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Effectiveness of Digital Teaching Materials with Content Ethnoscience in Increase Digital Literacy

Fadhilatul Mufrihah✉, Ellianawati Ellianawati , Ani Rusilowati

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Universitas Negeri Semarang, Indonesia

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Abstract

This study aims to develop digital teaching materials containing ethnoscience and measure their effectiveness on junior high school students' digital literacy. School digitalization through the use of android-based learning resources is one way to improve motivation and learning achievement. This study uses the Research and Development (R&D) method with the ADDIE model. Effectiveness testing was carried out through the Paired Sample T-Test and N-gain tests. The results showed that the use of digital teaching materials containing ethnoscience was able to significantly improve students' digital literacy, with an N-gain result of 0.7 for the experimental class and an N-gain result of 0.3 for the control class showing a higher increase compared to the control class. These results support the application of digital teaching materials containing ethnoscience as an effective method in improving students' digital literacy.

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✉ Correspondence Author:
E-mail: fadhilatulmufrihah20@students.unnes.ac.id

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INTRODUCTION

The field of education is increasingly driven by the renewal of technical results from daily scientific advances, especially in the process of teaching and learning activities in the classroom (Setiadi et al., 2018). One form of intervention outlined in the Independent Learning Curriculum is the implementation of digitalization in schools. Encouraging school facilities to function as learning resources, learning media, and gateways to obtain further information can help improve the quality of education (Rohmah et al., 2023). Innovative and interesting learning materials can improve students' academic achievement (Firmadani, 2020). As part of the school digitalization process, various digital platforms are utilized in an effort to increase productivity, simplify processes, provide independent learning, and provide inspiration (Cress & Kalthoff, 2023). The use of Android-based learning resources in school digitalization initiatives is one technique to increase students' enthusiasm for learning (Isnaeni et al., 2021) .

Source learning, such as teaching materials used by teachers and students, can help student in reach objective learning in activity learning. Accuracy selected teaching materials will determine how much good learning process ongoing (Hilton, 2020). Source digital learning in the form of mobile learning is one of the type source learning that can utilized . Standard learning with use technology called mobile learning is seen capable overcome constraint space and time (Aljawarneh, 2020).

Science learning is one of the subjects at the junior high school level that emphasizes the discipline of science related to the processes of natural phenomena that occur along with their causes and effects (Sintiawati et al., 2021). The development of experiences of natural phenomena and the interactions that occur in them are contained in science subjects (Zidny et al., 2020). Students can process and understand the information found effectively which is obtained through the information contained in science learning, for this reason the information in it must be verified for its truth through the empowerment of students' digital literacy (Asis Nojeng et al., 2023).

In addition, digital literacy is also one of the important competencies that must be mastered by students in the digitalization era. In this case, the use of technology and digital media in learning plays an important role (Zulkarnain et al., 2024). Various innovations in the world of education such as the development of digital teaching materials and the use of mobile learning platforms have been widely developed to improve students' digital literacy (Audrin & Audrin, 2022). Mobile learning is seen as an effective solution that can penetrate the limitations of space and time in the learning process, while increasing students' interest in learning (Alzahrani, 2020). Although various efforts have been made, research results show that the development of ethnoscience-based teaching materials that integrate local wisdom values with science is still limited (Yuliana et al., 2023). In fact, ethnoscience can help students understand scientific concepts by linking them to facts and customs that apply in society (Rahmawati et al., 2020).

Local wisdom values are characteristic of a particular region to introduce the various potentials found in the region. Its preservation is very important to do (Lestari & Hudaidah, 2023). However, in reality, in an era where technology is used in almost every aspect of human life, another problem has emerged, namely the crisis of local wisdom values that are slowly being forgotten (Hidayat, 2021). People seem to be more proud of foreign cultures so that the cultural values that have been upheld have begun to shift (Kharisma & Talan, 2023). Thus, to instill local wisdom values in students, various efforts are needed, including using learning that contains local wisdom in the surrounding environment (Jumriani et al., 2021).

Context culture especially common language used own significant influence to development cognitive someone (Danoebroto, 2017). The material raised in Mobile Learning is food and system digestion with load integrated ethnoscience with science as teaching materials in schools so that integration the can develop character generation young become a generation that understands and is proud to culture as well as wisdom local contained therein (Lidi et al., 2022). Research Wahyuni et al., (2022) found that Android- based Mobile Learning modules are proven to be valid, practical and effective. in increase digital literacy of junior high school students, with score effectiveness of 0.45 based on the N-gain test.

