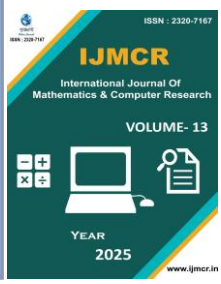
International Journal of Mathematics and Computer Research

ISSN: 2320-7167

Volume 13 Issue 10 October 2025, Page no. – 5787-5793

Index Copernicus ICV: 57.55, Impact Factor: 8.615

DOI: 10.47191/ijmcr/v13i10.13



The Effect of the Problem-Based Learning Model Using Wordwall Media to Improve Conceptual Understanding and Self-Efficacy of Junior High School Students

Lilya Titania[1], Marsigit Marsigit[2]

[1,2]Yogyakarta State University, Yogyakarta, Indonesia

ARTICLE INFO

Published Online:
23 October 2025

ABSTRACT

The Problem Based Learning (PBL) learning model is a student-centered learning approach that uses contextual problems as a starting point for learning with the help of interactive media in the form of Wordwall games. Conceptual understanding is the student's ability to master, explain, and apply a concept correctly in various relevant situations or problems. Self-efficacy is an individual's belief in their own ability to plan and maintain the actions needed to achieve certain learning goals. Research on the use of the PBL model assisted by Wordwall media is still limited, especially in the context of improving conceptual understanding and self-efficacy of junior high school students. This study aims to examine the effectiveness of the PBL learning model assisted by Wordwall media in improving conceptual understanding and self-efficacy of seventh grade students at SMP Negeri 2 Depok Yogyakarta. The type of research used is experimental research using a pre-experimental design. The research sample consisted of 32 students. The results of the study concluded that the Problem Based Learning model assisted by Wordwall media has a significant effect on conceptual understanding and self-efficacy of seventh grade students at SMP Negeri 2 Depok Yogyakarta.

Corresponding Author:
Lilya Titania

KEYWORDS: Problem Solving Skills, Geometry, Self Efficacy.

INTRODUCTION

Education plays a crucial role in preparing future human resources by developing their potential through the learning process at schools, from elementary schools (SD), junior high schools (SMP), senior high schools (SMA), vocational schools (SMK), to universities (PT), each with its own specific vision, mission, and goals. The world of education is required to make a more tangible contribution to efforts to improve the nation's progress. The purpose of education is to encourage people to strive to develop and equip themselves to face the changes brought about by the industrial revolution 4.0 (Aisy et al., 2020). This demonstrates that education plays a crucial role in human life, enabling a clear perspective on life.

According to Minister of Education and Culture Regulation No. 35 of 2018, the basic framework of the curriculum structure for learning, which was initially teacher-centered, has shifted to student-centered learning, resulting in active and interactive learning. However, learning difficulties in the 21st century, particularly in mathematics, lie not only in student skills but also in a lack of proficiency in utilizing technology among students (Nahdi, 2019). In fact, Indonesia ranks middle and has not yet maximized the use of technology in education (Machmud et al., 2021). The above description demonstrates the importance of active, interactive, and student-centered learning, and the use of technology for students is necessary in the current digital era so that students can apply it effectively.

One way to improve mathematics learning is by instilling conceptual understanding at the beginning of learning. According to Nurjanah, (2020) conceptual understanding is a basic skill that students must have in mastering mathematical knowledge well. As explained by Andamon and Tan, (2018) an important component of mathematics learning emphasizes the importance of understanding basic mathematical concepts. In addition, if students are able to write mathematical notation correctly, then the students have understood the mathematical concept (Ramdhani et al., 2017). Supported by previous research, one of the factors inhibiting mathematics learning is that students do not understand mathematical concepts (Sapitri, 2023). Therefore, if educators are able to provide correct, precise, creative and

innovative conceptual understanding, it will produce maximum learning outcomes, because conceptual understanding is an important ability for students to master in learning mathematics.

