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Culturally-Inspired Digital Comics to Enhance Indonesian Cultural Literacy among Thai Learners

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Abstract: Learning a new culture can be challenging for foreign students, especially when instructional materials fail to connect with their experiences. This study explores how Indonesian culture-oriented digital comics can support Thai learners in developing cultural literacy. A purposive sample of 240 students from Thaksin University participated in the study, engaging with the comics as part of their learning activities. Data were gathered through questionnaires, interviews, expert validation, and cultural literacy assessments, and analyzed using a combination of quantitative and qualitative methods. The results showed that the digital comics were highly valid (CVI = 0.95) and practical (practicality rating = 89.8%), and they significantly improved students' cultural literacy. Regression analysis further revealed that the comics accounted for 68.1% of the variation in students' cultural literacy gains ($R^2 = 0.681$). These findings suggest that culturally-inspired digital comics not only serve as effective learning tools for BIPA students but also offer an engaging and adaptable approach to cross-cultural education. The study encourages further development of digital learning resources that are culturally responsive and learner-centered.

Keywords: Digital Comics, Culture, Cultural Literacy, Language Learning, BIPA.

1. Introduction

Cultural literacy encompasses the ability to comprehend, value, and practice the cultural aspects needed to form a strong national identity and a favorable identity abroad. From cultural literacy, a person is able to learn about their history, traditions, and cultures, which helps them describe the distinctiveness and richness of their culture in an original manner. This process builds cohesion, national dignity, and appreciation of differences, which in turn enhances the country's image internationally (Mbuik & Benu, 2023). Cultural diplomacy uses cultural tools to achieve peaceful relationships with foreign countries. Cultural literacy is an anchor for the public and the government to promote cultural heritage, practice, and endorse cross-border collaboration. Cultural diplomacy which is bolstered by cultural literacy in the practice of cultural and environment protection can enhance both regional and international collaboration, especially in the protection and promotion of sustainable tourism (Sentanu & Mahadiansar, 2020). Therefore, strengthening cultural literacy becomes an important foundation for promoting national culture globally and for fostering mutual understanding between nations.

The introduction of Indonesian culture abroad, including to Thailand, is particularly difficult to initiate because of various structural, cultural, and practical factors. These factors include social context differences between the two countries, and restricted range of activities, which together highlight the necessity to tailor the method of cultural introduction to the Thai context. The introduction of Indonesian culture, within the framework of the BIPA program, has proven to be effective in cultivating an appreciation of Indonesian culture among Thai students in the Inter Disciplinary Cross Cultural Studies. Still, misalignment of the instructional materials with the context of the Thai learners, accompanied by a dwindling number of institutions that provide such programs, pose significant challenges (Isnaniah & Islahuddin, 2020). Moreover, in ethnomathematics, a learning area that combines culture with mathematics, even with support from Indonesian and Thai teachers, varying degrees of motivation and social contexts which underpin the need for different teaching strategies pose challenges (Payadnya *et al.*, 2024). These



challenges indicate that cultural learning requires more contextualized and innovative media that are capable of bridging cultural differences while maintaining learners' engagement and motivation.

There has been an increase in the use of digital media, especially digital comics, for educational purposes and entertainment. Digital comics facilitate access to knowledge and information through comics inclusive of creative engaging images and interactive narratives. In educational settings, digital comics have been shown to increase motivation, comprehension, and engagement. As a result, they have been adopted as one of the innovations in learning that foster entertainment diversity to wide audiences. The use and development of digital comics have increased beyond elementary to tertiary education across domains such as language instruction, science, literacy, and socio-value education (Fitria *et al.*, 2023; Suprpto *et al.*, 2024; Hudhana *et al.*, 2025; Belda-Medina, 2024). Factors such as the interactive nature, ease of access, and the engaging elements of digital comics have been noted to contribute to their growing popularity in education (Al-Abdullatif, 2022; Linardatos & Apostolou, 2023; Apostolou & Linardatos, 2023). Outside the educational domain, Digital comics have emerged as a new form of entertainment offered in social media, websites, and digital apps which has fostered the engagement of active readership and participation in creative communities (Rizzi *et al.*, 2024; Manuzzato, 2023; Berube *et al.*, 2024). This trend indicates that digital comics possess strong potential not only as entertainment media but also as an effective tool for delivering cultural narratives and intercultural learning experiences.

Though the studies of (Mbuik & Benu, 2023; Sentanu & Mahadiansar, 2020) view cultural literacy as the foundation for building identity and cultural diplomacy, the promotion of Indonesian culture abroad, including Thailand, continues to face systemic and pedagogic issues (Isnaniah & Islahuddin, 2020; Payadnya *et al.*, 2024) associated with weak social contextualization and innovation in pedagogy. Prior research completed on the BIPA programs and the development of conventional text-based instruction strategies, targeting the integration of other approaches to bridge cultural gaps using interactive digital media, remained underdeveloped.

Despite recognition of cultural literacy as foundational for identity and diplomacy (Mbuik & Benu, 2023), the promotion of Indonesian culture abroad still faces systemic and pedagogic issues, including weak contextualization and limited pedagogical innovation (Isnaniah & Kurniawan, 2022; Payadnya *et al.*, 2024). Prior BIPA research has focused mainly on conventional, text-based instruction, leaving the integration of interactive digital media underexplored, particularly for Thai learners. Consequently, there is a research gap regarding the use of digital comics to convey Indonesian cultural narratives in cross-cultural education. This study addresses that gap by designing a Nusantara-inspired digital comic that serves as a cross-cultural learning comic to foster representational Indonesian culture among Thai students in Thaksin University. Research about the use of digital comics for learning illustrates that students' interests and comprehension levels, coupled with the degree of engagement attained, improve significantly through the application of visual stories containing interactive features (Yousuf & Conlan, 2018). This study focuses on students of the Malay Language Program at Thaksin University as a conceptualization of Thai learners of Indonesian culture. This study aims to add to the Indonesian digital diplomacy by developing creative contextual eLearning material rising from cultural learning. By integrating cultural storytelling with digital visual media, the study also contributes to strengthening Indonesia's cultural representation in international educational contexts.

