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INCORPORATING ETHNOMATHEMATICS AND REALISTIC MATHEMATICS EDUCATION ON DEVELOPING MATHEMATICS CONNECTION USING THE *MENARA KUDUS*

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Abstract: This research was motivated by students' low mathematical connections and lack of knowledge about the local culture around where they live. This research aims to develop a student digital worksheet using the concepts of ethnomathematics and Realistic Mathematics Education following the ADDIE procedure. A number of 30 students of year five in a primary school in Kudus District, Province of Central Java, Indonesia, involved in the study. The learning material used the local cultural object namely *Menara Kudus*. This bulding is part of muslim gathering venue and known its adaptation to the Hinduism as it was built during the era. A digital worksheet is defined as a set learning activity that can be accessed using electronic gadgets, like computer or smartphone. Validation of the development resutls included experts and students to collect data on the feasibility assessment of the digital worksheet which consists of assessments by material experts and media experts. In addition, the use of web based interactive worksheets at *Menara Kudus* based on Ethno-RME shows a significant increase in students' mathematical connections. This means that the Ethno-RME-based digital worksheet at the *Menara Kudus* was declared feasible and can be used in mathematics learning.

Keywords: Worksheets, mathematical connection, ethnomathematics, Realistic Mathematics Education, Cube

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INTRODUCTION

In this era of globalization, education is the most important part of life. The capacity to use, grow, and master science, technology, and life skills in a balanced manner must support this growth. Mathematics is a basic science for all other scientific disciplines. Mathematics is a science that includes knowledge and life skills that can be used to improve the quality of education. Mathematical knowledge is critical to students' future success because it can be used to abstract, idealize, or generalize situations to solve problems or clarify and simplify them. The ability to think logically, regularly, and systematically can also be improved with mathematics. This is the reason why learning mathematics is important.

Mathematics is a universal language that underlies the creation of contemporary technology, plays an important role in many fields of science, and improves human cognition (Sunardi, 2016). In addition, connecting mathematical concepts with other sciences and the real world is very important for the position of mathematics in society (Pambudi *et al.*, 2020). According to the National Council of Teachers of Mathematics (NCTM), the main abilities in learning mathematics are problem-solving abilities, communication abilities, connection abilities, reasoning abilities, and representation abilities (NCTM, 2000). Students will have difficulty understanding mathematics if their mathematical connection skills are lacking because these skills are needed to study several mathematical topics that are related to each other (Siregar & Surya, 2020).

Low mathematical connection abilities cause some students to have difficulty learning mathematics in class. This is in line with several studies regarding students' mathematical connection abilities (Maulida, Suyitno, & Asih, 2019; Prasetyo, Sukestiyarno, & Cahyono, 2019; Rahmi, Usman, & Subianto, 2020; Sari & Chandra, 2018; Siagian, 2016). The results of this research show that students' mathematical connection abilities are still in the low category and need to be improved. These problems indicate that mathematics learning needs to be connected to real-world situations that they often encounter. In addition, connecting the subjects they have studied with the material they need to understand is a challenge that students must face (Apipah & Kartono, 2017). This is because the degree of students' knowledge of the content is influenced by their mastery of the required material (Lestari, Juniati, & St. Suwarsono, 2019).

Realistic Mathematics Education abbreviated as RME is a learning model that connects mathematics with real life (Isrokatun & Rosmala, 2018). Constructivism, reality, understanding, interaction, and activity are part of RME (Ngalimun, 2017). Several studies show that RME can develop students' mathematical connections (Choirudin et al., 2020; Fitria, 2019; Hasbi, Lukito, & Sulaiman, 2019). These studies show the effectiveness of RME in teaching mathematics. When used, the RME model presents contextual problems that must be solved by students. In RME, a "realistic" context that refers to real life is very important (Heuvel-Panhuizen & Drijvers, 2014).

The realistic context in the RME learning model can be linked to the culture of the surrounding environment which is relevant to students' lives. In this case, ethnomathematics can bridge students learning mathematics through the culture in which mathematics is taught. This makes mathematics less boring for students and allows them to learn about culture at the same time (Risdiyanti & Prahmana, 2014). Apart from that, cultural preservation can also be achieved through education that connects mathematics and culture. Considering that it is still found that some students are less interested in studying their culture (Wulandari, Yunianti, & Wahyuningsih, 2023). This means that apart from the RME model which is integrated with culture, it can improve mathematical connection skills, it can also be a means of introducing culture to students at various levels of education, including elementary school.

