An Enthoscience Based Digital Comic Development

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Abstract

Scientific literacy abilities remain low, and students' lack of interest in learning about culture is a contemporary educational concern, thus innovative, creative, and fascinating learning methods are required to boost students' interest in reading and the building of national cultural character. Many academics have worked on the development of digital comics in the field of science, but there are still few who integrate the material with local expertise to generate cultural characters. Based on the Independent Learning Curriculum, this ethnoscience-based digital comic was created as a pilot project and learning resource for teachers and students in Indonesia to master science, technology, skills, and attitudes. The data was analysed by converting validator answer data into qualitative data using a Likert scale. The research subjects included media, material, and language experts, 60 high school science students in class XI, and six biology professors. Expert validation exams and questionnaires were utilised as instruments. The data was analysed by converting qualitative data from validator answer data on a Likert scale. According to P5 (Strengthening Pancasila Student Profile Project), the goal of this research is to assess the impact of the ethnoscience-based digital comic "Tari Telek" on movement system material in improving students' scientific literacy skills and national cultural character. This study employs the 4D process (Define, Design, Develop, and Disseminate). The results of the validity tests suggest that the ethnoscience-based digital comics "Tari Telek" have a moderate level of validity, with an Aiken index value greater than 0.4. The feasibility test scores were 88% for instructors and 90% for students, and media practicability was 88% for teachers and 89% for students. It is possible to infer that ethnoscience-based digital comics "Tari Telek" are valid, realistic, and practical to utilise as supplemental media for Biology learning.

Keywords: Ethnoscience, Digital Comic, Movement System, Tari Telek

Introduction

The Independent Learning Curriculum in Indonesia has allowed teachers the opportunity to employ a variety of teaching materials based on the needs and characteristics of their pupils. Applications that give diverse references for teachers will also be used, allowing teachers to build teaching techniques on their own. The teching profession requires continuous professional development, particularly through the use of successful models, methodologies, strategies, and learning media (Sims et al., 2021). However, some teachers' concept of designing learning media remains categorical in the field. Teachers' usage of learning material is still limited on average (Irdalisa et al, 2022). Teachers continue to employ

simple media like as textbooks and photographs (Yin, Wang, Zhao, Lou, & Shen, 2021). This is one of the elements contributing to Indonesia's literacy abilities being less competitive in comparison to other nations, resulting in a literacy culture crisis (Gao et al., 2020). Data from The Programme For International Student Assessment (PISA) show that Indonesia's literacy capacity ranks 74th out of 79 nations, with an average score of 371 (Hewi & Shaleh, 2020).

Aside from the issue of literacy, the government is also concerned about the country's cultural identity. Because of the increasing amount of other cultures entering Indonesia, Indonesian culture is beginning to fade. As a result, people prefer foreign cultures that are more practical than local cultures. One of the issues contributing to the erasure of local culture today is a lack of future generations interested in studying and passing down their heritage (Nahak, 2019). A culture-based learning approach can allow students to create meaning and achieve an integrated understanding of the scientific information they receive, as well as apply this scientific information in the context of their culture community's problems (Saliman, 2016). To develop the nation's cultural character, education must be used as a cultural metamorphosis from one generation to the next (Pyo, Lee, Bae, Sim, & Kim, 2021).

Solving literacy difficulties and shaping the nation's cultural identity, one of which is through the development of entertaining and innovative educational medium, such as digital comics. Digital comics help students see the big picture and articulate story concepts in a coherent and appealing way (Lim et al., 2020). Teachers can use digital comic media to assist them express learning material and make the learning process more relevant (Ranting & Citra Wibawa, 2022). linkages, etiquette, emotions and thoughts, place and time, and cause and effect linkages portrayed with pictures are all fictitious components in digital comics (Akcanca, 2020). Digital comics are acceptable for use in science learning because they contain storylines that are relevant to the learning experience as well as technology advancements that make them practical, versatile, and easily available to users (Davy Tsz Kit, Luo, Chan, & Chu, 2022). Ide-ide kreatif dapat ditumbuhkan melalui metode pembelajaran maupun dengan bantuan aplikasi baru yang berkaitan dengan kegiatan nyata untuk menantang dan berupa pemecahan masalah menyarankan desain yang otentik dan baru, menghasilkan hipotesis yang berbeda (Jayathilaka et al., 2019).