This study contributes to the field of digital cultural education by developing and validating a culture-centered digital comic specifically designed to enhance Indonesian cultural literacy among Thai learners. By integrating visual storytelling, narrative elements, and participatory literacy, the study provides a concrete tool that improves cross-cultural learning efficiency. Furthermore, it offers a flexible, technology-driven pedagogical framework that shifts teaching from conventional methods to more interactive digital approaches, demonstrating how innovative media can support learner engagement and intercultural understanding. It also advances digital cultural education by offering an innovative approach that combines visual, narrative, and participatory literacy to improve cross-cultural learning efficiency. Thus, this study will: (1) investigate the needs and characteristics of Thai learners regarding cultural learning media, (2) design and develop culture digital comics based on Indonesian culture tailored to the Thai context, (3) assess the effectiveness of these comics on improving literacy of Indonesian culture and cross cultural learning interest, (4) and promote the developed product as a tool for educational and cultural diplomacy for dissemination through various digital media.



2. Literature Review

2.1 Digital Comics in Education and Cross-Cultural Learning

Digital comics blend telling stories visually along with use of texts which they call a narrative, with adding a dash of creativity and technology, to produce an effective educational tool. As noted, the digital comics helped to streamline complex ideas, warmed up to various types of learners, and (Irdalisa *et al.*, 2023) previously established that through a narrative structure, comprehension and retention increased. Even the simple inclusion of animated illustrations (Umairoh & Amaliyah, 2022) that require the user to engage thoroughly shifts learners from being passive to being actively involved. (Sinaga *et al.*, 2024) further supports this by claiming that this approach multimodal cognitive learning further supports the closing of cultural divides within the world and sheds light on the gaps in the classroom. Digital comics serve as remarkable tools for cross disciplinary cultural learning within the framework of international education. As noted by (Lopes *et al.*, 2024), comics allow digitally connected learners to appreciate cross cultural stories, thereby fostering international understanding. (Carlson *et al.*, 2019) noted the adoption of comics, appreciating peer interaction within the acquisition of learning. This helps bridge local with diasporic concerns and educates students on compassion and imagination in problem solving (Belda-Medina, 2024). As media from different contexts and cultures are added to the classroom, the previously stated outlook of digital comic's supports and expand the inclusive and multicultural responsive frameworks within education.

2.2 Cultural Literacy and Soft Diplomacy through Instructional Media

The term 'cultural literacy', refers to the understanding, appreciation and participation of an individual in, the diverse cultures that characterizes the contemporary world. This assists the individual in manoeuvring through the challenging and intricate web of different cultures and dealing with peoples of differing cultural backgrounds (Podbolotova *et al.*, 2021). Cultural literacy helps in building respecting and inclusive learning environments. The advent of electronic media has greatly augmented this phenomenon and created additional means of cultural interchange. As (Wahyuni & Aswar, 2023) emphasized, interactivity of electronic digital media greatly aids in the cultural exchange and understanding which enables students to acquire necessary cognitive skills and social appreciation in the world.

The application of soft diplomacy also relies on cultural and educational exchanges like the building of international trust and goodwill. Advanced digital media facilitates cross-border communication and collaboration (Kamaluddin *et al.*, 2023). These tools of advanced digital media help in the enhancement of global citizenry skills because students become active participants in international communication and discourse and also acquire advanced language and critical thinking skills. (Jamyly & Farran, 2023) has also noted that media literacy softens the global issues in the hands of any individual and this tends to strengthen the diplomacy of soft educational media. Integrating cultural literacy into education systems assists with the personal development of the individual and ensuring global peace and harmony through the development of soft diplomacy skills of the new generation educators.

2.3 Integrating Indonesian Cultural Heritage into Digital Learning Media

Introducing Indonesian cultural heritage in foreign language teaching periods with digital learning materials like comics is the one of the most effective ways to enhance foreign language teaching and learning. The deep traditions of Indonesia and her historical accounts provide a rich material to increase cultural literacy (Mahfudoh & Sunarso, 2024). Digital comics, in particular, are effective because they use appealing graphics and relevant cultural narratives to enhance students' understanding and foster motivation. For example, (Irdalisa *et al.*, 2023) indicated that digital comics based on ethnosience can simultaneously educate and entertain people, elucidating difficult cultural ideas. Such materials assist the learners to engage with the language and culture of Indonesia and, thus, augment their educational outcomes.

A tangible deficiency surrounds the customization of teaching media to particular learners, in this case, Thai students learning the Indonesian language. Most studies, which focus onto learners of Indonesian or approach the topic in broader terms, fail to appreciate the particular circumstances and the cultural background of Thai learners of the language (Udayani *et al.*, 2021). It is an important gap that provides the basis for designing Thai learner



specific digital comics which would promote better understanding of the culture and more efficient learning of the language. Addressing this gap gives multifaceted educators the chance to formulate and apply pedagogical approaches that exploit the culture language nexus. To sum up, the absence of culture centred digital comics is a deficiency Thai students of the Indonesian language and culture are facing. It does more than promote textbook cultural understanding. It also instils and teaching learning processes built around the language to make it more interesting. Social language and cultural understanding grow in cross mutuality. This kind of gap fosters educators' creativity and motivates them to greater cross-cultural understanding while simultaneously teaching more reflective approaches to language learning.