According to Ambrosio, students' environmental and cultural backgrounds are necessary to understand mathematics (D'Ambrosio, 1985). In this case, the RME model that is integrated with ethnomathematics is called Ethno–RME. The originator of Ethno–RME was Prahmana (Prahmana, 2022). Several cultural contexts in Indonesia can be included in RME learning, such as the culture of Purwakarta, Tabuik, Rumah Gadang, and Lore games from the Minang community (Cesaria, Fitri, & Rahmat, 2022; Fauzan, Tasman, & Fitriza, 2020; Fitriza & Gunawan, 2019; Irawan *et al.*, 2019). In this research, the cultural context that will be integrated into the RME model is the *Menara Sunan Kudus*.

The integration of Ethnomathematics and RME learning model is the theoretical base for the development of a learning worksheet. Moreover, if the worksheet has an attractive design, students can access it anywhere and at any time. online worksheets are a work guide that can make it easier for students to understand learning material in electronic form which is applied using computers, notebooks, smartphones, and cellphones which contain a set of basic activities that students must carry out to maximize understanding to achieve learning goals (Puspita & Dewi, 2021). In general, the advantages of online worksheets teaching materials with the Ethno–RME learning model include making it easier for students to understand the material contained in the e-worksheet. Because students tend to prefer reading if there are real illustrations in the form of pictures and have a colorful appearance (Apriliyani & Mulyatna, 2021). Apart from being able to encourage students' mathematical connection skills to be better, the use of Ethno–RME influences students' attitudes towards mathematics and introduces them to Kudus culture, which makes them believe that social and cultural diversity is part of their everyday lives.

These digital worksheets can be developed with an open source application. Digital worksheet is an application that can be used to create interactive Student Worksheets online, students can work on worksheets in the form of exercises and send answers online (Sudarman & Rahmawati, 2022). Digital worksheet provides various features that can be used to create attractive worksheets for students, making mathematics learning activities easier. Digital worksheets have good advantages for students because it is motivating and interactive so interest in learning arises. Meanwhile, for educators, it can save time and reduce paper usage. Several studies show that digital worksheet meet the criteria for being suitable for use as a learning medium for students because it has the advantage of being more efficient (paperless) and more effective by containing various types of exercises (Widiyani & Pramudiani, 2021). Furthermore, research by Farman, et al (Farman, Hali, & Rawal, 2021) regarding digital worksheets in mathematics learning shows that practical for use in learning, and influence students' abilities significantly.

In addition, mathematics learning in several elementary schools has never integrated learning with ethnomathematics-based technology. Based on an interview with one of the teachers at the participating school, it is known that mathematics learning only uses printed books and has never used digital worksheets. In other cases, the development of digital worksheets has indeed been carried out before, such as research by (Juwita, Ardiawan, & Darma, 2022) on ethnomathematics in the *Senaporan* and *Selimban* games and research by (Solihati, Rahmawati, & Pamungkas, 2023) on RME to improve solving abilities mathematical problems. Different from research (Juwita *et al.*, 2022; Solihati *et al.*, 2023), this research uses the local cultural context where the research was conducted, namely the Kudus culture in the form of the *Menara Kudus*. Juwita *et al.*, 2022 studied ethnomathematics in the *Senaporan* and *Selimban* games and its development has been empirically tested its effectiveness in improving certain mathematical abilities. Meanwhile, the development of ethno-RME's in this study was carried out by testing their effectiveness in improving students' mathematical connections. In addition, the digital worksheet development carried out in Juwita' research was not based on the activity steps of particular learning model such as RME. Even though the digital worksheet development by Solihati *et al.* has been based on RME, seemengly it has lack of integration with ethnomathematics approach.

Questions were raised whether the use of cultural context can assist students to visualise shapes and spaces. This research was aimed to develop a worksheet that can be completed electronically by students, in order to expand our understanding on how cultural activity can improve learning mathematics.