Student success is not only about understanding mathematical concepts, but also requires increasing self-efficacy (Jannah et al., 2019). Because, when completing tasks related to mathematics, students need self-efficacy (Masnia et al., 2020). According to Rosenberg in Chaouali et al., (2017), self-efficacy is a positive or negative attitude in someone towards a particular object. Self-efficacy aims to make students believe in their own abilities to succeed in the learning process (Destiniar et al., 2019). One of the findings in previous research shows that the higher the self-efficacy of students, the higher the mathematics learning outcomes (Muhtadi et al., 2022). Therefore, a high level of student self-confidence will influence the improvement of students' mathematics abilities.

Mathematical concept understanding and self-efficacy are interrelated abilities. A factor that can help someone succeed in understanding mathematical concepts is student confidence (D. E. Lestari et al., 2023). Therefore, educators and students need to realize that self-efficacy is crucial in the mathematics learning process, especially in understanding mathematical concepts (Masnia et al., 2020). However, current data shows that conceptual understanding and self-efficacy are still lacking and need to be improved immediately.

There are several previous research results, one of which was conducted by Fajar, (2019) showed that students' understanding of mathematical concepts was divided into three categories, namely the high category of 3%, medium as much as 10%, and low 87%. The results of Fauzi & Arisetyawan's research, (2020) showed that students had difficulty in understanding concepts in geometry material. The results of Cahani & Effendi's research, (2019) showed that the results of the concept understanding test conducted on class IX D students showed an overall result of 6 students at 20% in the high category, as many as 10 students at 33.33% in the medium category and as many as 14 students at 46.67% in the low category. Supported by research conducted by Umam & Zulkarnaen (2022) showed that students' mathematical concept understanding abilities were still below optimal. Facts in the field show that students' mathematical scores in understanding mathematical concepts in geometry material are not optimal.

Research conducted by Muhazir et al. (2021) shows that students' self-efficacy is in the moderate category. This is supported by research conducted by Azwar (2017) based on interviews with high school teachers at the research location, which shows that students' self-efficacy is in the low category, because students are reluctant to voice their opinions and answer questions when asked by teachers. Furthermore, several other studies, such as those conducted by Pratiwi & Imami (2022), show that students' self-efficacy is still suboptimal. This is certainly worrying and will impact their ability to learn mathematics. Therefore, this must be taken into consideration for improving mathematics education in the future.

Currently, mathematics learning in the classroom rarely uses learning media as an aid, and not all educators are qualified to create media-based learning. Therefore, efforts are needed to make learning more interesting, relevant, and enjoyable, as well as improve students' collaboration skills and simplify the learning process. Based on observations and interviews conducted at SMP Negeri 2 Depok Yogyakarta, mathematics teachers still use lecture methods, question and answer sessions, group discussions, and textbooks that provide supplementary materials to worksheets as learning aids and limit the delivery of material to using PowerPoint media.

The learning process is not yet student-centered because teachers have not fully utilized learning models and learning resources that motivate students to actively participate in the learning process. Teachers remain teacher-centered, and students become bored when traditional approaches are used, which reduces their motivation to collaborate and maximize learning outcomes. Learning activities are usually dominated by the teacher, who typically controls most of the learning activities; after presenting the material, students are asked to complete practice problems.

According to Hansson (2020), mathematics and technology are interrelated. Educators need technology and mathematics to design and implement an integrated mathematics curriculum (Trofimets, 2021). Mathematics is the foundation of all sciences (Thalhah et al., 2019). Mathematics is studied from elementary school to college, making it a very important foundational knowledge (Zulkarnain et al., 2020). Learning mathematics is not only a matter of calculating, but also connecting it with other subjects and everyday life, and explaining mathematical ideas to others (Deniz-Yilmaz & Incesu, 2022). Therefore, to achieve the goals of mathematics learning and be able to utilize it in life, it is necessary to develop technology-based mathematics learning.

One suitable model for today's era is problem-based learning, which can be applied. The PBL model places a strong emphasis on the role of students as active learners working through real-world or relevant problems (Wahyuni et al., 2023). Students are motivated to construct knowledge and naturally integrate the learning context at school into their daily lives when faced with authentic and active experiences, offered by the problem-based learning model, namely PBL (Arnidha & Noerhasmalina, 2018). In accordance with the opinion of Mujahidin et al., (2021), the problem-based learning model requires students to actively participate in solving problems systematically following the method's steps and allows students to understand and solve problems at their core.