3. Method

This current study implemented the Research and Development (R&D) methodology by utilizing a 4D model which consists of defining, designing, developing, and disseminating (Fauziah *et al.*, 2025). The 4D model provides a systematic framework for developing instructional media, including design, validation, and implementation. In the Define stage, a needs analysis was conducted to understand Thai students' preferences, motivations, and prior knowledge regarding Indonesian cultural learning. During the Design stage, bilingual storyboards were created to represent Indonesian cultural narratives visually and narratively. The Develop stage involved producing a digital comic prototype, conducting expert validation, and performing limited trials to assess practicality and usability. Finally, the Disseminate stage focused on broader distribution, integration into the BIPA program, copyright management, and publication to share findings with the academic community. Through these four stages, the study ensures that the developed digital comic is pedagogically relevant, culturally appropriate, and technically feasible for implementation in cross-cultural learning contexts.

With reference to the study's population, sampling was purposive and targeted 3rd to 5th semester students actively enrolled in Malay Language and Cultural Studies which provided the needed language proficiency and representativeness as target users of cross-cultural learning media. These students were selected because they had already acquired basic linguistic competence and cultural exposure, allowing them to meaningfully engage with Indonesian cultural learning materials.

The study sample consisted of 240 students who participated in limited trials to provide initial feedback on the comic's content, design, and engagement. Based on the insights from this phase, the comic was refined and subsequently tested with 120 students in a field trial to evaluate its effectiveness in improving cultural literacy. This two-phase sampling allowed the researchers to iteratively enhance the instructional media while ensuring rigorous evaluation (Bostley & Peters, 2023). There is a wide array of instruments for the assessment of the needs, the validity and practicality, and the effectiveness of the specified digital comic (Manuzzato, 2023).

Needs Analysis was assessed through a five-point Likert scale and semi-structured interviews conducted with Thai readers. Validation of the product stems from expert panels from media learning and Indonesia-Thailand Cultural Studies, as well as center focused design groups for the purpose of design refinement (Udayani *et al.*, 2021). Practicality testing was carried out through user response questionnaires and post-use interviews, while media effectiveness was evaluated through pretest–posttest cultural literacy assessments. The combination of quantitative and qualitative techniques enabled a comprehensive evaluation of the pedagogical and cultural aspects of media. This mixed-method approach allows the study to capture both statistical trends and in-depth insights regarding the usability and cultural relevance of the developed digital comics.

All the research instruments (Table 1) underwent content validation and reliability testing (Table 2) to ensure accuracy and consistency in measuring the study variables. The process of validation as discussed previously was carried out with four experts on learning media, Indonesian culture, cross-cultural education and educational technology and the validation with Content Validity Index (CVI) involved assessing the relevance of the items to the measured construct while assessing the instrument's internal consistency with Cronbach's alpha (Kaplan, 2023). All the instruments as per the analysis had CVI values of above 0.80 and Cronbach's alpha values above 0.70. This means the instruments were able to be used to capture data during the instruction and effectiveness testing of the developed digital comics.



Table 1. Research Instrument Blueprint

No	Measured Aspect	Measurement Indicators
1	Needs analysis of Thai readers toward cultural learning media	<ul style="list-style-type: none"> a. Interest in digital-based learning media. b. Preference for types of cultural content (history, traditions, arts, social values). c. Expectations of visual and narrative style of digital comics. d. Need for language and local context adaptation to Thailand.
2	Content and visual validity of digital comics (expert assessment)	<ul style="list-style-type: none"> a. Alignment of content with cultural learning objectives. b. Accuracy in presenting Indonesian cultural values. c. Quality of visual design and media interactivity. d. Integration of text, images, and cross-cultural context. e. Ease of use and accessibility.
3	Product practicality and comprehensibility (user response)	<ul style="list-style-type: none"> a. Ease of understanding comic content and storyline. b. Visual appeal and learning motivation. c. Relevance of material to Thai learners' experience. d. Level of engagement during media use. e. Perceived benefits of media in cultural learning.
4	Media effectiveness on cultural literacy (pretest–posttest)	<ul style="list-style-type: none"> a. Understanding of Indonesian cultural concepts (symbols, values, social practices). b. Ability to identify similarities and differences between Indonesian and Thai cultures. c. Appreciative attitude toward cultural diversity. d. Cross-cultural learning interest after using the media.

Table 2. Instrument Validity and Reliability Results

Instrument	Expert Evaluators (n)	CVI	Validity Interpretation	Cronbach's Alpha	Reliability Interpretation
Learning needs questionnaire	3	0.92	Highly valid	0.89	Reliable
Media expert validation sheet	4	0.94	Highly valid	0.91	Reliable
Cultural content validation sheet	4	0.96	Highly valid	0.93	Reliable
User response questionnaire	3	0.90	Highly valid	0.88	Reliable
Cultural literacy test	3	0.89	Valid	0.86	Reliable

This study employed a mixed-methods approach combining qualitative and quantitative analyses to evaluate the developed Indonesian culture-inspired digital comic and its impact on Thai learners' cultural literacy. Qualitative data were collected through open-ended questionnaires and semi-structured interviews to explore students' needs, preferences, and learning contexts (Creswell, 2014), and were analyzed thematically to identify patterns that informed the comic's design and refinement. Quantitative data were obtained from expert validation sheets assessing content accuracy, cultural appropriateness, and technical feasibility; user questionnaires measuring practicality and usability; and cultural literacy assessment tests evaluating learning outcomes. Validation and scoring procedures included the calculation of the Content Validity Index (CVI ≥ 0.80 as acceptable), descriptive percentage analysis for media practicality ($\geq 85\%$ = highly practical, 70–84% = practical, 55–69% = fairly practical, $< 55\%$ = less practical), and paired sample t-tests ($p < 0.05$) to assess improvements in cultural literacy. Simple and multiple linear regression analyses were performed to determine the contribution of the digital comic to cultural literacy and cross-cultural learning interest, with R^2 values indicating the proportion of variance explained (Okello, 2022). Data consistency and



validity were ensured through cross-checking between qualitative and quantitative datasets, confirming that the digital comic is a valid, practical, and effective tool for enhancing cross-cultural learning among Thai students. Table 3 explain the interpretation for need analysis and media validation score.