METHOD

This study describes an instructional design that was developed using the ADDIE procedure, Analyse, Design, Develop, Implement, and Evaluate (Mulyatiningsih, 2016). The Implementation and Evaluation stages involved 30 fifth grade students of an elementary school in Kudus, who had lived in the *Menara Kudus* environment. The development product in this research is a digital worksheet based on Ethno–RME at the *Menara Kudus,* particularly on the Cube shapes material. The data collection instruments used were student response questionnaire sheets and mathematical connection tests. The student response questionnaire sheet was used to test the practicality of the digital worksheet product at the *Menara Kudus*. Meanwhile, students' mathematical connection test instruments were used to determine the effectiveness of the Ethno–RME-based digital worksheet product that had been implemented. Before the instruments and products are used, they are validated by experts/validators.

The mathematical connection test instrument was developed based on indicators adapted from (Hidayati & Jahring, 2021) and adapted to the learning objectives to be achieved in the surface area and volume of cubes. The following **Table 1** shows a blueprint of mathematical connection test instruments.

Table 1. Mathematical Connection Test Instrument Blueprint

Learning objectives	Mathematical Connection Indicators	Test item indicators	Cognitive level
5.3. Calculating the Surface Area and Volume of a Cube	Understand the relationship between mathematical topics	Students are able to solve problems related to the surface area and volume of cubes using other mathematical materials	C3
	Understand the relationship between mathematical topics and other sciences	Students can use area and volume material as well as material other than mathematics to solve the problems given	C3
	Understand the relationship of mathematics to everyday life	Students can solve problems in everyday life related to the area and volume of cubes	C3

Note: C3: Application

Practicality questionnaires are used to assess products based on student assessments in product practicality testing activities. Meanwhile, the mathematical connection test sheet consists of pre-test and post-test description questions for students to see the effectiveness of the product in improving students' mathematical connection abilities. This research involved two validators as media experts who were also material experts to validate the Ethno–RME-based digital worksheet product.

On the other hand, the validator was also asked to assess the mathematical connection ability test instrument. This research tests validity, practicality, and effectiveness. Researchers collect data through observations carried out at the search and data collection stage (first stage). The questionnaire data collected was qualitative and then converted into quantitative data (both validity and practicality data).

Expert validity test data analysis is carried out to assess whether a media that has been developed is suitable or not as a learning medium. Researchers will carry out revisions if the experts provide appropriate suggestions that have been given. The experts will provide a decision on whether the media can be used without repair or if there are improvements.

The formula used for validation is the V-Aiken formula to calculate the content validity coefficient based on the results of assessing the items by a group of experts consisting of n people and the extent to which the items represent the construct being measured. Expert test data analysis was carried out using the V-Aiken formula (Retnawati, 2016).

Practicality test data analysis functions to find out students' responses to the learning media used, including attractiveness and convenience. This practicality analysis uses assessment criteria adapted from (Ebel & Frisbie, 1991) in **Table 2** where the media is said to be practical if the minimum practicality assessment is in the good category.

Table 2. Learning Media Practicality Criteria

Mean Score	Category
$X_i > 65$	Very Good
$55 < X_i \leq 65$	Good
$45 < X_i \leq 55$	Quite Good
$35 < X_i \leq 45$	Bad
$X_i \leq 35$	Very Bad

After the mathematical connection test instrument was declared valid and reliable, we used it to collect mathematical connection data both pre-test before students' mathematics learning using the Ethno–RME's digital worksheet and post-test after applying this treatment. After obtaining the pre-test and post-test mathematical connection data, we analyzed it using a paired t-test with $\alpha = 0.01$ to find out whether there was a significant difference between the average mathematical connection ability before and after being given the worksheet. Before the paired t-test analysis is carried out, a prerequisite test is first carried out on the mathematical connection pretest and posttest data, namely the normality test. If the pretest and posttest data are not normal, then data transformation is carried out and then the normality is tested again.

The homogeneous test will still be shown even though it is not a mandatory prerequisite for the paired t-test (Hasyim, Munawar, & Ma'arif, 2021). This implies that, if the data is not homogeneous then the paired t-test can still be carried out as long as the pretest and posttest data are proven to be normally distributed. Meanwhile, to determine the level of effectiveness, an N-Gain test was carried out. According to Meltzer, it is said to be in the high category if the N-Gain score is more than 0.7. Meanwhile, the level of effectiveness is in the medium category if the N-Gain value is $0{,}3 \leq$ N-Gain $\leq 0{,}7$ and is said to be in the low category if the N-Gain $< 0{,}3$ (Meltzer, 2002).