By using game-based learning media, wordwalls are a collection of vocabulary words systematically arranged and presented in large letters on classroom walls, whiteboards, or bulletin boards. To make them easy to read from each student's seat, the words are printed in large letters. Wordwalls are web applications used as learning media, learning resources, and assessment tools that are interesting and fun for students (R. D. Lestari, 2021). Fakhruddin et al., (2021) state that wordwalls are online tools for creating educational games that are bundled together as various types of interactive tests. In addition, Yuniar et al., (2021) revealed that wordwalls offer various game models and templates that can be customized to meet specific needs. Wordwalls can be used in the classroom both individually and collaboratively, offline or online, and anywhere and anytime (Sun'iyah, 2020).

Teachers and students use these terms to refer to a unit or a whole set of terms in various activities (Silvia & Wirabrata, 2021). Furthermore, according to Fikriansyah & Idzi'ayyinnati (2023), a wordwall is an engaging online web application intended to be a fun learning resource, media, and evaluation tool for students. The wordwall page also includes various examples to help new users understand how to use the media (Mujahidin et al., 2021). Wordwall is an online web application for creating fun quiz-based games. Students can use Wordwall in class or at home by accessing it through a website link.

Research on the use of the PBL model assisted by Wordwall media is still limited, especially in the context of improving conceptual understanding and self-efficacy of junior high school students. Therefore, this study aims to examine the effectiveness of the PBL learning model assisted by Wordwall media in improving conceptual understanding and self-efficacy of seventh-grade students at SMP Negeri 2 Depok Yogyakarta. Through this research, it is hoped that more effective and innovative learning methods can be found to improve the quality of education, especially in terms of conceptual understanding and student self-efficacy. The results of this study are expected to be a reference for teachers and education practitioners in developing more effective learning strategies that are appropriate to the needs of students in the digital era.

METHOD

The type of research used in this practicum activity is experimental research. The experimental design used is pre-experimental design, with the aim of determining the effect of problem-based learning model assisted by word wall media to improve conceptual understanding and self-efficacy of seventh grade students of SMP Negeri 2 Depok Yogyakarta. This study uses one class. In that class, students' conceptual understanding and self-efficacy will be tested before and after being given treatment. The research design used in this practicum activity is One-Group Pretest-Posttest Design.

The research design is presented in Table 1.

Table 1. Research Design Table

Pretest	Treatment	Posttest
O_1	x	O_2

Source: Sugiyono, 2015:111

Information:

X: Treatment using a problem based learning model assisted by wordwall media

O_1: : Initial test score (pretest) before treatment is given

O_2: Final test score (posttest) after treatment is given

This research was conducted at SMP Negeri 2 Depok Yogyakarta in the 2023/2024 academic year, located at Jl. Dahlia, Dero, Condongcatur, Depok District, Sleman Regency, Special Region of Yogyakarta 55283. This research was conducted in class VII-A. This research was conducted in the even semester of the 2023/2024 academic year.

The population in this study consisted of all seventh-grade students at SMP Negeri 2 Depok Yogyakarta. The total population of seventh-grade students was 128 students, divided into four classes.

The sample in this study is part of the population taken using simple random sampling technique, because in sampling every member of the population has an equal chance of being selected and taken. The sample in this study was given treatment with the PBL learning model assisted by word wall media, namely class VII A.

The research variables in this study are independent and dependent variables. The independent variable is mathematics learning using PBL with the aid of word walls. The dependent variables are students' conceptual understanding and self-efficacy.

Data Collection Techniques

This study used three data collection techniques, including observation, questionnaires, and tests. The observation technique of learning implementation was carried out to determine the level of learning implementation. The questionnaire was used to obtain student self-efficacy data, while the test was used to obtain data on conceptual understanding of the material on linear equations and inequalities of one variable. The questionnaire was used to determine student self-efficacy. The maximum score obtained from the student self-efficacy questionnaire was 75 points and the minimum score was 15 points. The tests used in this study were pretests and posttests containing material on linear equations and inequalities of one variable. Test data were obtained from assessments on student answer sheets with a maximum score of 100 and a minimum score of 0. Data collection of student conceptual understanding used pretests and posttests. The pretest was given before treatment to see

students' initial abilities. The posttest was given after treatment to see students' final abilities.