Creation of digital comics Many scholars have done this, however digital comics based on ethnoscience are still uncommon, despite the fact that the Merdeka Curriculum includes a Pancasila Student Profile programme that shapes national character. Ethnoscience is an activity that uses science to modify society's original scientific knowledge (Risdianto et al. 2021). Ethnoscience-based learning facilitates students' understanding and application of the science they learn and encounter in their daily lives (Nuralita, Reffiane, & Mudzanatun, 2020).

Tari Telek is an Indonesian culture that can be introduced into Biology lectures. Tari Telek was designated a UNESCO World Heritage Site in 2011 (Irmania, Trisiana, & Salsabila, 2021). Tari Telek is used as an extracurricular exercise in some schools. Tari Telek is also included in the local content curriculum in Indonesian schools ranging from elementary to high school and even colleges (Rajab Bahry, 2014). The dancing movements of this Tari Telek are dominated by hand, body, and head motions, but the most prominent movement of this Tari Telek is the hand movements, which are highly rapid and compact (Souri & Bhattacharyya, 2018). The Tari Telek's qualities are thought to be appropriate for use in learning media, particularly biology, movement system information in biology lectures. The goal of this study is to create ethnoscience-based digital comics for movement system material in secondary schools and to assess the product's validity, feasibility, and practicability (Nozariasbmarz et al., 2020).

Methods

The Research and Development (R&D) method will be used in this research, together with a development model 4D (Four-D Models) devised by Thiagarajan (1974). This 4D development

paradigm is divided into four stages: define, design, develop, and disseminate (Wang et al., 2021). The procedure is as follows:

Stage definition (definition)

At this step, doing a needs analysis entails identifying the issues encountered by teachers and students, particularly in the learning media utilised by teachers during the classroom learning process.

Design Stage (Designing) The process of making digital comic media by arranging content, developing story ideas, constructing scenarios, and preparing comic forms.

Stage of Development (Development)

This stage of development entails publishing digital comics using the Flif PDF Professional tool, followed by validating/feasibility and practicality of digital comic media (Song, Li, Won, Bai, & Rogers, 2020).The next step in testing the feasibility of what was done in this research was to determine whether or not the digital comic material delivered to biology professors and students was realistic.

Stage (Dissemination) This is the final stage of development, meaning distributing or promoting the finished product. This data analysis technique was derived from a validation questionnaire distributed to material experts, language experts, and media experts, and it was applied using Aiken's validity test formula, which is based on the results of expert assessments of n people on an item in terms of the extent to which the item represents the construct being measured, and it is as follows:

$$V = \frac{\Sigma S}{[n(c-1)]}$$

Information :

s = r – lo
lol = low validity assessment number (in this case = 1)
r = number given by an appraiser
n = number of validators (raters)
c = highest validity assessment number (in this case = 4

Following the receipt of the validated questionnaire scores, the scores are interpreted in accordance with the following benchmarks:

Table 1. Validity criteria for expert tests

No.	Mark	Criteria
1.	0.8 - 1.0	Very Valid
2.	0.61 – 0.80	Valid
3.	0.41 – 0.60	Fairly Valid
4.	0.21 – 0.40	Less Valid
5.	0.00 – 0.20	Invalid

This data analysis technique was derived from a feasibility questionnaire distributed to 6 teachers and 60 students, with the % appropriateness formula being used. Criteria interpretation score based on Likert scale:

Table 2. Eligibility interpretation criteria

Percentage (%)	Category
0 – 20	Very less
21 – 40	Not enough
41 – 60	Enough
61 – 80	Good
81 – 100	Very good

To calculate the percentage , use the following

$$K = \frac{F}{N \; x \; I \; x \; R} x \; 100\%$$

Information:

K = Percentage of eligibility
F = Number of response answers
N = Highest score in the questionnaire
I = Number of questions in the
questionnaire R = Number of respondents