RESULTS AND DISCUSSION

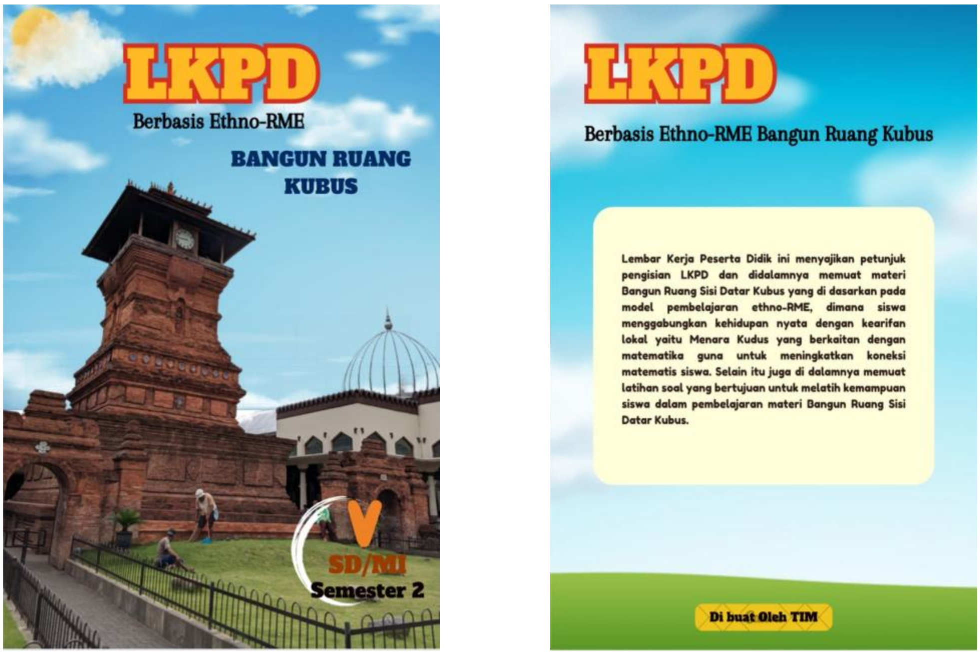
The development of an Ethno–RME-based digital worksheet to improve students' mathematical connections has been completed using the ADDIE development model. The development of such characterised worksheet in digital form to improve students' mathematical connections has been completed using the ADDIE procedure. The first stage carried out is the analysis stage. Based on information obtained from the analysis stage through observations of mathematics teachers and students at the participating school, a picture was obtained regarding the need for practising digital worksheets. The results of the analysis stage show that there is a need for worksheets that can be used to support learning, make students more able to connect the material with other material and life context problems, carry out the mathematization process, and improve students' mathematical connection abilities, especially in cube shape material.

The second stage is the design stage which is carried out by compiling the learning material, from the broad view of the ethnomathematical object that is *Menara Kudus* to the statement of the instructions, learning objectives, and problem solving activities. the digital worksheet was created in an online open source website. According to Adli (2020), the advantages of digital worksheets are: (1) students can view material and questions from anywhere or have multidirectional interaction; (2) students can use their devices or smartphones in learning, not just play games or social media; (3) students can get to know new and interesting learning models; (4) the presentation of material and questions on digital worksheets is more interesting which can increase students' interest in learning.

Student activities in digital worksheets are structured by adapting the stages of the RME learning model and incorporating elements of local culture in Kudus, namely the *Menara Kudus*. The digital worksheet display is packaged in dominant orange and blue colors with a total of 14 pages. Apart from that, the design stage was also carried out by designing research instruments in the form of validation questionnaires for material experts, media experts, instrument validation, and student response questionnaires. The digital worksheet display design includes:

a. Digital worksheets cover

The cover of digital worksheets contains 2 pages, namely the front and back pages. The front page contains the title, illustrations related to the title, and classes for using the digital worksheets. On the other hand, the back page contains the title of the digital worksheet, the author's name, and a summary of the contents of the digital worksheet. The front and back pages of the digital worksheets can be seen in Figure 1.



(a) (b)

Figure 1. Cover (a) Front (picture of *Menara Kudus*); (b) Back page (short description)

b. Instructions for using digital worksheets

Instructions for using digital worksheets contain information for teachers and students in using web-based worksheets. The display of instructions for using digital worksheets can be seen in Figure 2.

c. Learning outcomes and learning objectives

Learning outcomes and learning objectives contain the competencies that students must achieve in Phase C elements of geometric development referring to the national curriculum of Indonesia at the time the study was carried out. The display of learning outcomes and learning objectives can be seen in Figure 3.