1) Test

The test instrument is intended to measure students' conceptual understanding. In this study, the test instrument is a written test related to the material being tested. The written test consists of several descriptive questions covering all the material taught during the study. In this study, two stages of written testing were conducted: a pretest and a posttest. The pretest aims to determine the extent of students' knowledge before being given any treatment. Meanwhile, the posttest is a test to measure students' abilities after being given special treatment, so that the development of student learning achievement can be seen. The pretest has five questions, while the posttest has one. Essentially, each indicator in the pretest and posttest has the same scope, namely indicators that correspond to the main material of linear equations and inequalities with one variable.

2) Self-Efficacy Questionnaire

Non-test instruments were used to obtain qualitative data. Qualitative data were then processed by comparing the obtained data with existing theories. In this study, two non-test instruments were used: a learning implementation observation sheet and a student learning independence questionnaire. A questionnaire is an exploratory method with a list of questions that must be examined by respondents (students who are the objects of the research). The self-efficacy questionnaire is intended to obtain data on the self-efficacy of the students who are the objects of the research. The following is a summary of the student self-efficacy questionnaire.

Data Collection Instruments

Instruments in data collection are tools used by researchers in data collection activities to make the activity systematic and easier. The data instrument used in this study is a concept understanding test. The test is used to collect data on students' conceptual understanding before and after learning. Pretest questions are used to determine students' initial conceptual understanding and posttests are collected to collect data on students' final conceptual understanding. Self-Efficacy Questionnaire: The self-efficacy questionnaire is used to collect data on students' self-efficacy.

The self-efficacy questionnaire grid is shown in the table 2.

Table 2. Student Self-Efficacy Questionnaire Grid

Dimensions	Indicators	Criteria	Questionnaire Items
Level	Confidence in one's abilities	Mathematics difficulty level	1, 5
		Independence	3, 7
Strenght	Confidence in being able to complete math assignments	On time in completing assignments	4, 9
		Try to do the task without cheating	2, 6
		Have a fighting spirit and do not give up easily when experiencing obstacles in completing tasks	15
Generality	Confidence in achieving goals (mathematics learning achievement)	Enthusiastic about participating in mathematics learning	8, 10
		Display an attitude that shows self-confidence throughout the learning process	11, 12
		Using life experiences as a step to achieve success	13, 14

Scoring Guidelines

The scale used in this questionnaire is a Likert scale with five answer choices, as follows:

Table 3. Self-Efficacy Scoring Criteria

Statement	Positive statement score	Negative statement score
Always (A)	5	1
Often (O)	4	2
Sometimes (S)	3	3
Seldom (S1)	2	4
Never (N)	1	5

$$\text{final score} = \frac{overol\ score}{Number\ of\ Questions} x100$$

RESULTS AND DISCUSSION

The purpose of this practicum is to determine the differences in students' conceptual understanding and self-efficacy before and after using the problem-based learning model assisted by

wordwall media. This practicum was conducted at SMP Negeri 2 Depok Yogyakarta by taking class VII A consisting of 32 students who were given treatment using the problem-based learning model assisted by wordwall media. The data collected in this study were data on students' conceptual understanding and self-efficacy obtained using test instruments in the form of pretest, posttest, and questionnaire test sheets.

Results of Descriptive Statistical Analysis

The results of the descriptive analysis are in the form of data from observations of the implementation of learning and the results of tests on students' conceptual understanding and self-efficacy before and after the implementation of the problem-based learning model assisted by wordwall media.

Description of the results of measuring students' conceptual understanding and self-efficacy abilities

Descriptive data analysis was performed on the pretest and posttest data. The pretest and posttest data were used to examine the impact of the wordwall-assisted problem-based learning model on students' conceptual understanding and self-efficacy. Pretest and posttest data for each variable are presented in Table 4.