Table 3. Data Analysis Criteria

Data Type	Analysis Technique	Interpretation Criteria
User needs data	Quantitative descriptive analysis and qualitative thematic analysis	<ul style="list-style-type: none"> • 1.00–1.80 = Very Low • 1.81–2.60 = Low • 2.61–3.40 = Moderate • 3.41–4.20 = High • 4.21–5.00 = Very High
Media practicality data	Descriptive percentage analysis	<ol style="list-style-type: none"> 1. $\geq 85\%$ = Highly Practical 2. 70–84% = Practical 3. 55–69% = Fairly Practical 4. $< 55\%$ = Less Practical

4. Results

4.1 Define Stage Results – User Needs Analysis

The Define stage indicated a significant need for visual and interactive digital learning materials among 240 students in Thai universities. Table 4 shows the respondent distribution details. Respondents largely appreciated digital comics as a more engaging and easier option than traditional textbooks. More specifically, they exhibited interest in content about Indonesia's monumental culture, heritage sites like the Borobudur and Prambanan Temples, traditional arts, the batik and wayang, and other regions. Many students, on the other hand, had issues grasping the culturally distinct Indonesian social context and the culturally specific phrases. To solve these problems, the respondents underscored the need for a bilingual (Indonesian–Malay) edition that included a glossary and focused analytical cultural comparison with Thailand. This finding indicates that cross-cultural learning materials must not only present cultural information but also provide linguistic and contextual scaffolding to facilitate comprehension among foreign learners.

As for the design, students indicated a preference for comic books that employ vivid colours, are illustrated in a semi-realistic anime style, and feature engaging and identifiable characters and narratives, which should ideally span 10–15 minutes in length for each episode. Other participants also appreciated comics with interactive elements like clickable explanations, basic animations, and brief quizzes. Respondents, the majority of whom were third- and fourth-semester students aged 19-22 with at least one semester of studying Indonesian culture, provided well developed and relevant responses.

Table 4. Details of Respondent Distribution (n = 240)

Characteristic	Category	Frequency	Percentage (%)
Semester	Semester 3	95	39.6
	Semester 4	87	36.3
	Semester 5	58	24.2
Age	19–20 years	102	42.5
	21–22 years	118	49.2
	>22 years	20	8.3
Experience in Learning Indonesian Culture	None	28	11.7
	1 semester	134	55.8
	2 semesters	65	27.1
	>2 semesters	13	5.4
Total		240	100.0



These responses emphasize the need for cultural reference, linguistic and aesthetic modification, and sociocultural context when developing educational materials that are intended to be engaging and motivational. Therefore, the results of this stage served as the conceptual foundation for designing culturally responsive digital comics tailored to the learning characteristics of Thai students.

A demands analysis conducted on 240 Thai students revealed (mean score = 4.39) a stark necessity for the creation of digital learning media focusing on Indonesian culture. Digital media attracted interest with the highest score (4.50) along with the need for Thai language and culture adaptation (4.47) and the demand for attractive visuals and narratives (4.35) in a descending order. Preferences for cultural content were very high (4.23) with historical temples being the most preferred. These results indicate that Thai students possess a considerable enthusiasm toward learning about Indonesian culture with the support of language-sensitive digital media that is visually stimulating. The high mean scores across all indicators demonstrate that digital media integrating cultural narratives, visual storytelling, and contextual language support are highly relevant for cross-cultural learning environments. Overall, students' requirements for digital cultural learning media were labeled very high (mean = 4.39) particularly for interest in digital culture learning, visual–narrative elements, and contextual language learning relevant to Thailand, as listed in table 5.

Table 5. Results of Cultural Digital Learning Needs Analysis

No.	Learning Need Indicator	Mean Score	Category
1.	Interest in Digital-Based Learning Media	4.50	Very High
2.	Need for Language and Local Context Adaptation (Thailand)	4.47	Very High
3.	Expectation for Visual and Narrative Style of Comics	4.35	Very High
4.	Preference for Appealing Cultural Content	4.23	Very High
	Overall Mean	4.39	Very High

Meanwhile, the interview results (Table 6) confirmed a strong interest in temple and visual cultural content, with the main challenges being difficulty in understanding cultural terminology and the lack of comparative context between Indonesia and Thailand. The primary expectations were bilingual media, visually engaging designs, and short episodic stories. These qualitative findings reinforce the quantitative results by highlighting the importance of combining linguistic accessibility with visually rich storytelling in digital learning media.

Table 6. Themes from Semi-Structured Interview Results

Main Theme	Dominant Subtheme	Frequency (n)	Sample Quotation
Motivation to Learn Culture	Cultural similarities between Indonesia–Thailand; learning language through culture	11 / 9	"Learning the language is easier when I understand the cultural stories."
Learning Barriers	Difficulty understanding cultural terms; lack of comparative context; boring textbooks	12 / 10 / 8	"Many cultural terms have no equivalent in Malay."
Expectations for Media	Bilingual format; visually appealing; short episodic stories	12 / 11 / 9	"If there were Malay translations and colorful visuals, I would understand much better."
Content Preferences	Temples and historical sites; visual arts; life values	12 / 10 / 7	"Borobudur is very famous—I want to learn more about it."