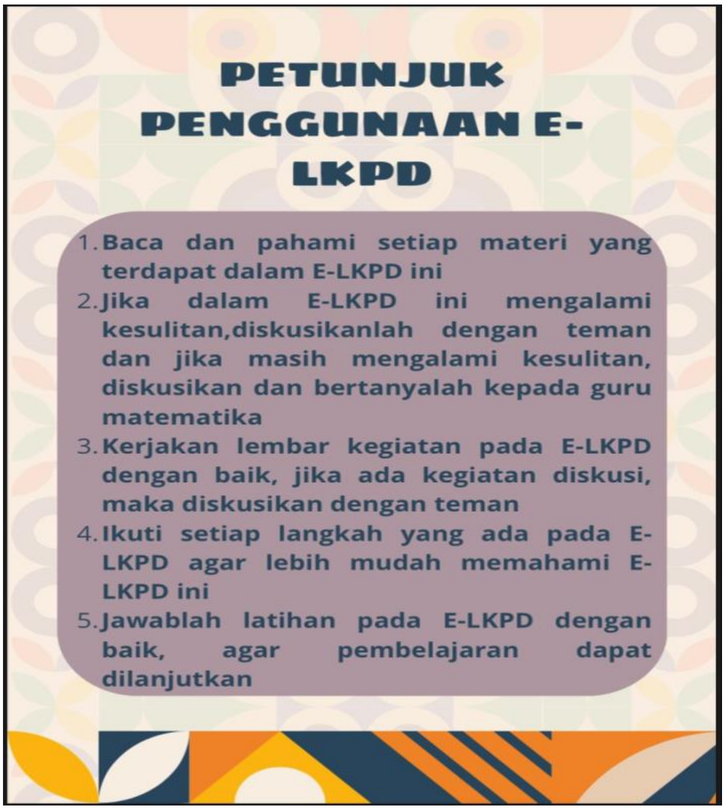


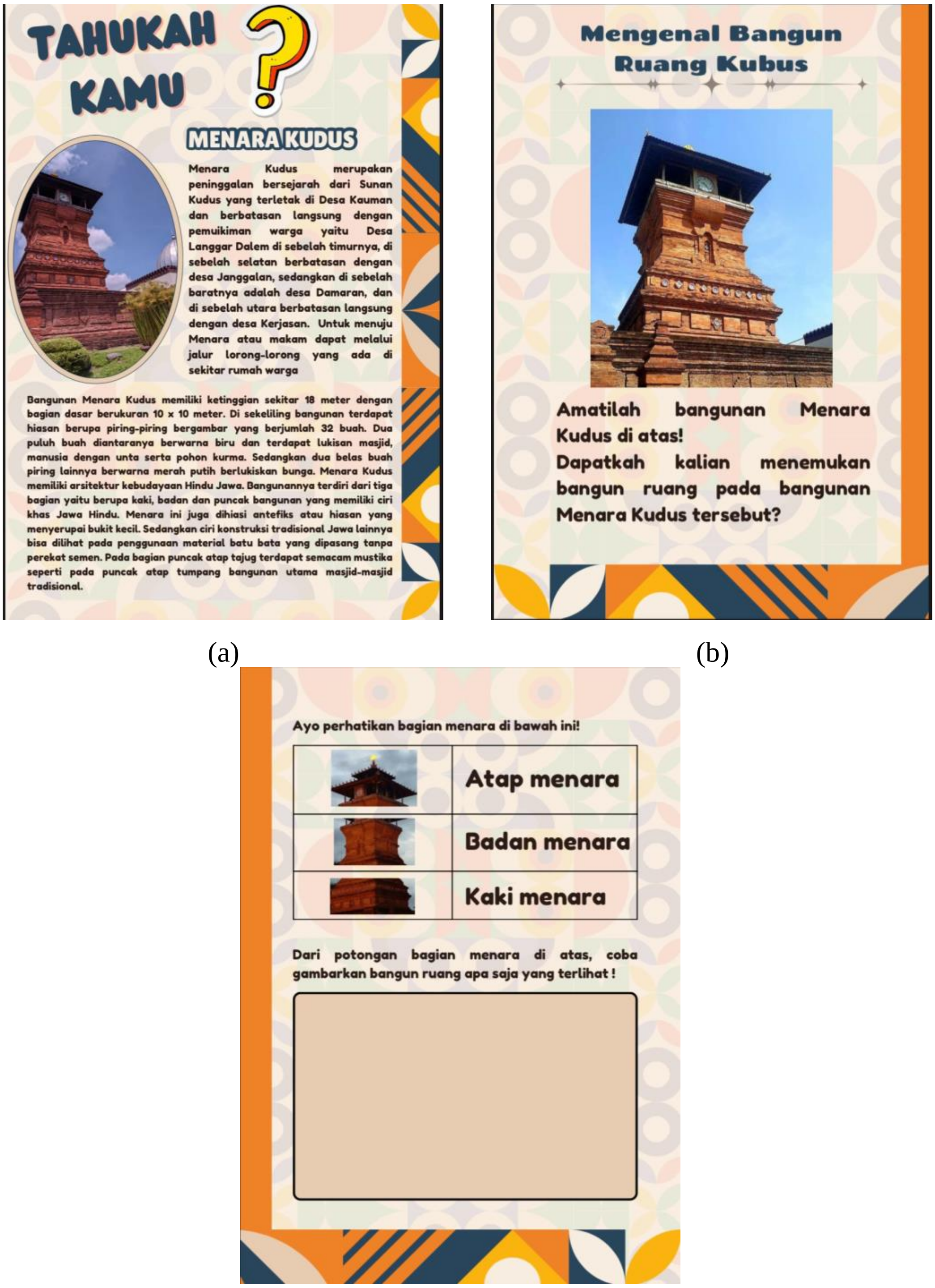
Figure 2. Display of instructions for using worksheets

