JTAM (Jurnal Teori dan Aplikasi Matematika)
http://journal.ummat.ac.id/index.php/jtam
p-ISSN 2597-7512 | e-ISSN 2614-1175
Vol. 9, No. 4, October 2025, pp. 1094-1108

Optimizing Junior High School Students' Mathematical Literacy through Wordwall-Based E-Modules with the FICAS Learning Model

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Article History:
Received : 21-05-2025
Revised : 02-07-2025
Accepted : 05-07-2025
Online : 01-10-2025

Keywords:
Mathematical Literacy;
E-Module Wordwall;
FICAS;
Flipped Classroom;
Learning Independence.

ABSTRACT

The development of digital technology opens up great opportunities in the transformation of mathematics learning, especially in improving students' mathematical literacy. This study aims to develop a Wordwall-based e-module integrated with the FICAS (Flipped Classroom–Advocacy Sosiograph) learning model that is valid, useful, and can help junior high school students become more independent and more mathematically literate learners. The development study of the design research type, which includes the analysis, design, expert validation, limited trials, and assessment phases, is the methodology used. Teachers need to understand the use of technology in learning, especially through wordwall-based e-modules. The technique analysis used is T test analysis to compare the use of wordwall-based e-modules. The findings of this study reveal that the Wordwall-based e-module is able to optimize the flipped classroom approach interactively, improve conceptual understanding, student interest in mathematics learning, and encourage mathematical literacy skills more meaningfully. These findings indicate that the integration of digital media and innovative learning models has significant potential in supporting 21st-century mathematics learning.

https://doi.org/10.31764/jtam.v9i4.31647

A. INTRODUCTION

Language literacy, numeracy literacy, scientific literacy, digital literacy, financial literacy, and cultural and civic literacy are the six fundamental literacies that Indonesians must learn if their country is to prosper in the twenty-first century (Anggraini et al., 2023). One of the most crucial literacy abilities that the country's youth need to possess to compete globally is mathematical literacy, often known as numeracy literacy (Cheung et al., 2021). Students must be able to understand mathematical ideas in a variety of situations to advance their mathematical literacy. Students who possess mathematical literacy are better able to use mathematical ideas while making judgments and selecting tactical solutions to situations they face on a daily basis. Mathematical problem solving, mathematical communication, mathematical reasoning, mathematical connections, and mathematical representation are all examples of mathematical literacy abilities in mathematics education (Fatkurochman et al., 2024). Mathematical literacy can help individual to understand role of mathematics in everyday

life. This is done by using mathematical thinking in problem solving to face life's challenges (Rakhmawati & Mustadi, 2022).

Mathematical literacy is a crucial skill in facing global challenges in this modern era (Heyd-Metzuyanim et al., 2021). A worldwide indicator of pupils' general mathematics literacy is the Program for International Student Assessment (PISA) (Kusmaryono & Kusumaningsih, 2023). The capacity to effectively use mathematical knowledge and comprehension to overcome obstacles in daily life is known as mathematical literacy (Fointuna, 2021; Niss & Jablonka, 2020; Oktiningrum et al., 2016). But the problem is, based on the results we received from 2000 to 2022, there has been no real improvement in quality since we participated in PISA. Based on PISA survey data, Indonesian students' mathematical literacy was came in at number 64 out of 65 nations in 2012, number 63 out of 69 nations in 2015, and number 74 out of 79 nations in 2018, and 12 points lower in 2022 compared to 2018 (OECD., 2012). Based on various research results that have been conducted, it also shows that at all levels of education, Indonesian students still have poor mathematical literacy (Astuti et al., 2019; Kurniawati & Mahmudi, 2019; Rohman et al., 2019). This shows that there is a need to improve the educational process to maximize students' abilities in mathematics.

The existence of the right model is anticipated to help pupils in the domain of the process of processing mathematical information so that their literacy skills can increase (Mahdiansyah & Rahmawati, 2014). Learning can help foster the ability to process information independently and mathematically is the flipped classroom (Pardimin. et al., 2020). With the flipped classroom learning approach, students complete homework that is usually completed at home and study material that is usually completed in class at home (Bergmann & Sams, 2012). Flipped Classroom learning requires students to be independent in their learning (Suryawan et al., 2021). In order to optimize the domain of information processing, students need an instructional approach to advocacy learning. Advocacy learning can improve students' sense of responsibility (Handayani, 2019), students' social skills (Komalasari, 2017), Understanding of students' social problems (Nurwahidah & Muttaqin, 2018), Learning Activities and Achievement (Lisnawati, 2020), Student Learning Outcomes (Haryanto & Suhartono, 2019).