Based on this needs analysis, it can be concluded that Thai students show exceptionally high enthusiasm for using digital comics as a learning media for Indonesian culture. In order to adapt language, context culturally, and fashion, under media, and contextually as well as to the illustrations, the visual components that must be interwoven during the media designing stage need to be consolidated and resolved concurrently as interrelated problems.



Evidence suggests that the media which is to be developed must emphasize bilingual treatment, contextualized stories, contemporary illustrations, and culturally important historical materials, especially those related to the ancient temples in Indonesia. Thus, the Define stage provides empirical justification for developing culturally contextualized digital comics as a medium for cross-cultural learning between Indonesia and Thailand.

4.2 Design Stage Results – Product Development

Stage Design made a digital comic prototype named “Jejak Candi: The Cultural Adventure of the Archipelago” in relation to the Thai learners needs analysis outcome. The comic is intended to be viewed on mobile devices in vertical webtoon format and consists of five episodes in which learners encounter cultural crossovers with Indonesia through historical temples. The creation of the comic was a joint effort of specialists in instructional media, visual designers, cultural experts, and illustrator artists to ensure correctness in content, language, and teaching approach. This collaborative design process ensured that the product integrated pedagogical, cultural, and technological considerations in a balanced manner.

Design outcomes demonstrated that Thai students enjoyed illustrations in a stylistic approach with semi-realism as well as the blended first person commentary in Indonesian and Malay, as well as motifs of spirituality and harmony with nature. These facts indicated and governed the use of cultural visual storytelling design principles that targeted Arum and Nara, two cross cultural children of Thailand and Indonesia. Interactive features, such as a cultural glossary, visual cultural comparison panels, and reflective quizzes at the end of each episode, were integrated to enhance engagement and cross-cultural comprehension. Such features were designed to encourage reflective learning and intercultural dialogue, enabling students to actively compare Indonesian and Thai cultural contexts.

Table 7. Digital Comic Design Characteristics Based on Needs Analysis

Component	Design Specification	Rationale (Based on Thai Students' Needs Analysis)
Title and Theme	<i>Jejak Candi: The Cultural Adventure of the Archipelago</i> – focusing on Indonesia's historical temples	Temple themes received the highest preference (Mean = 4.47) due to their spiritual and historical relevance to Thai culture
Cultural Values	Spirituality, harmony with nature, mutual cooperation (<i>gotong royong</i>), tolerance	Universal values that are easily understood and contextually relevant to Thai society
Story Structure	5 episodes, 30–40 panels per episode, reading duration 10–15 minutes	Aligned with ideal reading duration (Mean = 4.27) and episodic preference
Language	Bilingual (Indonesian–Malay) with interactive glossary	High need for translation and explanation of cultural terms (Mean = 4.68 and 4.54)
Main Characters	Arum (Indonesia) and Nara (Thailand), university students aged 20–21	Peer representation and symbol of intercultural dialogue (Mean = 4.31)
Visual Style	Semi-realistic with anime/manga influences	Most preferred visual style among Southeast Asian students (Mean = 4.43)
Color Palette	Warm tones (orange, gold) combined with cool tones (blue, turquoise)	Symbolizing balance and cultural prosperity
Interactive Features	Info buttons, relief detail zoom, cultural comparison panels, mini quizzes	Addressing the need for interactive and reflective elements (Mean = 4.19–4.41)
Distribution Platform	Web-based (HTML5), vertical format	High accessibility without additional application installation
Accessibility	Vertical scrolling navigation, universal icons, file size <15 MB	Aligned with Thai students' digital content access habits



The resulting digital comic design demonstrates a high degree of alignment between Thai learners' needs and Indonesian cultural elements. The development results confirm that the integration of cross-cultural narratives through interactive visual media effectively facilitates a contextual and engaging understanding of Indonesian cultural values (Archipelagic Heritage). This alignment between user needs and design specifications strengthens the pedagogical relevance of the developed digital comic as a cross-cultural learning medium, as listed in table 7.

4.3 Develop Stage Results – Validation and Testing of the Digital Comic

The Development Phase evaluates the feasibility, practicality, and effectiveness of digital comics through three sub-phases: expert validation, limited trials, and field implementation. This stage aims to ensure that the developed product meets academic standards of validity, usability, and instructional effectiveness before wider dissemination.

4.3.1 Expert Validation

Expert validation included four specialists in digital instructional media, Nusantara and Southeast Asia studies, cross-cultural and BIPA education, and education technology specializing in UI/UX design. The digital comic recorded high validity, achieving an overall Content Validity Index (CVI) score of 0.95. Of particular note, cultural accuracy achieved a mean score of 4.81 with CVI of 0.98, and confirmed the presence of Indonesian cultural value. Also, highly rated text-image integration, bilingual strategy, and learning objectives alignment (CVI = 0.96) contributed.

Visual design, functionality, and user accessibility remained consistently classified as highly valid (CVI scores of 0.94 and 0.92, respectively). Eight minor improvement suggestions focusing on tutorials, audio quality, and interactivity, which all were implemented before testing. High expert agreement level (mean = 4.69) consolidated the product's readiness for further testing, as shown in Table 8.