Tabel 4. Data Hasil *Pretest* dan *Postest* Kemampuan Pemahaman Konsep dan *Self Efficacy*

Description	Bililty to understand concepts		Self Efficacy	
	Pretest	Posttest	Pretest	Postetst
Average	48.44	89.69	43.38	87.16
Standard Deviation	10.273	5.070	8.035	8.211
Variance	105.544	25.706	64.565	67.426
Maximum Value	65	95	57	98
Minimum Value	30	80	34	68

The following is a table that describes the descriptive data of students' mathematical pretest, posttest and normalized gain (N-gain).

Table 5. N-Gain Results Data on Conceptual Understanding Ability and Self-Efficacy

Score	Skills	
	Understanding of consepts	Self Efficacy
N = 32		
Pretest	48.44	43.38
Posttest	89.69	87.16
N-gain	79.19%	77.4%
Kategori N-gain	Tinggi	Tinggi

Based on the above, the average pretest scores for conceptual understanding and self-efficacy were 48.44 and 43.38, respectively. Meanwhile, the average posttest scores for conceptual understanding and self-efficacy were 89.69 and 87.16, respectively. This indicates a difference in students' conceptual understanding and self-efficacy before and after receiving the learning.

Normality Test

The normality test aims to determine the normality of the data sample on students' conceptual understanding and self-efficacy. In testing normality, the researcher used the Kolmogorov-Sminov statistical test with the help of IBM Statistics 25 software. If the significance level value is greater than 0.05, then the data is normally distributed and acceptable. Meanwhile, if the significance level is less than 0.05, then the data is not normally distributed and cannot be accepted.

Table 6. Results of the Normality Test for Pretest and Posttest Data

Shapiro-Wilk	Understanding of Concepts	Self-Efficacy
Sig.	0.20	0.077
Decision	Normal	Normal

The first hypothesis test to determine the influence criteria is the average conceptual understanding score before and after using the problem-based learning model assisted by wordwall media. Before conducting this test, a univariate hypothesis test will be conducted first. This test aims to see whether there is a difference between the average conceptual understanding score assisted by the problem-based learning model assisted by wordwall media before and after being given the treatment. The results of the average test of students' conceptual understanding abilities using the paired samples t-test in SPSS software are presented in Table 7.

Table 7. Summary data of data results for understanding concepts using problem based learning with the help of wordwall media

Statistics	t	df	Sig.	Information
Paired Sample Test	-20.168	31	0,000	H_0 Ditolak

The results of the hypothesis test using the paired sample t test, Learning the problem based learning model assisted by wordwall media with the ability to understand concepts obtained a significance value of 0.000 <0.05, thus indicating that there is an influence between the average pretest and posttest values of the ability to understand concepts before and after using the problem based learning model assisted by wordwall media.

The second hypothesis test to determine the influence criteria is the average self-efficacy score before and after using the

problem-based learning model assisted by wordwall media. Before conducting this test, a univariate hypothesis test will be conducted first. This test aims to determine whether there is a difference between the average self-efficacy scores of the problem-based learning model assisted by wordwall media before and after being given the treatment. The results of the student self-efficacy average test using the paired samples t-test in SPSS software are presented in Table 8.

Tabel 8. Data Rangkuman Hasil Data Self Efficacy Dengan Pembelajaran problem based learning berbantu media wordwall

Statistics	t	df	Sig.	Information
Paired Sample Test	-40.221	31	0,000	H_0 Ditolak

The results of the hypothesis test using the paired sample t test, the problem based learning model assisted by wordwall media with self-efficacy obtained a significance value of 0.000 <0.05, thus indicating that there is an influence between the average pretest and posttest self-efficacy values before and after using the problem based learning model assisted by wordwall media.

CONCLUSION

Based on the results of the practicum, it can be concluded that there are differences in students' conceptual understanding and self-efficacy before and after receiving instruction using the Problem-Based Learning model assisted by wordwall media at SMP Negeri 2 Depok Yogyakarta. Based on the calculation results, the significance value (2-tailed) is 0.000, less than 0.05 using an independent t-test. From these data, it can be concluded that the use of the Problem-Based Learning model assisted by wordwall media has an effect on the conceptual understanding of seventh-grade students at SMP Negeri 2 Depok Yogyakarta. Based on the calculation results, the significance value (2-tailed) is 0.000, less than 0.05 using an independent t-test. From these data, it can be concluded that the use of Problem-Based Learning assisted by wordwall media has an effect on the self-efficacy of seventh-grade students at SMP Negeri 2 Depok Yogyakarta.

