational settings as primary users. By integrating local wisdom into narratives, the digital comic fosters both literacy skills and cultural identity.

**d. Prototype: Designing And Implementing the Digital Comic**

The process of designing and editing the digital comic used the IbisPaint application for drawing and designing, following a pre-designed storyboard. The prototypes of the developed media are presented in Table 1.

**Table 1: Prototype Product.**



At the model feasibility stage, expert validation was conducted to assess the quality of the digital

comic in terms of media design, content, and language. Three experts were involved in each

validation. The expert validation results are summarized in Table 2.

**Table 2: Expert Validations.**

Aspect Evaluated	Number of Experts	Average Score (%)	Category
Media	3	86%	Very Good
Content	3	92%	Very Good
Language	3	95%	Very Good
Overall Average		91%	Very Good

The summary of expert validation demonstrates the overall feasibility and high quality of the digital comic developed through a Design Thinking approach. With average scores of 86% for media, 92% for content, and 95% for language, all of which fall into the "Very Good" category, the comic demonstrates strong visual design, relevant and well-structured material, and excellent language use. The overall average score of 91% confirmed the product's quality and readiness for educational testing.

**e. Test: Evaluating The Effectiveness of the Intervention**

The testing phase involved a comprehensive evaluation of the effectiveness of the digital comic intervention through rigorous quantitative analysis. The pre- and post-test instruments distributed across three Muhammadiyah schools in DKI Jakarta were evaluated in terms of their validity and reliability.

**Table 3: Test Instrument Evaluation.**

No	School	Cronbach's Alpha	Result
1	SD Muhammadiyah 11 Jakarta	0.808	Reliable
2	SD Muhammadiyah 2 Plus	0.643	Reliable
3	SD Muhammadiyah 24 Rawamangun	0.743	Reliable

The findings revealed that the three schools showed acceptable levels of item validity and instrument reliability. All of them met or exceeded

the 0.6 threshold for internal consistency, indicating that they were reliable instruments.

**Table 4: Normality Tests.**

No	School	Pretest Sig.	Posttest Sig.	Result
1	SD Muhammadiyah 11 Jakarta	0.128	0.200	Normally Distributed
2	SD Muhammadiyah 2 Plus	0.173	0.078	Normally Distributed
3	SD Muhammadiyah 24 Rawamangun	0.121	0.053	Normally Distributed

The normality test using the Kolmogorov-Smirnov method indicated that the pre- and post-test scores from all three schools were normally

distributed ( $p$ -values  $> 0.05$ ). This supports the assumption of normality required for the subsequent statistical tests.

**Table 5: Homogeneity Test.**

Reading Literacy	Levene Statistic	df1	df2	Sig.
Based on Mean	0.914	2	67	0.406
Based on Median	0.635	2	67	0.533
Based on Median with adjusted df	0.635	2	60.201	0.534
Based on Trimmed Mean	0.832	2	67	0.440

Levene's test for equality of variances on posttest scores across the three schools showed a significance value of 0.406, which is above 0.05. This confirms that

the data were homogeneous and suitable for further parametric analysis using ANOVA.

**Table 6: One-Way ANOVA - Reading Literacy Scores.**

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. (p-value)
Between Groups	782.291	2	391.146	3.296	0.043
Within Groups	7951.480	67	118.679		
Total	8733.771	69			

Table 4 shows that the test yielded an F-value of 3.296 with a p-value of 0.043, which is less than the alpha level of 0.05. This confirms that, following the

implementation of the digital comic intervention, there was a statistically significant difference in reading literacy scores across the three schools.

**Table 7: Effect Size (Cohen's D).**

No	School	Cohen's d	Effect
1	SD Muhammadiyah 11 Jakarta	2.180481	Strong
2	SD Muhammadiyah 2 Plus	2.15508	Strong
3	SD Muhammadiyah 24 Rawamangun	1.719538	Strong

Based on Cohen's d values, all three schools exhibited significant impact sizes, with scores considerably greater than 0.8. This demonstrates how the digital comic intervention considerably and effectively improved participants' reading literacy levels.

## 5. DISCUSSION

The findings of this study confirm that integrating local culture-based digital comics into literacy education significantly enhances reading comprehension and engagement among elementary school students. In the first step, Empathize, it was found that the students encountered reading difficulties due to limited home literacy environments, where parents did not assist students in learning to read (Hemmerechts et al., 2017; Carroll et al., 2019). In other words, they were not encouraged to read at home, so there were no regular reading routines to foster reading habits (Puglisi et al., 2017; Dong et al., 2020). Additionally, a comfortable and conducive learning environment is essential for improving students' reading literacy. As reported by Rance et al. (2023), when the learning environment is uncomfortable, students' concentration is distracted while reading. Additionally, Permatasari and Wienanda (2023) added that students often show poor levels of intrinsic desire to read and tend to get distracted during traditional, text-heavy instruction. They struggled to maintain focus over lengthy reading periods with traditional materials and showed a greater preference for interactive and visually engaging content (Aguayo-Télez & Martínez-Rodríguez, 2020; Ludewig et al., 2025).