Table 8. Expert Validation Results of the Digital Comic

Validation Aspect	Item	V1	V2	V3	V4	Mean	SD	CVI	Category
Alignment with cultural learning objectives	3	4.67	5.00	4.67	4.33	4.69	0.28	0.96	Highly Valid
Accuracy of Indonesian cultural values	4	4.75	5.00	4.75	4.75	4.81	0.13	0.98	Highly Valid
Visual design and interactivity quality	4	4.50	4.50	4.75	4.75	4.63	0.14	0.94	Highly Valid
Integration of text, imagery, and cross-cultural context	4	4.75	5.00	4.75	4.50	4.75	0.20	0.96	Highly Valid
Ease of use and accessibility	3	4.33	4.67	4.67	4.67	4.58	0.17	0.92	Highly Valid
Overall Mean	18	4.60	4.83	4.72	4.60	4.69	0.18	0.95	Highly Valid

4.3.2 Practicality Testing

Involving 240 Thai students, limited trials found that the digital comic in question earned average ratings of 4.43 (Very Practical), with regard to the aspects of the comic as learning tools. With the scores of learning motivation and visual appeal motivation having the highest mean of 4.53, it can be suggested that the design was able to capture students' interests. High scores in the learning benefit (4.47) suggested that the students were able to gain cultural understanding. These findings indicate that the developed media successfully combines educational value with visual attractiveness, which is crucial for sustaining learner engagement in digital learning environments.



These results (Table 9) were further complemented with the results of a field trial with 120 students, where the mean rose to 4.49. Interestingly, as many as 89.2 percent of the assessors indicated the innovation as "Very Practical," with no negative ratings given. The largest gains were in relevance, engagement, and comprehension, underscoring that the digital comic was indeed captivating and applicable to genuine learning environments. The consistently high practicality scores across both trials demonstrate the usability and acceptance of the media among Thai learners.

Table 9. Practicality Test Results: Limited and Field Trials

Practicality Aspect	Limited Trial (n=240) Mean (SD)	%	Field Trial (n=120) Mean (SD)	%
Ease of understanding content and storyline	4.42 (0.58)	88.4	4.48 (0.54)	89.6
Visual appeal and learning motivation	4.53 (0.51)	90.6	4.56 (0.49)	91.2
Relevance of material to Thai experience	4.35 (0.64)	87.0	4.41 (0.61)	88.2
Student engagement level	4.38 (0.61)	87.6	4.44 (0.57)	88.8
Perceived benefit of cultural learning	4.47 (0.55)	89.4	4.52 (0.52)	90.4
Overall Mean	4.43 (0.58)	88.6	4.49 (0.55)	89.8

4.3.3 Effectiveness Testing – Improvement in Cultural Literacy and Learning Motivation

The purpose of the effectiveness test was to gauge the improvement of cultural literacy and motivation for cross-culture learning among Thai Students due to Indonesian culture inspired digital comics. With the help of the one-group pre-test/post-test design over a course of three weeks and 240 participants, four different dimensions were assessed. These dimensions represent key indicators of intercultural competence in language and cultural learning environments. Table 10 lists the results of prerequisite tests.

The t-test results (Table 11), as well as the normal and homogeneity tests, (Kolmogorov test and Levene's test, $p > 0.05$), all confirmed that the data were able to meet the parametric assumptions. All dimensions of cultural literacy and motivation were assessed as a paired sample, with t= test results showing a significant improvement across the board, $p < 0.001$. This indicates that the digital comic intervention significantly enhanced students' cultural understanding and interest in cross-cultural learning.

Table 10. Results of Prerequisite Tests

Test	Variable	Statistic	df	p-value	Conclusion
Normality (K-S)	Cultural Literacy Pre-test	0.068	240	0.082	Normal
	Cultural Literacy Post-test	0.071	240	0.065	Normal
	Learning Motivation Pre-test	0.062	240	0.124	Normal
	Learning Motivation Post-test	0.069	240	0.074	Normal
Homogeneity (Levene's Test)	Cultural Literacy	2.18	478	0.140	Homogeneous
	Learning Motivation	1.95	478	0.163	Homogeneous

There was a significant improvement in all aspects in cultural literacy after the intervention. The total cultural literacy score improved from a baseline of 52.38 to 75.62, which means an average of 23.24 points was gained ($p < 0.001$). The effect size was large as seen with the Cohen's d value equaling 2.12, which verifies that the digital



comic had a great impact on the enhancement of cross cultural literacy. The large effect size indicates that the intervention had a substantial educational impact beyond statistical significance.

Table 11. t-Test Results for Cultural Literacy and Learning Motivation

Measured Aspect	Pretest Mean (SD)	Posttest Mean (SD)	Gain	t	p-value	Cohen's d	Interpretation
Understanding of cultural concepts	51.25 (8.42)	75.83 (7.15)	24.58	35.42	<0.001	2.29	Very High Effectiveness
Identification of cultural differences	52.83 (9.15)	76.00 (7.48)	23.17	31.68	<0.001	2.05	Very High Effectiveness
Appreciative attitude toward diversity	53.17 (8.76)	75.62 (7.82)	22.45	30.12	<0.001	1.94	High Effectiveness
Cross-cultural learning motivation	52.25 (9.38)	75.00 (7.65)	22.75	29.85	<0.001	1.93	High Effectiveness
Total Cultural Literacy	52.38 (7.92)	75.62 (6.58)	23.24	32.86	<0.001	2.12	Very High Effectiveness

4.4 Regression Analysis

The digital comic significantly enhanced both cultural literacy and cross-cultural learning motivation among Thai students. Regression analysis (Table 12) showed that media usage intensity (X_1) positively influenced cultural literacy (Y_1) and learning motivation (Y_2), $p < 0.001$. Alone, X_1 explained 68.1% of the variance in cultural literacy and 63.1% in learning motivation, indicating that more frequent engagement with the comic leads to greater learning gains. When media practicality (X_2) was included, the model's explanatory power increased to $R^2 = 0.743$ for cultural literacy and $R^2 = 0.698$ for learning motivation, showing that both the intensity of use and the perceived practicality together account for nearly 70–74% of students' improvements. These findings highlight that the digital comic is not only engaging but also a highly effective tool for enhancing learners' understanding of Indonesian culture and fostering motivation in cross-cultural learning contexts.