This data analysis technique was derived from a feasibility questionnaire distributed to six teachers and sixty pupils. The practicality questionnaire for instructors and students uses a positive Linkert scale with four answer categories that will be transformed into grades using the following value scale:

Table 3. Practicality Category Criteria

Score	Category	Score
1	Very good	4
2	Good	3
3	Enough	2
4	Not enough	1

Furthermore, in order to determine the usefulness of digital comic media, the mean score for each response will be generated using the following formula (Noorhidayati et al., 2021).

$$V = \frac{TS_e}{TS_h} \times 100\%$$

Information :

V = percentage value
TS_e= total answer score
TS_h= expected maximum total score

As a result of these computations, researchers will group the assessment criteria into the following groups based on media practicality criteria:

Table 4. Practicality Percentage Category Criteria

Category	Category
Very Practical	81.00% - 100.00%
Practical	61.00% - 80.00%
Enough	41.00% - 60.00%

Less Practical	21.00% - 40.00%
Impractical	00.00% - 20.00%

Results and Discussion

The ethnoscience-based digital comic "Tari Telek" employs a 4D development methodology that includes steps such as define, design, create, and disseminate. At the define stage, teachers conduct curriculum analysis and identify difficulties in the learning process, particularly with regard to learning media. The outcomes of the define stage serve as the foundation for product design. Researchers develop and design digital comic media during the design stage (Zeng, Wasylczyk, Wiersma, & Priimagi, 2018). The finished project is subsequently validated by experts in media, materials, and language. The generated ethnoscience-based digital comic product's validity is assessed using an expert agreement index (V) based on the Aiken index. Table 1 summarises the findings.

Table 5. Aiken Index Coefficient Results for Ethnoscience-Based Digital Comic Media

Assessment Aspects	Aiken Index (V)	Category
Technical quality	0.75	Currently
Display quality	0.86	Very Valid
Ease of use	0.75	Currently
Relevance of the material	0.83	Very Valid
Material accuracy	0.83	Very Valid
Serving equipment	0.75	Currently
Language	0.87	Very Valid
Average	0.80	Currently

Table 1 shows that ethnoscience-based digital comics have a moderate level of validity, with an Aiken index value greater than 0.4. According to validity testing, the ethnoscience-based digital comics created are considered valid as learning material. A development trial was conducted on 60 pupils and 5 teachers to ensure the practicality of the product being produced. The feasibility of the ethnoscience-based digital comic being developed is evaluated in terms of its ability to teach students (self instructional), comprehensiveness and completeness (self contained), adaptability, user friendliness (user friendly), and use of written language (Table 2).

Table 6. Media Appropriate Test Results by Students

Assessment Aspects	Total Score	Eligibility Percentage
Able to teach students (*Self Instructional*)	870	90.63%
Comprehensive and complete (*Self contained*)	640	88.89%
Adaptive	875	91.15%
Friendly with the user (*User friendly*)	420	87.50%
Use of written language	660	91.67%
Average		90%
Conclusion		Very Worth It

Table 2 displays the results of the feasibility test performed by students who scored 90% in the

highly feasible category. Table 3 shows the results of the feasibility test for ethnoscience-based digital comics conducted by instructors.

Table 7. Media Appropriate Test Results by Teachers

Assessment Aspects	Total Score	Eligibility Percentage
Able to teach students (*Self Instructional*)	72	90.00%
Comprehensive and complete (*Self contained*)	53	88.33%
Adaptive	71	88.75%
Friendly with the user (*User friendly*)	35	87.50%
Use of written language	52	86.67%
Average		88%
Conclusion		Very Worth It

Table 6 displays the results of the feasibility test conducted by teachers, which were 88% in the extremely feasible group. As a result, the ethnoscience-based digital comics created are appropriate for use as learning media. After the product is certified practicable, a practicality test is performed to establish whether the digital comic media generated by researchers can be used as a learning medium (Souri et al., 2020). Aspects of practicality assessment include media ease of use, usefulness, attractiveness, and presentation. Table 3 shows the results of the practicality test for ethnoscience-based digital comic media built based on student feedback.