In order for the formed groups to interact as well as possible, it is important to examine the students' communication network (Ouyang et al., 2023). This is done to involve students more throughout the educational process and optimize student-teacher interaction. Using a sociograph to assess the students' autonomous learning process is an additional way to identify the communication network. One type of research finding resulting from the influence of sociomathematical norms is the sociograph. Studying the analysis of sociograph data can help teachers find out which student groups are right, who when grouped, will be able to work together more optimally during group work or discussions (Wijayanto et al., 2023). The problem in this study is the difficulty of individuals in learning mathematics. Basically, learning mathematics is difficult for some people so there needs to be a change in learning methods by utilizing digital technology.

During the epidemic, students and instructors had issues with online learning, including poor communication and interaction (Coman et al., 2020). High levels of student involvement are linked to positive results, including improved academic success and reduced dropout rates (Lo & Hew, 2021b). Some mathematics educators use the flipped classroom technique to

improve student participation in traditional lecture-based courses. This teaching strategy involves moving typical classroom events outside and vice versa (Lo & Hew, 2021a). In some math flipped classrooms, instructors use instructional films to convey basic topics prior to class. This frees up class time for more interactions between instructors and students (Bond, 2020). The flipped classroom approach shifts the focus from professors to students by giving lectures outside the classroom and active learning activities inside.

Seeing the potential of students as a generation Z who are responsive to technology, teachers need incorporating technology into the educational process. E-modules with e-Project specifications, live worksheets, digital content, etc. are innovations that are in line with fulfilling the competencies of 21st Century students (Winatha & Abubakar, 2018). In its implementation, schools are given the freedom and independence to provide projects that are relevant and close to the school environment (Pecore, 2015). According to the background information, the goal of this research is to satisfy the demands of learning innovation in order to develop mathematical literacy abilities. This will hasten the adoption of new paradigm learning where a digital learning environment (e-module) is needed. The specifications of this research are to build mathematical literacy skills through numeracy problems and its specific purpose is to analyze and design technology-integrated learning with e-modules based on integrated wordwalls Flipped Classroom Advocacy Sosiograph (FICAS). The problem solving used in this problem is by utilizing a wordwall-based e-module with quizzes and interactive activities.

However, students' mathematical literacy skills in Indonesia can still be said to be low. In this study, a Wordwall-based e-module will be used as a digital platform that provides quizzes and interactive activities. Interactive learning with wordwalls helps increase student engagement and motivation. The use of wordwalls can also support differentiated learning in the learning methods given to students. This is an opportunity for teachers to increase student participation. With the help of the FICAS (Flipped Classroom Advocacy Sociograph) learning paradigm, this project aims to create a Wordwall-based e-module that is valid, useful, and may help junior high school students become more mathematically literate and independent learners. The purpose of this study is to analyze the use of Wordwall-based e-module as digital platform in order to optimizing mathematical literacy in Junior High School Students.

B. METHODS

Design research-style development studies over multiple stages are the methodology employed. This study was carried out in two phases, namely the preliminary stage, the trial stage (prototyping) (Gravemeijer & Cobb, 2006; Martin, 2016). In the preliminary stage, the activities carried out by researchers include: a) literature review, identification of learning outcomes and mathematical content (flat-sided geometric shapes), numeracy context in flat-sided geometric shapes, construction of mathematical literacy ability indicators, advocacy learning, sociograph suitability, flipped classroom model, and making e-module storyboards. To produce complete theory and suitability of class implementation, a Focus Group Discussion (FGD) was conducted involving junior high school teachers from several junior high schools in Yogyakarta City, lecturers and students b) Preparation of learning tools. Furthermore, the trial stage (prototyping) to perfect the intervention in each product design cycle. In the prototyping stage, the activities carried out by researchers include: development of learning tools, formative

evaluation through self-evaluation, one-to-one, expert validation, small group, and field test. The last stage is the assessment which is a summative test to obtain potential effects from product implementation. The purpose of using the instrument is to focus the analysis on clear learning. The use of appropriate and adequate tools needs to be implemented so that learning can show effectiveness.