Figure 3. Learning outcomes and learning objectives

d. Content

The contents of the digital worksheets begin with an introduction to the *Menara Kudus*, starting from its history, location, physical characteristics of the

Menara Kudus, etc. This prefix is the development of learning media that uses the Ethno–RME model where the model combines realistic real life with local wisdom to help clarify the delivery of material on the volume and surface area of the cube contained in the *Menara Kudus*. The material presented is the surface area and volume of a cube, also accompanied by practice questions. Some content displays can be seen in Figure 4.



(a) (b)

(c)

Figure 4. Content display (a) Historical story; (b) Instruction to observe; (c) Identifying its parts

e. Exercises

After studying the material on the digital worksheets, students can measure their ability to understand the material through the available practice questions. The questions presented are in the form of descriptions and are adapted to mathematical connection indicators, including understanding the relationship between mathematical topics, understanding the relationship between mathematical topics and other sciences, and understanding the relationship between mathematics and everyday life. The display of the practice questions can be seen in Figure 5.

Figure 5. Display of practice questions.

The third stage of the ADDIE stage is the development stage. After the digital worksheet has been created at the design stage, a prototype of the digital worksheet was assessed by expert validators, both material experts and media experts. Validation was carried out by two material expert validators and two media expert validators, who are knowledgeable with the ethnomathematics content and mathematics instructions. The two validator experts also validated the students' mathematical connection test instruments and student response questionnaires. The results of the development stage are an assessment of the feasibility of the Ethno–RME-based digital worksheet product being developed and several suggestions from validators. The results of material expert validation can be seen in **Table 3**.

Table 3. Material Validation Results

Indicators	V-Aiken	Category
Content (Mathematics)	0,8875	Very Valid
Instructional construction	1	Very Valid
Language	0,8541	Very Valid
Mean score	0,91	Very Valid

The results of the material expert validation of the three indicators consisting of content (mathematics), instructional construction, and language are in the valid category. The validation results show that the digital worksheets are in the very valid category with an average V-Aiken value obtained of 0.91. The construction aspect received a score of 1.0, which means that the digital worksheets developed are easy to use. Furthermore, the content aspect of the material received a value of 0.8875, which means that the digital worksheets are by learning outcomes, and learning objectives, and the material presented is related to life in the surrounding environment and involves local cultural elements. After that, the language aspect obtained a value of 0.8541, which means that the digital worksheets already have the correct material concepts and use language that is easy to understand. Meanwhile, validation results by media experts are shown in **Table 4**.

