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Research Article

Connecting, Organizing, Reflecting, Extending Learning Model Assisted By Wordwall Media On Stundents' Numeracy Skills

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ABSTRACT

Students' low numeracy skills are caused by their unfamiliarity in solving word problems, the continued use of conventional learning models, and the limited utilization of instructional media. This research seeks to examine the influence of the Connecting, Organizing, Reflecting, and Extending learning model, supported by Wordwall media, on students' numeracy abilities. This study adopted a quantitative approach through a quasi-experimental design, specifically utilizing the Nonequivalent Control Group framework. The population consisted of all 11 th-grade students at SMAN 1 Kuta Makmur. The sampling technique used was purposive sampling, where class XI A1 was assigned as the experimental group and class XI A2 as the control group. Data collection techniques included observation and testing. The prerequisite tests consisted of the normality test (Shapiro-Wilk), homogeneity test (Levene's statistic), and Mann-Whitney test, assisted by SPSS 26 software. The hypothesis testing results showed a significance value of $0.002 < \alpha$ ($\alpha = 0.05$), indicating that the Connecting, Organizing, Reflecting, Extending learning model assisted by Wordwall media had a significant effect on students' numeracy skills. This result demonstrates that students in the experimental class had better numeracy skills than those in the control class.

Keywords: Connecting; Organizing; Reflecting; Extending; Numeracy; Wordwall

1. INTRODUCTION

Numeracy skills are essential due to their fundamental role in daily life and education. According to Warmansyah et al., (2022), numeracy skills should be developed from an early age, as they expand knowledge and experience, and help students achieve personal growth and improvement. Numeracy is not merely about performing procedures to solve problems; it also encompasses the ability to apply these skills in real-life situations (Weo et al., 2024). Possessing strong numeracy skills enables students to solve everyday problems effectively and is considered a prerequisite for understanding more advanced knowledge. Furthermore, numeracy skills are crucial for students because they are directly related to the application of numbers in daily life (Alfarisi et al., 2023). It can be stated that numeracy skills offer numerous benefits that significantly contribute to solving real-life problems (Salsabila et al., 2024). In general, numeracy skills comprise several key indicators. Han et al., (2017) identify these indicators as: (1) using numbers and symbols to solve problems; (2) analyzing information presented in problems; and (3) interpreting analytical results to draw conclusions.

Based on the results of the Programmer for International Student Assessment (PISA) conducted by the Organisation for Economic Co-operation and Development (OECD) every three years, the 2022 assessment revealed that Indonesia ranked 68th out of 81 participating countries, with an average score of 366. This shows a decline compared to the 2018 results, where Indonesia scored 379, while the OECD average score was 487 (OECD, 2023). Furthermore, Maulidia et al., (2023) reported that Indonesian students' numeracy skills remain relatively low, as many students still struggle to answer PISA questions at levels 1 and 2.

Based on the findings from classroom observations and interviews with a mathematics teacher at SMAN 1 Kuta Makmur, it was identified that students' numeracy proficiency remains considerably below the expected standard. This low level of numeracy is evident from students' difficulties in solving problems related to numeracy skills, as well as during the learning process, where many students are still unable to answer basic questions from the teacher, such as multiplication, division, subtraction, and even addition. On the other hand, the frequent use of conventional teaching methods (lecturing) and the limited integration of technology in the learning process are also contributing factors to students' low numeracy performance. To address this issue, it is necessary to design a learning model that can improve students' numeracy skills. Therefore, the researcher adopted the Connecting, Organizing, Reflecting, and Extending learning model as an instructional approach to address these challenges.

The Connecting, Organizing, Reflecting, and Extending learning model is grounded in constructivist theory and is designed to foster students' active engagement throughout the learning process, enabling them to solve problems independently and strengthen their memory of acquired information. In the Connecting, Organizing, Reflecting, Extending learning model, students are expected to construct their own understanding through group discussions (Hidayat et al., 2022). This process promotes creative thinking, as students become more active and engaged in the learning experience (Triyani & Maysarah, 2024). The model consists of several stages: (1) Connecting in this stage, the teacher presents information related to previously learned material that is relevant to the new topic (Nisa et al., 2022); (2) Organizing in this phase, students explore and express their prior ideas and reorganize the knowledge they have acquired (Zebua et al., 2024); (3) Reflecting here, the teacher assists students in reconstructing their understanding (Indriani & Noordyana, 2021); and (4) Extending at this stage, students begin applying the newly acquired knowledge to solve meaningful problems (Aprilia & Saputri, 2023). The Connecting, Organizing, Reflecting, Extending learning model also offers several advantages, such as increasing student engagement, enhancing memory retention, fostering critical thinking skills, and providing a meaningful learning experience (Atiyah & Priatna, 2023).

In addition, the researcher also utilized instructional media to enhance students' numeracy skills. The learning media used was Wordwall. Wordwall is an online platform that allows teachers to create various types of interactive games and quizzes, which students can access through digital devices (Alessiya & Utoyo, 2024). Wordwall offers 18 easy-to-use templates, all of which are available for free (Sari, 2021). With its interactive features, Wordwall helps students understand mathematical concepts in a more engaging and enjoyable way. It serves as an educational game designed to support the learning process. The incorporation of Wordwall as an instructional medium effectively mitigates students' tendencies to experience disengagement or cognitive strain when completing numeracy exercises assigned by the teacher. Wordwall also has several advantages: it provides a meaningful learning experience, is user-friendly, can be accessed anytime and anywhere via mobile devices, and offers a variety of creative templates that capture students' attention (Lestari, 2021).