REFERENCES

1. Aisy, D. R., Farida, F., & Andriani, S. (2020). Sigil Software-Assisted E-Module Development with a Scientific Approach to Two-Variable Linear Equation Systems (SPLDV) Material. Edu Sains Journal of Science & Mathematics Education, 8(1), 61–71. https://doi.org/10.23971/eds.v8i1.1499
2. Arnidha, Y., & Noerhasmalina, N. (2018). Model Problem Based Learning (Pbl) Pada Pembelajaran Matematika. *JURNAL E-DuMath*, *4*(2), 46. https://doi.org/10.26638/je.755.2064
3. Azwar, A., Surya, E., & Saragih, S. (2017). Development of Learning Devices Based on Contextual Teaching and Learning Model Based on the Context of Aceh Cultural to Improve Mathematical Representation and Self-Efficacy Ability of SMAN 1 Peureulak Students. *Journal of Education and Practice*, *8*(27), 186–195. http://digilib.unimed.ac.id/id/eprint/29968
4. Cahani, K., & Effendi, K. N. S. (2019). Kemampuan Pemahaman Konsep Matematika Siswa SMP Kelas IX pada Materi Bangun Datar Segiempat. *Seminar Nasional Matematika Dan Pendidikan Matematika Sesiomadika 2019*, *2008*, 120–128.
5. Deniz-Yilmaz, D., & Incesu, M. (2022). Introducing Prospective Mathematics Teachers to the Dual Modelling Cycle. *International Online Journal of Educational Sciences*, *14*(1), 232–253. https://doi.org/10.15345/iojes.2022.01.018
6. Fajar, A. P., Kodirun, K., Suhar, S., & Arapu, L. (2019). Analisis Kemampuan Pemahaman Konsep Matematis Siswa Kelas VIII SMP Negeri 17 Kendari. *Jurnal Pendidikan Matematika*, *9*(2), 229. https://doi.org/10.36709/jpm.v9i2.5872
7. Fakhruddin, A. A., Firdaus, M., & Mauludiyah, L. (2021). Wordwall Application as a Media to Improve Arabic Vocabulary Mastery of Junior High School Students. *Arabiyatuna : Jurnal Bahasa Arab*, *5*(2), 217. https://doi.org/10.29240/jba.v5i2.2773
8. Fauzi, I., & Arisetyawan, A. (2020). Analisis Kesulitan Belajar Siswa Pada Materi Geometri. *Jurnal Sosial Teknologi*, *2*(7), 659–654. https://doi.org/10.59188/jurnalsostech.v2i7.377
9. Fikriansyah, M., & Idzi'ayyinnati. (2023). Pengaruh Media Pembelajaran Berbasis Website (Wordwall) Terhadap Hasil Belajar Peserta Didik Pada Mata Pelajaran Fiqih Kelas VII Di Sekolah Menengah Pertama Muhammadiyah 07 Paciran. *Jurnal Mahasiswa Pendidikan*, *4*(2), 1–34. https://doi.org/10.37286/jmp.v4i2.248
10. Hansson, S. O. (2020). Technology and Mathematics. *Philosophy and Technology*, *33*(1), 117–139. https://doi.org/10.1007/s13347-019-00348-9
11. Machmud, M. T., Widiyan, A. P., & Ramadhani, N. R. (2021). The development and policies of ICT supporting educational technology in Singapore, Thailand, Indonesia, and Myanmar. *International Journal of Evaluation and Research in Education*, *10*(1), 78–85. https://doi.org/10.11591/ijere.v10i1.20786
12. Masnia, F., Amir, Z., & MZ. (2020). Pengaruh Penerapan Model Pembelajaran Scaffolding terhadap Kemampuan Pemahaman Konsep Matematis Berdasarkan Self Efficacy Siswa SMP/MTs. *JURING*

(Journal for Research in Mathematics Learning), *3*(4), 367. https://doi.org/10.24014/juring.v3i4.10647