Data collection techniques and instruments are based on the data needs used in answering the formulation of research problems. Valid criteria use validation sheets with indicators adopted MBA (2007) which consists of the suitability of content, presentation, language, and graphics. Practical criteria Rahmatsyah & Dwiningsih (2021) using a practicality questionnaire with indicators of ease of use of the product, time efficiency, easy to interpret, in accordance with the material, attractiveness, can be used for independent learning. Furthermore, to see the impact of the development of e-modules containing numeracy with the FICAS integrated wordwall model, a measurement of the potential effect on mathematical literacy skills was carried out using N-gain (normalized gain) (Suryani et al., 2025). In addition, the initial-final assessment is used to determine the increase in students' mathematical literacy skills after and before participating in learning activities with e-modules. Interview techniques are used to obtain information that cannot be obtained from validation sheets and questionnaires, for example to reveal students' mathematical literacy processes. Instruments in the form of validation sheets and questionnaires are calculated using a Likert scale of 1-4 and interview guidelines.

C. RESULT AND DISCUSSION

1. Validation Data

Prototype I of the FICAS learning model book that the researcher developed was validated by validators based on their areas of specialization. A number of changes have been made in response to the validation results of the FICAS learning model book. The results of the validation examination conducted by the validator on the FICAS learning model are shown in Table 1.

Table 1. Expert Team Validation Results Regarding the FICAS Learning Model

No	Validation component	Information	Score	Category
1	Rationalization	Ok, can be used with a little revision	3,60	Valid
	Development of FICAS Learning Model			
	Rationalization			
2	Theoretical Basis	Ok, can be used with	3,20	Valid
	Development of FICAS Learning Model	a little revision		
	Theoretical Basis			
3	Development Phase	Ok, can be used with	3,80	Valid
	Learning Model	a little revision		
	FICAS			
4	FICAS Learning Model Syntax	Ok, can be used with	3,80	Valid
		a little revision		
5	Social System Model	Ok, can be used with	3,70	Valid
	FICAS Learning	a little revision		

No	Validation component	Information	Score	Category
6	Role and Duties of Lecturers	Ok, can be used with	3,90	Valid
	Learning Models	a little revision		
	FICAS			
7	Support System	Ok, can be used with	3,70	Valid
	Learning Model	a little revision		
	FICAS			
8	Instructional Impact	Ok, can be used with	3,50	Valid
	and Supporting	a little revision		
	FICAS Learning Model			
	Instructional Impact			
9	Implementation Guidelines	Ok, can be used with	3,60	Valid
	Learning Model	a little revision		
	FICAS			

It is clear from Table 1 above that the validator claims that the learning model has a solid supporting theory. Each supporting element of the FICAS learning model depends on the others. The expert validation scores for the nine components are included in the "Valid" category, with an average score of 3.64 so that the FICAS learning model is worthy of being tested in the field with revisions. Expert Validation of Learning Tools. This research creates educational resources, such as teaching materials, RPP, LKPD Liveworksheet, mathematical literacy ability test questions, and interview sheets.

a. Expert Validation of Textbooks

Prototype I of the textbook that the researcher developed was validated by validators according to their respective fields of expertise. Based on the validation results, several modifications were made. The following are the results of the textbook evaluation from the validator, as shown in Table 2.

Table 2. Validity of Textbooks

No	Aspect	Information	Score	Category
1	National Security	Ok, can be used with	3,60	Valid
		a little revision		
2	Contents	Ok, can be used with	3,20	Valid
		a little revision		
3	Presentation	Ok, can be used with	3,80	Valid
		a little revision		
4	Implementatio	Ok, can be used with	3,80	Valid
		a little revision		
5	Language	Ok, can be used with	3,70	Valid
		a little revision		
6	Illustration	Ok, can be used with	3,90	Valid
		a little revision		
7	Graphic	Ok, can be used with	3,70	Valid
		a little revision		

Based on Table 2 above, it is concluded that the validator stated that the textbook is based on a strong concept of material and presentation. The supporting aspects of the textbook are consistently interrelated. The results of expert validation on the seven aspects show the category "Valid" with an average score of 3.67 so that the textbook is worthy of being tested in the field with revisions.

b. Expert Validation of the Learning Implementation Plan (RPP)
Prototype I of the RPP that the researcher developed was validated by validators according to their respective fields of expertise. Based on the results of the RPP validation, several modifications have been made. The following are the results of the RPP assessment by the validato, as shown in Table 3.