Table 4. Media Validation Results

Indicators	V-Aiken	Category
Content Eligibility	0,825	Very Valid
Language Eligibility	0,9125	Very Valid
Display	0,8125	Very Valid
Learn to be independent	0,7187	Quite valid
Mean score	0,81	Very Valid

Based on **Table 4**, the validator has provided an assessment of the aspects of the appropriateness of the content, appropriateness of language, presentation, and independent learning. The content feasibility aspect received a value of 0.825. This shows that the digital worksheets developed have met the learning outcomes in the surface area and volume of a cube. Then for the language suitability aspect, the score was 0.9125. This reveals that the language used in digital worksheets is straightforward, communicative, dialogical, and interactive, according to student development and language rules, as well as consistent use of terms, symbols, or icons. Furthermore, the feasibility aspect of the presentation received a value of 0.8125. This shows that the presentation of the digital worksheets can be understood and is by the realistic mathematics approach and contains elements of local culture and indicators of students' mathematical connections. In the aspect of independent learning, the score was 0.7187. This shows that digital worksheets influence students' independence and interest in learning.

Expert validators also provide several responses, suggestions, and criticisms of the digital worksheets to improve the quality of the digital worksheets that have been developed. One of the improvements to the digital worksheets that was developed was regarding the questions to be more adapted to the difficulty level of elementary school children. Therefore, the researcher added several questions according to suggestions for improvement. Then the researcher also arranged the layout of the components in the E-worksheets so that it looked more neatly arranged.

The fourth stage of ADDIE is the implementation stage. At this stage, the digital worksheets that have been validated and improved so that they are in a good category are then tested on students. Digital worksheets were tested offline on 30 fifth grade students of an elementary school in Ngembal Kulon, Kudus. After working on the digital worksheets, students fill out a student response questionnaire to find out student responses to using digital worksheets. The results of the student response questionnaire obtained showed that student responses to the Ethno–RME-based digital worksheets were in a good category with the average score obtained being 62.7 categorised as good (See Table 2).

The fifth stage of ADDIE is the evaluation stage. At this stage, it is used to find out whether the media being developed can be applied and effective. So the minimum assessment is in the good category referring to **Table 6** which is obtained from the guidelines in **Table 3**. Based on the student's response, the digital worksheet can be said to have been completed as a final product and suitable for use in the learning process. Apart from that, we also conducted a paired t-test to determine the effectiveness. Before the t test was carried out, the pre-test and post-test results were tested for normality and homogeneity. Because the pre-test and post-test data were known to not be normally distributed, data transformation was carried out and normality was tested again using Kolmogorov-Smirnov with a significance level of 0.01 which is shown in **Table 6**.

Table 6. Normality Test Results

	Kolmogorov-Smirnov		
	Statistic	**df**	**Sig**
pretes	.234	30	.001
postes	.253	30	.000
trans_pre	.172	30	.074
trans_pos	.165	30	.034

Based on **Table 6**, the normality test on pretest and posttest data which has been transformed using Kolmogorov-Smirnov shows ($p < 0.01$). This means that H_0 is accepted so that the mathematical connection pretest and posttest data are known to be normally distributed. After that, a homogeneity test was carried out on the pretest and posttest data which had been transformed in **Table 7**.

Table 7. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig
Koneksi matematis	Based on Mean	9.826	1	57	.003
	Based on Median	7.688	1	57	.007
	Based on Median and with adjusted df	7.688	1	35.086	.009
	Based on trimmed mean	8.867	1	57	.004

Based on **Table 7**, the homogeneity test on the transformed pretest and posttest data shows ($p < 0.01$). This means that the variance of students' pretest and posttest mathematical connection data is not homogeneous. However, the paired t-test was still carried out because the mathematical connection pretest and posttest data were normally distributed. The results of the paired t-test carried out show that the use of digital worksheets with Ethno–RME-based had a significant influence on students' mathematical connection abilities which will be shown in **Table 8**.