Digital teaching materials that contain element ethnoscience to hook science concept with wisdom locally sourced from culture, tradition and knowledge public local. This is help participant educate understand science with more Good Because the material presented relevant with environment and experience daily they (Irfandi et al., 2023). Ethnoscience connecting modern science with knowledge local, so that participant

educate can more easy understand and apply science concept in life real. Digital teaching materials that contain element ethnoscience also plays a role in increase digital literacy of participants educate. Digital literacy is not only covers ability in utilise technology, but also the ability in understand, evaluate, and create digital content.

Utilization digital teaching materials containing element ethnoscience involving participant educate in access information through digital media, learning material in a way independent , and use various application or digital platforms. Thus, participants educate trained For develop skills literacy digital, including ability access, navigate, and evaluate relevant digital information. In reality, there is still Lots school that has not utilise method life local. Many things have an impact on this such as teacher limitations in connecting ideas, procedures, and applications For to uphold values (Ilhami et al., 2021).

Implementation ethnoscience aiming For get used to participant educate to facts that develop in a public Then connect it with sources scientific and expertise (Bakhtiar, 2016). Research This focused on development digital teaching materials in the form of Mobile Learning which contains material about food and system loaded digestion ethnoscience as supplement learning for participant educate about food and system digestion. Research objectives This is analyze effectiveness digital teaching materials containing ethnoscience in increase digital literacy of participants junior high school education.

METHOD

Students' digital literacy was measured using a Likert scale. The scale was filled in by all students in grades VIII D and VIII F. Furthermore, the data was analyzed to obtain the average value of the students' assessment.

This research is a development research (R&D) using the Quasi Experimental Design method, namely the control group but does not fully control external variables. The subjects of the study were students of class VIII of SMP Negeri 2 Tengaran, with a purposive sampling technique. The analysis of the effectiveness of digital teaching materials on digital literacy skills was tested using the Hypothesis Test (Paired t-test) and the N-Gain test.

Students' knowledge regarding digital literacy can be known how far their understanding is by using the right measuring tools. Related with matter said, network activist digital literacy Japelidi (2018) formulated existence ten competence in digital literacy, but in this research only 6 digital literacy competencies are used, namely accessing, selecting, understanding, analyzing, verifying, evaluating (Raharjo & Winarko, 2021). Japelidi's digital literacy competency indicators can be seen in Table 1.

Table 1. Digital Literacy Competency Indicators

Aspect/ Competence	Indicator
Access	a. Using digital media features to access the internet b. Using search engines like Google and other platforms c. Searching for information data on the internet using various applications
Selecting	a. Sorting information data according to needs b. Ignore information data that does not match your needs c. Delete information data that does not match your needs
Understand	a. Mastering written information that is appropriate to the language used b. Mastering the symbols used
Analysis	a. Distributing information data that is in accordance with the message target b. Ensuring message conformity to media application c. Disseminate information data that is in accordance with the message format
Verification	a. Mastering information data sourced from the format b. Connecting information data with the purpose of forming a message c. Recognizing the existence of diverse meanings of information
Evaluation	a. Matching information data from various information sources obtained b. Recognizing errors in received information data c. Deciding on the accuracy of the information data received

Distribute	a. Distributing information data that is in accordance with the message target b. Disseminate information data that is in accordance with the message format c. Connecting information data with the purpose of forming a message
Production	a. Using written messages in digital media b. Using photo/image messages in digital media c. Using video in digital media
Participation	a. Engage in digital communities that suit individual needs
Collaboration	a. Online forums/communities b. Managing topics in online forums/communities

Indicators in mobile learning products include various features that support students' digital literacy. In the aspect of accessing, basic application features such as login and search pages are designed to encourage students to use digital devices and the internet effectively. Furthermore, in the aspect of selecting, students can practice the skills of sorting and selecting relevant information through case study-based quizzes or bookmark management features. For the aspect of understanding, learning content is presented in simple language and equipped with familiar symbols or icons for easy understanding. Meanwhile, the aspect of analyzing is realized through discussion forums and information sharing features that help students disseminate information according to the right context and format. In the aspect of verifying, the application provides validation of information sources through trusted labels or learning modules that teach how to check the accuracy of sources. Finally, the aspect of evaluating is facilitated through data comparison exercises and case studies on false information designed to develop students' information evaluation skills.