Table 3. Expert Team Validation Results Regarding RPP

No	Aspect	Information	Score	Category
1	Format	Ok, can be used with a little revision	3,60	Valid
2	Contents	Ok, can be used with a little revision	3,20	Valid
3	Language and Writing	Ok, can be used with a little revision	3,80	Valid

Based on Table 3 above, it is concluded that the validator stated that the RPP is based on a strong format, content, language and writing. The supporting aspects of the RPP are consistently interrelated. The results of expert validation on the three aspects show the category "Valid" with an average score of 3.53 so that the RPP is worthy of being tested in the field with revisions.

c. Expert Validation on LKPD Liveworksheet
Prototype I LKPD Liveworksheet that the researcher developed was validated by validators according to their specialized domains. Based on the results of the LKPD Liveworksheet authentication, several modifications have been made. The results of the LKPD Liveworksheet validation investigation, as shown in Table 4.

Table 4. Expert Team Validation Results Regarding LKPD Liveworksheet

No	Aspect	Information	Score	Category
1	Contents	Ok, can be used with a little revision	3,60	Valid
2	Language	Ok, can be used with a little revision	3,20	Valid
3	Navigation	Ok, can be used with a little revision	3,80	Valid
4	Convenience	Ok, can be used with a little revision	3,80	Valid
5	Writing	Ok, can be used with a little revision	3,70	Valid
6	Appearance	Ok, can be used with a little revision	3,90	Valid

Table 4 above leads to the conclusion that the validator stated that the LKPD Liveworksheet is based on strong material content and media application content. The supporting aspects of the LKPD Liveworksheet are consistently interrelated. The results of expert validation on the six aspects show the category "Valid" with an average score of 3.67 so that the LKPD Liveworksheet is worthy of being tested in the field with revisions.

d. Expert Validation of Mathematical Literacy Ability Test Questions
In accordance with their specialized knowledge, validators verified the first prototype of the researcher's mathematical literacy test questions. A number of changes were made in response to the validation results of the test questions for mathematical literacy. These are the findings from the examination of the mathematical literacy test questions by the validator, as shown in Table 5.

Table 5. Expert Team Validation Results Regarding Mathematical Literacy Ability Test Questions

No	Aspect	Information	Score	Category
1	The formulation of indicators does not give rise to multiple interpretations.	Ok, can be used with a little revision	3,80	Very Valid
2	The test question grid can be used as a guideline for designing the writing of question items and ensuring the validity of the content.	Ok, can be used with a little revision	3,60	Very Valid
3	The instructions for working on the questions are clear and easy to understand.	Ok, can be used with a little revision	3,60	Very Valid
4	Instructions for working on questions using sentences that match spelling.	Ok, can be used with a little revision	3,60	Very Valid
5	The questions are in accordance with the indicators for the mathematical literacy test questions.	Ok, can be used with a little revision	3,80	Very Valid
6	The questions are in accordance with the development of the students.	Ok, can be used with a little revision	3,60	Very Valid
7	The formulation of the questions uses sentences that do not create double meanings.	Ok, can be used with a little revision	3,80	Very Valid
8	The formulation of the questions is in accordance with the grid.	Ok, can be used with a little revision	3,60	Very Valid
9	The instructions for scoring students' mathematical literacy test questions are clear.	Ok, can be used with a little revision	3,80	Very Valid

Based on Table 5 above, it is concluded that the validator stated that the mathematical literacy test questions were based on the formulation of indicators according to the subject CP, question items according to the level of student development, and a clear form of assessment. The supporting aspects of the mathematical literacy test questions

are consistently interrelated. The results of expert validation on the nine aspects showed the category "Valid" with an average score of 3.51 so that the mathematical literacy test questions are worthy of being tested in the field with revisions.

e. Expert Validation of Interview Sheet

Prototype I of the interview sheet that the researcher developed was validated by validators according to their respective fields of expertise. Based on the validation results by the validator, several modifications were made. The following are the results of the validator's evaluation analysis on the interview sheet, as shown in Table 6.

Table 6. Expert Team Validation Results Regarding Interview Sheets

No	Aspect	Information	Score	Category
1	Have the ability to reveal the oral communication process in the mental structure of the action stage and the mental mechanism of interiorization	Ok, can be used with a little revision	3,60	Valid
2	Have the ability to reveal the oral communication process at the mental structure stage of the process and the coordination and reversal mechanisms	Ok, can be used with a little revision	3,80	Valid
3	Have the ability to reveal the process of oral communication at the mental structure of the object stage and the mental mechanisms of encapsulation and de-encapsulation	Ok, can be used with a little revision	3,60	Valid
4	Have the ability to reveal the oral communication process in the mental structure of schemas and mental mechanisms of thematization	Ok, can be used with a little revision	3,80	Valid

Based on Table 6 above, it is concluded that the validator stated that the interview sheet was based on the mental structure and mental mechanism of the material being tested. The supporting aspects of the interview sheet are consistently interrelated. The results of expert validation on the four aspects showed the category "Valid" with an average score of 3.70 so that the interview sheet is worthy of being tested in the field but with slight revisions. A summary of the results of the learning device validation test can be seen in Table 7 below.