Table 12. Simple Linear Regression Results

Model	Dependent Variable	Independent Variable	B	t	p-value	R ²	Interpretation
Model 1	Cultural Literacy (Y_1)	Media Usage Intensity (X_1)	0.74	24.18	<0.001	0.681	Strong, Significant Effect
Model 2	Learning Motivation (Y_2)	Media Usage Intensity (X_1)	0.69	21.35	<0.001	0.631	Strong, Significant Effect

In general, the regression analysis attested to the fact that the frequent use of digital comics, particularly the ease of navigation, positively correlated with advancements in cultural literacy and learning motivation. The R^2 values higher than 0.60 confirmed the effectiveness of the model, thus corroborating the digital comic's potential not only as a means to convey cultural information, but also as a means to facilitate reflective learning that enhances motivation towards transnational educational engagement.

4.5 Cultural Literacy Level Shift

The students jumped from a moderate to a high, and even to a very high level. They showed a remarkable degree of improvement even post the intervention. This change is clearly visible on the graphs and maps which represent the data on changes in culture level. The findings indicate that the Indonesian culture-inspired digital comic



effectively supported Thai students in improving their cultural literacy and cross-cultural learning motivation as shown in Table 13. Most students experienced noticeable learning gains, particularly in understanding cultural narratives through visual and interactive storytelling.

Table 13. Distribution of Thai Students' Cultural Literacy Level Improvement

Category	Score Range	Pretest f (%)	Posttest f (%)	Shift	N-Gain Mean	Effectiveness
Very High	81–100	0 (0.0)	52 (21.7)	+52	0.504	Moderate
High	61–80	23 (9.6)	176 (73.3)	+153	0.491	Moderate
Moderate	41–60	184 (76.7)	12 (5.0)	-172	0.479	Moderate
Low	21–40	33 (13.8)	0 (0.0)	-33	–	–
Total	–	240 (100%)	240 (100%)	–	0.488	Effective (Moderate)

Expert evaluations confirmed that the comic was highly valid, and student feedback indicated it was practical and user-friendly. Paired t-tests revealed statistically significant improvements in cultural literacy ($p < 0.001$) with a large effect size (Cohen's $d > 2$), while regression analyses suggested that both the intensity of media use and its perceived practicality explained a substantial portion of the variance in literacy and motivation (R^2 ranging from 0.63 to 0.74). Overall, the results suggest that the digital comic is a promising educational tool for cross-cultural learning, enhancing engagement and comprehension while remaining within the measured outcomes.

5. Discussion

The results of this study indicate that the Indonesian culture-inspired digital comic was highly valid (CVI = 0.95), practical (89.8%), and effective ($p < 0.001$; $d = 2.12$) in enhancing the cultural literacy of Thai university students. These outcomes highlight the value of a user-centered design approach, expert evaluations, and systematic empirical testing in developing educational media. The findings suggest that culturally contextualized digital comics, particularly those employing bilingual visual narratives, can support cross-cultural learning by improving students' comprehension of cultural content and fostering reflective thinking about the social meanings and values embedded in the materials. This interpretation aligns with previous research indicating that interactive visual storytelling enhances engagement, cognitive processing, and deeper understanding of cultural concepts (Belda-Medina, 2024; Suprpto *et al.*, 2024). By integrating cultural narratives with digital visual media, the study demonstrates a practical approach for strengthening students' cultural literacy and motivation in a cross-cultural learning context.

Moreover, digital comics serve as a culturally mediated work through the embodiment of text, cultural icons, and transnational meaning-making interpretations. As Wilde (2023) observed, digital comics circulate cultural agency through narrative and transactional digital spaces, enabling cultural meanings to be indefinitely redefined in digital environments. These observations resonate with Berube *et al.* (2024), who pointed out the intersection of technology and civic engagement. Thus, digital comics function not merely as learning tools but also as cultural communication platforms that enable learners to interpret and negotiate cultural meanings in digital environments. Hence, these data broaden the scope of the cultural literacy theory in relation to digital technology in education, as argued above, by demonstrating that digital comics do not only embody culture, but also cultural experience as mediated form that is alive and dynamic, and transcends geospatial and linguistic boundaries.

This research adds to existing knowledge on the cross-cultural use of education by incorporating the theory of visual narrative pedagogy and the development reluctance in multimodal learning. From the theory's perspective, the research validates the pedagogical benefits of digital comics' interactive visual narrative features compared to static text. Deep learning is supported by the integration of visuals, narrative, and interactivity along with symbols, characters and context (Fitria *et al.*, 2023; Linardatos & Apostolou, 2023). The multimodal instructional design



supports the cognitive constructivist theory by activating more than one channel of information; the learner senses and interacts with the materials (Suprpto *et al.*, 2024; Al-Abdullatif, 2022). This confirms that multimodal digital learning environments can enhance cognitive engagement and facilitate deeper comprehension through the simultaneous activation of visual, textual, and interactive learning channels. In the domain of visual and narrative pedagogy, the works of Yousuf and Conlan (2018) on exploratory visual narratives, and Stanciulescu *et al.* (2022) on dynamic progressive visuospatial cues, supports this theory. In cross-cultural education, the developed digital comic is an example of pedagogical diplomacy that acts as a bridge to dialogic visual narratives and to merging Indonesian and Thai identities and perspectives.

(Astuti *et al.*, 2024) shows that there is cross cultural gain from code switching that is bilingual. Then there is the addition of interactive components that foster engagement and comprehension (Zhi *et al.*, 2019). This is supported by Stanciulescu *et al.* (2022) in claiming that the moral and cultural messages of digital comics are primary due of how digital comics communicate them and by Birla and Sunaina (2023) in pointing out that digital media has enabled deeper ASEAN cultural diplomacy. The bilingual narrative and intercultural storytelling approach used in this study therefore promotes dialogic learning, allowing students to compare, interpret, and reflect upon cultural similarities and differences between Indonesia and Thailand. This comic on interculture has characteristics of both nations and with the stereotypes of the nations, fosters transformative intercultural learning. This support the mutual respect and cultural solidarity needed for educational diplomacy in the digital age.