Digital literacy uses questionnaires to systematically measure digital literacy understanding and skills, making it easier to collect data from many respondents in a short time. Questionnaires can also collect quantitative and qualitative data, identify areas for development, and facilitate data analysis, making it easier for researchers to evaluate the condition of respondents' digital literacy.

The results of the normality test analysis show that the data is normally distributed and the homogeneity test shows that the data is homogeneously distributed and is a requirement for the t-test, so this test is carried out using the Paired Sample T-test which is tested using parametric testing with the help of IBM SPSS 25 software. The test criteria are as follows (Sugiyono, 2016).

If the Sig. value (p-value) < α (α = 0.05) then the two data have a significant difference (have an influence)
If the Sig. value (p-value) ≥ α (α = 0.05), then the two data do not have a significant difference (no influence).
The N-gain formula will be used and proposed by Hake, (1998), namely:

$$\langle g \rangle = \frac{\%\langle Sf \rangle - \%\langle Si \rangle}{\%\langle Smaks \rangle - \%\langle Si \rangle}$$

Information:
Sf : final score (post-test)
Si : initial score (pre-test)
Smaks : maximum score that can be achieved

The N-gain index results obtained were then interpreted using the score interpretation criteria in Table 2.

Table 2. Interpretation of N-Gain

Get Value $\langle g \rangle$	Criteria
$\langle g \rangle \geq 0.7$	Tall
$0.7 > \geq 0.3$ $\langle g \rangle$	At the moment
$\langle g \rangle < 0.3$	Low

Once the resulting gain index level is known, the next step is to interpret the percentage of the N-gain score whether it is effective or not.

Table 3. Interpretation Categories of N-gain Score Effectiveness

Percentage (%)	Interpretation
> 76	Effective
56 - 75	Quite Effective
40 - 55	Less Effective
< 40	Ineffective

(Sugiyono, 2013)

RESULTS AND DISCUSSION

Testing Hypothesis (Paired t-test)

Research alpha value (0.05) is significant more big from mark significance (Sig.) of 0.000. This is show that students who use digital teach-

ing materials with ethnoscience own score digital literacy is far more high on posttest compared to with pretest. The statement "There is significant difference" indicates that improvement Junior high school students' digital literacy is greatly influenced by the use of digital teaching materials that combine ethnoscience.

In other words, there is strong evidence that these digital learning resources improve students' proficiency in using digital technology, their ability to search for information efficiently, and their capacity to assess the reliability of information sources needed in the modern digital world. This is in line with the findings of Rusydiyah et al. (2020) who reported that the use of digital media in learning activities can improve students' digital literacy.

N-gain Test

The N-gain values of the experimental and control classes in the pre-test and post-test (in Table 4).

Table 4. Value of N-gain Test

Data	Experimental Class		Control Class	
	Pre-Exam	Post-Eest	Pre-Exam	Post-Test
The highest score	76	113	77	92
Lowest value	48	98	47	70
Average	49.3	84.9	49.1	65.1
N advantage	0.7		0.3	
N-Gain (%)	69.95		31.13	

Students in the experimental class experienced an increase in scores from an average pretest of 49.3 to a posttest of 84.9. This shows a significant increase in digital literacy after using digital teaching materials in the form of mobile learning containing ethnoscience. Mobile Learning is a learning method that can facilitate learning activities for students because it can be accessed efficiently via mobile devices without time constraints. Mobile learning is an application of interactive animation development that can introduce students to basic programming concepts (Jurayev, 2023).

The creation of Mobile Learning is from the PowerPoint application converted into HTML5 by the iSpring Suit application. Digital teaching materials in the form of Mobile Learning begin by inserting material into PowerPoint and utilizing the hyperlink feature that can be accessed in the insert menu » link » mouse click / mouse over » hyperlink to. The use of mouse click activates slide switching when the cursor is clicked and the use of mouse over activates slide switching when the cursor is moved. The finished material is then converted by activating the iSpring Suit application in PowerPoint and can then be published on the iSpring Suit menu by first setting it in the Player submenu » Select Player » Apply & Close » Publish. This Mobile Learning can then be shared online and its use can be offline, but if you want to use the video button connected to the YouTube link, you must be connected to the internet when using it.