Table 7. Expert Validation Results Regarding Learning Tools

No.	Types of Learning Devices	Validation Results	Information
1.	Textbook	Can be used	Slight revision
2.	RPP	Can be used	Slight revision
3.	LKPD Liveworksheet	Can be used	Slight revision
4.	Mathematical Literacy Test	Can be used	Slight revision
5.	Interview Sheet	Can be used	Slight revision

Based on the results of the expert validation above, all learning devices in this study can be used with the note that there are slight revisions.

2. Normality Test

Table 8. Normality Test

Value Output SPSS 26.0		
Data	Kolmogorov-Smornov Z	Asymp. Sig. (2-tailed)
Value pretest	1,055	0,200

Table 8 indicates that both the experimental and control groups' data have a Sig. value of 0.200. Since Sig.≥α, that is, 0.200≥0.05, H_0 is accepted.

Table 9. Homogeneity Test

Value Output SPSS 26.0		
Data	Levene Statistic	Sig.
Value preteset	6.446	0.014

Table 9 indicates that there is a Sig. value of 0.014≥0.05 for both the experimental and control group data. H_0 is allowed since the Sig. value is less than α. According to the experimental group's and the control group's data come from a population that has the same variance (homogeneous).

Table 10. Final Data Normality Test

	Kolmogorov Smirnov		
	Statistic	**Df**	**Sig.**
Standardized Residual for Post-test Values	0,065	64	0,200

Based on the tests summarized in Table 10 above, as can be shown, H0 is approved since the Kolmogorov Smirnov value is 0.200≥0.05. The data is therefore considered to be regularly distributed.

3. Statistical Test

Table 11. Independent Samples T Test

	Levene's Test for Equality of Variances			**t-test for Equality of Means**		
	F		**Sig.**	**T**	**df**	**Sig. (2-tailed)**
Post-Test Mathematics Literacy Test	Equal variances assumed	2.989	.089	2,909	62	.005
	Equal variances not assumed			2,909	58.707	.005

According to Table 11, H0 is rejected and H1 is accepted if the Sig. (2-tailed) value is less than 0.05. This is due to the fact that the Sig. (2-tailed) assumption of equal variance has a value of 0.005. Students in the treatment-receiving experimental group and those in the control group had different final averages for mathematical literacy. The following is a paired sample t-test, as shown in Table 12.

Table 12. Paired Samples T-Test

Paired Samples Correlations				
		N	**Correlation**	**Sig.**
Pair 1	Pre Test & Post Test	32	.541	.001

From Table 12 it can be seen that Sig. (2-tailed) is 0.000, H0 is rejected while H1 is accepted when Sig. (2-tailed) < 0.05. Thus, it can be said that the average pretest value has increased in relation to the posttest value.

4. Discussion of Findings

According to Table 11, H0 is rejected and H1 is accepted if the Sig. (2-tailed) value is less than 0.05. This is due to the fact that the Sig. (2-tailed) assumption of equal variance has a value of 0.005. Students in the treatment-receiving experimental group and those in the control group had different final averages for mathematical literacy. In this case, it is shown that the effectiveness of using the FICAS model and e-module in learning is far different. The application of learning using wordwall-based e-modules with FICAS learning is known to be able to increase the average value in class to provide understanding to students. The use of wordwall-based e-modules with FICAS learning helps in increasing students' learning independence. In this case, students can further improve their ability to find solutions and be more active in learning (Pardimin et al., 2022). Generation Z has a fast response to the use of technology so that technology must be included in the learning process to support it. E-modules are used as learning innovations to meet student competencies in the 21st century (Winatha & Abubakar, 2018). Every educational institution is given an opportunity to utilize digital usage to improve students' mathematical literacy skills. Literacy is used to teach reading, mathematics and science skills. Mathematical literacy requires students to be able to explain and understand mathematical concepts. Each individual with different mathematical capacities needs to receive deeper learning.