Traditional literacy instruction in Indonesia has long been characterized by rote memorization, passive teacher-centered delivery, and limited integration of engaging media (Agrahari, 2016; Gildore et al., 2025). Programs such as the Gerakan Literasi Sekolah (School Literacy Movement), while well-intentioned, concentrate only on increasing reading frequency without adequately considering how students experience or perceive reading (Laksono & Retnaningdyah, 2018; Kartikasari &

Nuryasana, 2022). Owing to this, students are usually disengaged and see reading as a chore rather than a fulfilling activity.

In contrast, the digital comic developed in this study offered a visually rich and interactive format that captured students' attention and encouraged their interaction. Through visual storytelling and multimodal design, the comic promotes greater accessibility and comprehension by appealing to multiple senses and learning styles. This strengthens Kirchoff's (2017) claim that comics, particularly digital ones, can help young readers comprehend difficult texts and gain a deeper understanding. However, motivation alone is insufficient to achieve this. Zarvianti and Sahida (2020) asserted that comics have the capacity to promote critical thinking, interpersonal relationships, and story exploration (Hollis, 2023), all of which are frequently lacking in traditional literacy practices. Therefore, the transition from static to dynamic learning materials is not only aesthetically pleasing but also necessary from a pedagogical standpoint.

Furthermore, the strong effect sizes across all three schools underscore the potential of culturally grounded content to increase students' emotional and cognitive investment in reading. This aligns with Gay's (2018) foundational work on culturally responsive teaching, which believes that learning becomes more meaningful when students can connect academic materials with personal and social concepts. Similarly, Ariya's (2025) recent research corroborates that culturally familiar content fosters greater emotional engagement and cognitive involvement for students. Rather than engaging with texts as disinterested readers, students actively create meaning by analyzing narratives using their lived and personal experiences as a guide (Tanase, 2020; Madkins et al., 2020). Such findings reinforce the view that literacy is not only a cognitive skill but also a culturally situated practice (Frankel et al., 2016; Gee 2018). Therefore, regardless of how advanced the intervention is, it can risk alienating students and weakening their bond with the subject matter if it ignores their sociocultural identities (Kamalova et al., 2020; Ulbricht et al., 2024). Thus, the success of the

local digital comic highlights how crucial it is to create literacy resources that speak to students' cultural realities to maintain their interest and promote meaningful learning.

The innovation of the study intervention lies in its seamless fusion of narrative, culture, and visuals – three elements that are rarely combined intentionally in elementary literacy education. By fusing visual storytelling with well-known cultural stories, this intervention supports and expands on ideas that view literacy as a cognitive and sociocultural activity (Koh et al., 2015; Buitrago-Flórez et al., 2020). According to Byrd (2016), students engage more fully and learn more effectively when they encounter materials that represent their identities, surroundings, and customs. This convergence not only supports comprehension but also nurtures students' sense of belonging and cultural pride, which Strayhorn (2018) believes to be critical components of lifelong learning. Additionally, the use of comics as a teaching tool places this study in the larger conversation about student-centered design and digital literacy. This also highlights the ways in which accessible technologies can be used to support inclusive and differentiated learning (Navas-Bonilla et al., 2025).

#### D. Conclusion

This study demonstrates that integrating local culture-based digital comics into elementary literacy instruction significantly improves students' reading motivation, comprehension, and engagement. Theoretically, this study contributes to the growing body of knowledge on culturally responsive pedagogy and multimodal literacy, reinforcing the view that literacy is both a cognitive and sociocultural

process. In addition, it broadens the use of the Design Thinking model in the field of education, specifically in the creation of student-centered and identity-affirming learning media. Practically, this study presents a tangible example of instruction that teachers and curriculum designers may use to improve reading outcomes with accessible digital resources. Socially, integrating local cultural narratives into the curriculum inspires students' sense of cultural pride and belonging, which helps deepen their emotional bond with reading and encourages Indonesia's national literacy goals.

This study is not without limitations. First, the intervention was only tested in three Muhammadiyah elementary schools in Jakarta, which may limit the study's applicability to other educational settings or areas with different sociocultural dynamics. Additionally, the functions of family participation and teacher facilitation were not thoroughly examined. In addition, the study mostly used quantitative data from pre- and post-test assessments, which might not adequately reflect students' complex reading-related experiences, attitudes, or long-term behavioral changes.

Future research should assess the model's application across diverse school settings – both urban and rural – to assess its adaptability and effectiveness in larger educational contexts. Longitudinal studies would be beneficial in assessing the long-term impact of digital comics on students' reading habits and academic performance. In addition, to expand the use of culturally based digital literacy interventions in Indonesian education, more research into teacher preparation, parental involvement, and integration with national curricular frameworks would be beneficial.

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