Students in the control class also experienced an increase from an average pretest of 49.1 to a posttest of 65.1. However, this increase was lower than the increase in the experimental class. The N-gain value of 0.7 indicates that students in the experimental class experienced a significant increase in digital literacy after using digital teaching materials. Digital learning materials have great potential to improve students' digital literacy because they provide an interactive learning environment integrated with technology. Elements such as multimedia, interactive texts, and quizzes help students understand the material and develop digital skills. The indicators of digital literacy developed include technical, information, social, and communication literacy. Ethnoscience elements in digital learning materials strengthen learning through local cultural contexts, which are relevant to students' daily lives. Research supports that ethnoscience-based digital learning materials are effective in improving students' digital and science literacy.

N-gain Test per Indicator

Students in the experimental class showed a significant increase in digital literacy, especially in selecting, understanding, verifying, and evaluating digital information, compared to the control class which showed a lower N-gain. The use of digital teaching materials containing ethnoscience proved to be more effective in improving students' digital literacy compared to conventional methods. These results confirm that the ethnoscience approach can enrich the learning experience and significantly improve students' digital literacy skills, making it relevant to be applied in broader learning.

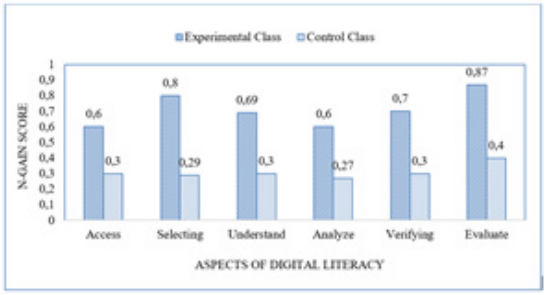

Figure 1. N-gain Test Graph per Indicator

Students in the experimental class showed a significant increase in digital literacy, especially in selecting, understanding, verifying, and evaluating digital information, compared to the control class which showed a lower N-gain. The use of digital teaching materials containing ethnoscience proved to be more effective in improving students' digital literacy compared to conventional methods. These results confirm that the ethnoscience approach can enrich the learning experience and significantly improve students' digital literacy skills, making it relevant to be applied in broader learning.

Students in the experimental class showed a fairly effective increase in digital literacy with an N-gain of 0.6 (moderate category) and a score of 59.95% indicating a good ability to access science information through various digital platforms. In contrast, the control class had a lower N-gain of 0.3 and a score of 32.57% indicating an insignificant increase in utilizing digital platforms for science learning. These results emphasize the importance of the ability to utilize the internet to search for information related to the material, in line with the views of Hottecke & Allchin, (2020) on digital literacy in science education.

Students in the experimental class used Google Chrome more often to search for information compared to the control class who had difficulty in determining keywords and understanding the differences in website domains. The results of the N-gain test showed that the use of digital teaching materials containing ethnoscience significantly increased the ability to access science-based information in the experimental class, while the control class experienced an ineffective increase. This confirms that this approach makes a positive contribution to students' digital literacy, especially in accessing information through digital platforms. This finding is in line with research Sulistri et al. (2020) which shows an increase in digital literacy through these teaching materials.

Students in the experimental class showed an N-gain of 0.8 (high category) and a score of 80.97%, indicating an effective increase in selecting science-based information on the internet. They were able to select the information needed, distinguish between true and false information, and identify misinformation. In contrast, the control class only recorded an N-gain of 0.29 and a score of 29%, indicating an insignificant ability to select digital information. These findings indicate that the use of digital teaching materials containing ethnoscience is very effective in improving students' information selection skills, in line with van Peppen et al. (2021) statement about the importance of information selection skills.

Students in the experimental class were able to select and evaluate information well, while the control class had difficulty in distinguishing relevant information. The results of the N-gain test showed that digital teaching materials containing ethnoscience significantly improved the ability to select science-based information, with the experimental class experiencing an effective increase and the control class only experiencing a slight increase. This approach makes a positive contribution to students' digital literacy, in accordance with research (Suryania et al., 2023).