Table 8. Mean and Standard Deviation of Pre-Test and Post-Test Scores on Students' Mathematical Connection Ability Before and After learning

		Mean	Std. Dev	Std. Error Mean	95 % Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	pre-post	-55.15556	13.78314	2.51645	-62.09185	-49.918	-21.918	29	.000
Pair 2	trans_pre – trans_pos	-.91437	1.44160	.26320	-1.63985	-.18889	-3.474	29	.002

Based on **Table 8**, $p < 0.01$, it means that there is a significant difference between the results of the pre-test and post-test of students' mathematical connections who used the Ethno–RME-based live worksheet. It is known that the average pre-test score for mathematical connection ability is 8.09, while the average post-test score for mathematical connection ability is 63.24. Because the post-test average is greater than the pre-test, it can be concluded that students' mathematical connection abilities after using the Ethno–RME-based digital worksheet are better than before using the Ethno–RME-based digital worksheet. After the paired t-test, the N-Gain test was carried out which is shown in **Table 9**. The N-Gain is obtained at 0.6. These results are included in the moderate category, according to the criteria established by Meltzer (Meltzer, 2002).

Table 9. N-Gain Test Results

	N	Minimum	Maximum	Mean	Std. Deviation
N-Gain	30	0.12	0.73	0.6043	0.15687
Valid N (listwise)	30				

DISCUSSION

One of the results of this research is that the digital worksheet product that has been developed has received a good response from students. Students are interested and actively involved in building the concept of area and volume of a cube through an ethno-RME-based digital worksheet on the *Menara Kudus*. Digital worksheets can be an alternative online teaching material that is interesting and interactive but still constructs student understanding (Fitriani, Hidayah, & Nurfauziah, 2021). Meanwhile, this research also shows that students' mathematical connection abilities after using the Ethno–RME-based digital worksheet are better than before. In addition, the effectiveness of increasing students' pre-test and post-test mathematical connections is in the medium category. In other words, this product can improve the mathematical connections of fifth-grade students.

Digital worksheet developed makes learning more interactive and easy for students to access. This is in line with previous research which states that learning mathematics using digital worksheet in the classroom in Trigonometry learning for high school is an alternative use of e-learning media that contributes to teachers and students (Widiyarsih, Farida, & Sudarman, 2023). Digital worksheet as a technology-based worksheet development is expected to become a learning tool that provides benefits and convenience for students in learning mathematics, including the worksheet developed being easy to use and flexible.

This means that there are no restrictions on place and time in the process. Students can select and input the desired answers and the students' answers will automatically be assessed. Then students can answer many times until they understand. Apart from that, the results of this research are also supported by Mahendra, et al who show that the development of PBL-based worksheets can facilitate students' reasoning abilities (Mahendra, Caswati, & Bharata, 2019). On the other hand, students can learn mathematics well when mathematics is not taught by teachers by conveying formulas or formal mathematical concepts directly but is taught by teachers by involving students in active activities that link mathematics learning to concrete problems (Maharani, Marsigit, Wijaya, 2020). Therefore, teachers must be able to make the best use of it to improve the quality of the mathematics learning process. In other words, teachers should continue to innovate to develop meaningful learning, adapt to student needs, utilize technological advances, and plan fun learning for students (Maharani et al., 2023).

The development of Ethno–RME-based digital worksheets in the current study is limited used to measure students' mathematical connections, hence further efforts to develop mathematical abilities are expected. Apart from that, these Ethno–RME-based digital worksheets were only developed by highlighting the cultural context of the *Menara Kudus*, and for students who had lived in Kudus region. On the other hand, the application of this product is carried out in class so it does not provide real experience for students. Even though students can come directly to the *Menara Kudus* location because it is close to their school. For this reason, in the future study, this product can be integrated with the Math City Map and invite children to come directly to the *Menara Kudus* while learning mathematics. As mentioned by Al Ashari et al., 2021, learning cultural-based mathematics (ethnomathematics) using the Math City Map can improve students' mathematical critical thinking abilities.

CONCLUSION

The development of Ethno–RME-based learning digital worksheets in learning to improve students' mathematical connections on surface area and volume of cubes requires expert or validators to obtain its quality. The validation and evaluation results showed that the worksheet can improve students' mathematical connection abilities for students who lived in the environment of *Menara Kudus*. The modul contained pictures of *Menara Kudus*, task instructions to identify its elements, and followed by problem solving activites. The problems were provided in the context of *Menara Kudus*, thus students might be able to illustrated the problem solution based on their way in connecting their realistic experience in observing *Menara Kudus* with the given problem.The Ethno–RME-based digital worksheets that the researchers developed can be used as an alternative teaching material that is useful for the mathematics learning process. However, attempts to understand how students use mathematical connections are undoubtedly needed. When students were able to identify cultural objects in their living environment, they might use this to experience mathematics connections.

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