Education is a deliberate and organized effort to establish a learning environment that enables students to actively develop their potential for personality, intelligence, spiritual and religious strength, and skills that society and themselves require. Learning activities are the most basic actions in the education process (Dwi Gustia et al., 2024). Sania et al. (2022) support the findings of this study by revealing that the flipped classroom approach in teaching critical thinking. Because more time and quality are available, the flipped classroom approach can improve student learning in the classroom. The length of time spent in class is due to the fact that the material is given through handouts from previous meetings. Mathematical communication skills are the process of organizing and consolidating their mathematical thinking on how students can think logically about mathematics and how students can communicate their ideas or thoughts orally, in writing, real, pictures, graphically, and algebraic strategies so that they can be responsible for these ideas and thoughts.

The findings of this study are in line with studies Astria et al. (2023) which revealed that the average value of students with project based learning increased more than with conventional learning methods. Hikmah et al. (2024) stated that flipped classroom is a learning approach that can change students' interest and involvement during the learning process. In his view, flipped classroom is useful and effective in improving learning outcomes. This

approach can be implemented in students who achieve low achievement. Flipped classroom with wordwall-based e-modules is one of the learning innovations that helps the communication process so that students can better understand what is being taught (Sudariana et al., 2023). Zhou (2023) revealed that the flipped classroom that is applied can affect cognitive abilities in students. The flipped classroom strategy helps improve learning comprehension because of the direct instructions in teaching practices.

The wordwall-based e-module strategy touts a number of learning benefits. Especially when taught in a hybrid environment that combines some form of face-to-face and online training, most of these benefits seem quite beneficial (e.g., extending learning time to make it more engaging). However, there are also drawbacks to this tactic. Trenawati et al. (2024) refutes the statement by stating that the application of unique and creative learning patterns is very important to increase the effectiveness and efficiency of learning. This aims to prevent learning from being boring, repetitive, and less interesting, which can hinder the spread of knowledge. Therefore, the application of learning tools is very important. The Peer Instruction Flipped Classroom approach is a teaching strategy that combines media into its learning process. The flipped classroom learning model allows students to be more active in interacting and sharing information Ulya & Rahayu (2017) after receiving probing-prompting instruction based on ethnomathematics, students' mathematical literacy increased. Traditionally, the growth of students' mathematical literacy skills is in the moderate range, which is 0.54 or 54%.

E-books are a different approach to solving educational problems through the use of technology by using learning materials that are created, produced, and used in the classroom to encourage students' independent learning (Gustia et al., 2024). The statement is in line with the instruments used in this study, especially the use of e-modules. According to this perspective, e-modules that use problem-based models can help students solve difficulties and train judgment when selecting existing knowledge based on the problems faced. E-modules are very useful and efficient for online education. In view of Islahiyah et al. (2021), If e-modules are successful in helping students solve mathematical problems that satisfy at least 70% of students' learning completeness requirements, they are considered effective. Thus, the use of e-modules in flipped classroom instruction can be considered is able to improve learning outcomes because of student participation in thinking and solving mathematical problems.

Wordwall is a website-based feature that provides various types of games, which can be used for the learning process and developed into interesting and fun learning evaluations (Mardiana & Hisnan, 2024). Wordwall as ICT in learning is a strategic step that can increase students' interest and learning achievement and stimulate the development of mathematical creative thinking skills. The use of Wordwall can increase students' interest in learning, which in turn has a positive impact on mathematical creative thinking skills (Emilia et al., 2024). Ayu et al. (2024) supports this by stating that wordwall-based e-modules are used in education to help teachers increase student engagement in working on quizzes on wordwalls. The attractive form implemented on wordwalls makes the learning system more interesting for students in order to increase their desire to solve mathematical problems. Wordwalls can be used to increase the effectiveness of mathematics learning. Wordwalls are implemented on e-modules as games to guide students in solving mathematical challenges (Sagita & Mulyani, 2023).

D. CONCLUSION AND SUGGESTIONS

It can be concluded that the use of Wordwall-based e-modules as digital platform can enhance students' comprehension and motivation to engage in educational activities. The percentage of skill improvement are 54.1% shows from the pearson score. However, pupils' autonomous learning can be enhanced via the FICAS learning model. It is suggested that junior high school students use Wordwall-based e-modules in conjunction with the FICAS learning model to enhance their mathematical literacy and self-directed learning. It is suggested that further researchers can develop this research by using another type of learning, such as hybrid learning, snack ladder game learning, animation video learning and many more.

ACKNOWLEDGEMENT

The author would like to thank the lecturers of the master of elementary education of Sarjanawiyata Tamansiswa University for the various assistance provided. Hopefully the results of this study can provide a significant contribution to the development of science.

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