The practicality and validation tests conducted indicate that alongside the Cross-Cultural Learning approach the developed digital comic has cross-cultural learning relevance, with a CVI value of 0.95 and practicality value of 89.8%. These results highlight the user-centric design principle that the media and design should match the requirements of the users (Al-Abdullatif, 2022; Linardatos & Apostolou, 2023). Interactive elements like the mini-quizzes, cultural glossary, zooming in on temple reliefs, and the bilingual narration of stories, have been shown to promote the relevance of Thai students to the culture. These features facilitate active learning processes by encouraging exploration, reflection, and contextual understanding of cultural content. In terms of cultural literacy, quantitative data shows that students had a gain of +23.24 ($p < 0.001$). The value of $R^2 = 0.681$ shows that the use of digital comics accounts for 68.1% of the gain in cultural literacy, while Cohen's $d = 2.29$ indicates a significant gain on the understanding of the cultural concepts.

These results support what other previous studies have found in Indonesia including Bina (2025) who found an 89% improvement in numeracy with the use of cultural comics, Zain *et al.* (2024) who found improvements in reading literacy with the use of folklore, and Dharma *et al.* (2025) who found an effect size of 0.849 with the use of culture-based digital books in Balinese learning contexts. This research extends these findings to a cross-national and cross-linguistic context, demonstrating that incorporating local culture into digital media can foster both local cultural identity and cross-cultural understanding.

This study has several practical implications. The Indonesian culture-inspired digital comic developed here can be applied in BIPA and cultural studies programs in Thailand as a model for cross-cultural education. Quantitative results showed significant improvements in cultural literacy (Mean Gain = 23.24, $p < 0.001$; Cohen's $d = 2.12$) and that media usage intensity explained a substantial portion of the variance in literacy and motivation ($R^2 = 0.681 - 0.743$). Complementing this, qualitative data from student feedback and interviews indicated that bilingual storytelling, interactive mini-quizzes, and culturally rich visuals fostered engagement, exploration, and reflective thinking. Together, these findings demonstrate that the comic not only supports comprehension of Indonesian cultural content but also encourages active, reflective, and motivated learning. By combining Thai and Indonesian cultural perspectives in a balanced and interactive format, the comic provides a practical example of how digital media can enhance cultural literacy and cross-cultural understanding, consistent with pedagogical principles highlighted by Erbe *et al.* (2023) and Li (2021) regarding culture teaching in language classes.

The cross of technology and heritage education is also represented in the responsive HTML5 format, which is a shift in digital educational innovation that is aligned to the work of Kamaluddin *et al.* (2023) on the benefits of adaptive teaching materials. This research does acknowledge its shortcomings of the sample scope (Thaksin University students) and the duration of the trials and the lack of sustained retention measures. However, this study has several limitations. The sample was restricted to students from Thaksin University, the trial duration was relatively short, and no longitudinal measures were used to assess long-term retention of cultural literacy. Future research



should expand to other ASEAN universities, include larger and more diverse samples, and incorporate longitudinal assessments to examine sustained improvements in cultural literacy and cross-cultural learning outcomes.

6. Conclusion and Suggestions

Generally, the current study validated the success of user-centered design methodology in developing cross-cultural instructional media relevant to the real-life contexts of Thai learners. Digital comics fulfil the technical and pedagogical feasibility requirements, and more importantly, foster cultural empathy through the skilful incorporation of visual narratives, meditative bilingual components, and culturally tailored materials aligned with the audience's interests. These findings demonstrate that culturally responsive digital learning media can effectively bridge linguistic and cultural gaps in international educational settings. This achievement serves as a testament to the notion that digital products for cultural education ought not to merely be the digitalization of traditional content; instead, a fundamental re contextualization to the learners' socio-cultural context is needed. Thus, the integration of local cultural narratives, visual storytelling, and interactive elements becomes a crucial strategy for enhancing intercultural understanding in digital learning environments.

The findings of the current study should prompt the systematic inclusion of similar media to BIPA (Bahasa Indonesia for Foreigners) instructional programs and cultural diplomacy efforts. By incorporating digital comics into BIPA curricula and international cultural programs, educational institutions can strengthen Indonesia's cultural representation while simultaneously promoting intercultural dialogue among foreign learners.

On the other hand, the scholarly community needs to address the creation of multilingual versions of the materials, AI-driven personalized learning, and other longitudinal investigations on the enduring effects of learning. Future research may also explore adaptive digital learning environments that integrate artificial intelligence to personalize cultural learning experiences based on learners' linguistic proficiency and cultural background. The potential for the same template to be applied to a wider array of source and target cultural contexts in order to build a more robust theoretical contribution to cross-cultural digital pedagogy needs to be addressed. Expanding the application of this model across different cultural contexts may contribute to the development of a broader framework for digital intercultural pedagogy and global cultural education.

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Luthfa Nugraheni: Conceptualization, Methodology, Investigation, Data Curation, Writing – Original Draft, Supervision. Irfai Fathurohman: Formal Analysis, Validation, Writing – Review & Editing. Richma Hidayati: Visualization, Resources, Data Curation. Rani Setiawaty: Investigation, Data Collection, Project Administration. Muhammad Salaebing: Validation, Resources, Writing – Review & Editing. All authors have read and agreed to the published version of the manuscript.

Does this article screen for similarity?

Yes

Conflict of Interest

The authors have no conflicts of interest to declare. There is also no financial interest to report. The author certifies that the submission is original work and is not under review at any other publication.

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