Students in the experimental class showed an N-gain of 0.69 (moderate category) and a score of 68.97%, indicating an effective increase in understanding science-based information on the internet, including the meaning of hyperlinks and symbols. In contrast, the control class only achieved an N-gain of 0.3 and a score of 32.37%, with an insignificant increase. The control class still had difficulty understanding information and using URLs. This finding is in line with the research of Salganova & Osipova (2023) which shows that students' digital literacy increases significantly through understanding science-related information and using hyperlinks.

Students in the experimental class understood the components of the URL and were able to identify website addresses to search for science information, while the control class still had difficulty with information on the internet, including the meaning of hyperlinks. The results of the N-gain test showed that digital teaching materials containing ethnoscience significantly improved the understanding of science-based information in the experimental class, with an effective increase, while the control class experienced an insignificant increase. This finding is in line with Astuti et al., (2020) who emphasized that this approach is positive for students' digital literacy.

Students in the experimental class showed an N-gain of 0.6 (moderate category) and a sco-

re of 56.74%, reflecting an effective increase in analyzing science-based information on the internet, including the ability to identify accurate websites. In contrast, the control class only had an N-gain of 0.27 and a score of 26.62%, indicating minimal improvement and difficulty in selecting accurate information. This finding is in line with Johnston (2020) who emphasized the importance of students' ability to analyze and select information from reliable sources.

Students in the experimental class were able to select information from trusted websites well, demonstrating effective analytical skills, while the control class had difficulty in analyzing and assessing the credibility of online information. The results of the N-gain test showed that digital teaching materials containing ethnoscience significantly improved the ability to analyze science-based information, with the experimental class experiencing quite effective improvement, while the control class showed almost no improvement. This finding is in line with Lee et al., (2020) who emphasized the positive contribution of digital teaching materials to students' digital literacy.

Students in the experimental class showed an N-gain of 0.7 (high category) and a score of 72.45% indicating an effective increase in verifying science-based information, including cross-checking and using other sources. Meanwhile, the control class only recorded an N-gain of 0.3 (moderate category) and a score of 31.12% indicating an ineffective increase in verifying information. This finding is in line with Hardiansyah & Mulyadi (2022) who emphasized that students in the experimental class showed significant abilities in verifying information.

Students in the experimental class routinely cross-checked to ensure the accuracy of information from the internet, demonstrating care and understanding in verifying information. They also supplemented information from other sources, such as books, to gain a comprehensive understanding. This habit shows initiative in verifying the information obtained, in line with research findings. Breakstone et al., (2021) on the importance of verification and use of multiple sources of information.

Students in the experimental class compared information from the internet with various other media to ensure its accuracy, demonstrating good critical thinking skills. The results of the N-gain test showed that digital teaching materials containing ethnoscience significantly improved the ability to verify science-based information, with the experimental class experiencing an effective increase, while the control class did not. This finding is in line with Supriyatno et al., (2020) who emphasized the positive contribution of this approach to students' digital literacy.

Students in the experimental class showed an N-gain of 0.87 (high category) and a score of 87.44%, reflecting an effective increase in evaluating science-based information, including the ability to compare sources and identify errors. In contrast, the control class only achieved an N-gain of 0.4 and a score of 35.56%, indicating an ineffective increase. These findings are in line with Belova et al. (2022) who emphasized that students in the experimental class routinely selected valid and relevant information.

Students in the experimental class were able to identify misinformation and utilize various sources to compile information related to science learning, thus demonstrating critical skills in evaluation. The results of the N-gain test showed that digital teaching materials containing ethnoscience significantly improved the ability to evaluate science-based information, with the experimental class experiencing an effective increase, while the control class did not experience an increase. This finding is in line with Sharon & Tsabari (2020) who emphasized that this approach makes a positive contribution to students' digital literacy.

CONCLUSION

The effectiveness of digital teaching materials on food and digestive system material with ethnoscience content on increasing digital literacy can be seen from the N-gain value of 0.7 with high criteria for the experimental class and the N-gain of 0.3 with moderate criteria for the control class. Meanwhile, the N-gain value of 69.95 with quite effective criteria for the experimental class and the N-gain value of 31.13 with ineffective criteria for the control class. This shows that the use of digital teaching materials with ethnoscience content can be said to be effective in increasing digital literacy in learning food and digestive system material.

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