Table 8. Practicality Test Results for Students

Assessment Aspects	Total Score	Practicality Percentage
Ease of use of media	1050	87.50%
Utility	1280	88.89%
Attractiveness	430	89.58%
Presentation	660	91.67%
Average		89%
Conclusion		Very Practical

Table 3 demonstrates that the ethnoscience-based digital comic media developed is very practical, with an 89% success rate. The practicality test results for instructors were 88% (Table 4).

Table 9. Practicality Test Results for Teachers

Assessment Aspects	Total Score	Practicality Percentage
Ease of use of media	72	90.00%
Utility	53	88.33%
Attractiveness	71	88.75%
Presentation	35	87.50%
Average		88%
Conclusion		Very Practical

Thus, based on the perspectives of students and teachers as users, the ethnoscience-based digital comic medium "Tari Telek" developed is very useful. In accordance with contemporary advancements,

notably technology and local culture, learning media must be able to make the subject more concrete and easy for students to understand (Sulistri, Sunarsih, Utama, & Moseki, 2020). Collaboration with local wisdom values that are part of community culture can help to build students' character (Sari, Pangestika, & Khaq, 2023). To assist the learning process, the value of character education and local wisdom can be included in learning media (Fadillah, 2013). Comics can be used as an alternate medium for students to receive character messages (Ngazizah & Laititia, 2022). Ethnoscience-based digital comics were created as part of this study. In this case, the researcher created a digital comic that incorporated local community culture, specifically the Tari Telek. The generated digital comic is based on "Tari Telek" ethnoscience, which is integrated into the learning of movement system material. Tari Telek and movement system material are related in the sense that Tari Telek movements have distinct characteristics in the form of hand, body, and head movements, making them suitable for inclusion in biology learning, particularly movement system material (Shi et al., 2020). The ethnoscience approach employs knowledge that is culturally acceptable and easily integrated based on community behaviour (Munawaroh, Sari, Pambudi, & Ekapti, 2022). Learning will be meaningful if local wisdom values are integrated to prevent cultural degradation and to enhance students' character (Wahyudi & Agung, 2021). Ethnoscience learning is said to be beneficial because it mixes local culture with the subject pupils study in school, allowing students to absorb the material more easily (Rahmawati & Atmojo, 2021).

In addition, adequate learning tools and learning media are required to promote scientific literacy (Sulistri et al., 2020). Students with scientific literacy are accustomed to critical thinking and can apply their knowledge to address problems in their surroundings (Filjinan, Supeno, & Rusdianto, 2022). The ethnoscience-based digital comic "Tari Telek" on movement system material has become an innovation in learning media because it depicts movement system material that is linked to phenomena and culture around students in a learning environment where student activities lead to literacy achievement. science. Scientific literacy is linked to future competences that students must possess in order for its application to become an important factor in an era of rapidly advancing technology (Fitria, Malik, Mutiaramses, Halili, & Amelia, 2023). Students enjoy comics because they include images in each story, which helps students understand the information (Ye, Zhang, Chen, Han, & Jiang, 2020). Learning material depicted in comic form allows students to better understand the picture as a whole, develop imagination, convey concepts clearly, and tell stories coherently (Gu, Wang, & Lin, 2019). As a result, the ethnoscience-based digital comic "Tari Telek" provides an alternate medium for providing a joyful learning experience with local cultural material in order to enhance students' scientific literacy and national cultural character (Dong, Sun, Liu, Jiang, & Lu, 2022).

Conclusion

The ethnoscience-based digital comic "Tari Telek" has been pronounced legitimate based on expert validation results, with a moderate level of validity and an Aiken index value more than 0.4. The feasibility test results demonstrate that the ethnoscience-based digital comic "Tari Telek" is appropriate for use as a learning medium. The feasibility test yielded 88% for teachers and 90% for students. The ethnoscience-based digital comic "Tari Telek" that was created has been certified practical based on evaluations by respondents, especially teachers and students. Teachers rated media practicability at 88%, while students rated it at 89%.

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