13. Muhazir, A., Hidayati, K., & Retnawati, H. (2021). Literasi matematis dan self-efficacy siswa ditinjau dari perbedaan kebijakan sistem zonasi. *Pythagoras: Jurnal Pendidikan Matematika*, *15*(2), 227–245. https://doi.org/10.21831/pg.v15i2.36255
14. Muhtadi, A., Assagaf, G., & Hukom, J. (2022). Self-Efficacy and Students' Mathematics Learning Ability in Indonesia: A Meta Analysis Study. *International Journal of Instruction*, *15*(3), 1131–1146. https://doi.org/10.29333/iji.2022.15360a
15. Mujahidin, A. A., Salsabila, U. H., Hasanah, A. L., Andani, M., & Aprillia, W. (2021). Pemanfaatan Media Pembelajaran Daring (Quizizz, Sway, dan Wordwall) Kelas 5 di SD Muhammadiyah 2 Wonopeti. *Innovative: Journal Of Social Science Research*, *1*(2), 552–560. https://doi.org/10.31004/innovative.v1i2.3109
16. Nahdi, D. S. (2019). Jurnal cakrawala pendas. *Jurnal Cakrawala Pendas*, *5*(2), 133–140.
17. Nurjanah, Dahlan, J. A., & Wibisono, Y. (2020). The Effect of Hands-On and Computer-Based Learning Activities on Conceptual Understanding and Mathematical Reasoning. *International Journal of Instruction*, *14*(1), 143–160. https://doi.org/10.29333/IJI.2021.1419A
18. Pratiwi, A. F., & Imami, A. I. (2022). Analisis self-efficacy dalam pembelajaran matematika pada siswa SMP. *AKSIOMA: Jurnal Matematika Dan Pendidikan Matematika*, *13*(3), 403–410.
19. Silvia, K. S., & Wirabrata, I. D. G. F. (2021). Meningkatkan Kosakata Anak Usia Dini Melalui Media Wordwall. *Jurnal Pendidikan Anak Usia Dini Undiksha*, *9*(2), 261. https://doi.org/10.23887/paud.v9i2.36814
20. Sun'iyah, S. L. (2020). Media Pembelajaran Daring Berorientasi Evaluasi. *Jurnal Studi Keagamaan, Pendidikan Dan Humaniora*, *7*(1), 1–18.
21. Thalhah, S. Z., Tohir, M., Nguyen, P. T., Shankar, K., & Rahim, R. (2019). Mathematical issues in data science and applications for health care. *International Journal of Recent Technology and Engineering*, *8*(2 Special Issue 11), 4153–4156. https://doi.org/10.35940/ijrte.B1599.0982S1119
22. Trofimets, E. N., & Trofimets, A. A. (2021). Digital Technologies In Mathematical Education. *European Proceedings of Social and Behavioural Sciences*, 1506–1512. https://doi.org/10.15405/epsbs.2021.09.02.168
23. Wahyuni, Syakhruni, & Muniarti. (2023). Penerapan Model Pembelajaran Problem Based Learning dengan Media Wordwall untuk Meningkatkan Minat Belajar Peserta Didik. *Jurnal Pemikiran Dan Pengembangan Pembelajaran*, *5*(3), 913–922.
24. Yuniar, A. I. S., Putra, G. A., Purwati, N. E., Hayatunnufus, U., & Nafi'ah, U. (2021). HITARI (Historical-archaeology Heritage Riddle): Pemanfaatan wordwall sebagai media ajar Indonesia zaman prasejarah di Sekolah Menengah Atas. *Jurnal Integrasi Dan Harmoni Inovatif Ilmu-Ilmu Sosial (JIHI3S)*, *1*(11), 1182–1190. https://doi.org/10.17977/um063v1i11p1182-1190
25. Zulkarnain, Zulnaidi, H., Heleni, S., & Syafri, M. (2020). Effects of SSCS Teaching Model on Students' Mathematical Problemsolving Ability and Self-efficacy. *International Journal of Instruction*, *14*(1), 475–488. https://doi.org/10.29333/IJI.2021.14128A