This research is also supported by previous studies Nasrulloh et al., (2023) found a significant difference in students' numeracy skills before and after the implementation of the Connecting, Organizing, Reflecting, Extending learning model. This difference was evident from the average numeracy test scores, in which the posttest mean score was higher than the pretest mean score. In addition, (Alessiya & Utoyo, 2024) reported that the use of Wordwall media had a positive impact on students' numeracy skills due to its interactive and engaging nature. Therefore, Wordwall can serve as a supportive medium to enhance classroom learning activities. In line with the research problem outlined above, this study aims to investigate the influence of the Connecting, Organizing, Reflecting, and Extending learning model, supported by Wordwall media, on the enhancement of students' numeracy proficiency.

2. RESEARCH METHOD

This study employed a quantitative approach, which is grounded in the positivist paradigm, emphasizing the collection of clear and objective data. Data were gathered using numerical instruments to test the research hypothesis (Sugiyono, 2019). The type of research applied was a quasi-experimental design, as there were external variables beyond the researcher's control (Sugiyono, 2019). In particular, this research adopted a nonequivalent control group design, wherein the experimental and control classes were assigned without randomization. The research design used in this study is presented as follows:

Table 1. Non-equivalent Control Group Desain

Groups	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_1		O_2

Source: Adapted from Sugiyono, (2019)
Description:
X : Treatment: Implementation of the Connecting, Organizing, Reflecting, Extending learning model supported by Wordwall media
O_1 : Pretest of the experimental class and the control class
O_2 : Posttest of the experimental class and the control class

The study was conducted at SMAN 1 Kuta Makmur during the even semester of the 2024/2025 academic year. The population refers to the entire group of individuals serving as the focus of the research, which in this case consisted of all eleventh-grade students at SMAN 1 Kuta Makmur. The study applied purposive sampling, designating class XI A1 as the experimental group and class XI A2 as the control group. Data collection was carried out through classroom observations of both teacher and student activities, as well as through testing. A numeracy skills test was administered to both the experimental and control groups as a pretest and posttest.

The test instrument was developed by the researcher based on the indicators of numeracy skills. Prior to its use in the study, the instrument underwent tests for validity, reliability, discriminating power, and difficulty level using SPSS version 26. The validity test was conducted to determine whether the instrument was appropriate for measuring the intended

construct, while the reliability test assessed the consistency of the instrument (Janna & Herianto, 2021). Additionally, the discriminating power test was performed to differentiate the abilities of individual students, whereas the difficulty level test classified items into difficult, moderate, and easy categories (Rajagukguk & Naibaho, 2023). The results indicated that out of the seven items developed, five were valid, with a Cronbach's alpha reliability coefficient of 0.786, falling within the reliable category. The discriminating power analysis revealed that four items were categorized as good and one as very good. The difficulty level analysis showed that one item was easy, two were moderate, and two were difficult. Before conducting data analysis, prerequisite tests were performed, including normality and homogeneity tests. Given that the data did not meet the assumption of normality, the Mann–Whitney U test, a non-parametric statistical procedure, was utilized to examine the research hypothesis.

3. RESULTS AND DISCUSSION

3.1 Descriptive Statistics of Students' Numeracy Skills

These results were analyzed descriptively to determine the distribution of students' scores after the treatment was given. The purpose of this analysis is to provide an overview of students' numeracy skills following the treatment in both the experimental and control classes. The following are the results of the data analysis using SPSS 26 software:

Table 2. Descriptive Statistical Data of Students' Numeracy Skills

	N	Minimum Score	Maximum Score	Mean	Standard Deviation
Experiment	21	14	26	21.38	3.584
Control	21	8	23	17.76	3.770

Based on **Table 1**, the experimental class obtained a minimum score of 14, a maximum score of 26, with a mean score of 21.38 and a standard deviation of 3.584. Meanwhile, the control class obtained a minimum score of 8, a maximum score of 23, with a mean score of 17.76 and a standard deviation of 3.770. The results indicate that the experimental group's mean score falls within a higher category compared to the control group. This suggests that the implementation of the Connecting, Organizing, Reflecting, Extending learning model assisted by Wordwall media led to more optimal numeracy skill achievements in the experimental class.

3.2 Normality Test

The purpose of the normality test is to assess whether the collected data follow a normal distribution (Hudri et al., 2024). In this study, The Shapiro–Wilk test was employed to assess data normality, as it is appropriate for sample sizes below 50 participants (Sintia et al., 2022). The data were deemed to follow a normal distribution when the significance value was equal to or greater than 0.05, thereby supporting the acceptance of the null hypothesis (H_0). Conversely, when the significance value fell below 0.05, the data were classified as non-normally distributed, leading to the rejection of the null hypothesis (H_0). The results of the normality test using SPSS version 26 are presented below:

Table 3. Normality Test Results of Students' Numeracy Skills

	Shapiro-Wilk		
	Statistic	df	Sig.
Experimental Posttest	0,874	21	0,011
Control Posttest	0,942	21	0,236

Based on **Table 2**, revealed that the experimental class obtained a significance value of 0.011, which is below the 0.05 threshold, leading to the rejection of the null hypothesis (H_0) and indicating non-normal data distribution. In contrast, the control class yielded a significance value of 0.236, exceeding the 0.05 criterion, thereby supporting the acceptance of H_0 and confirming a normal distribution. Given that one group failed to meet the normality assumption, it was concluded that the dataset as a whole was not normally distributed; consequently, the hypothesis testing employed a non-parametric statistical approach, specifically the Mann–Whitney U test.

3.3 Homogeneity Test

The homogeneity test aims to determine whether the data from the experimental and control classes are homogeneous or not (Annisak et al., 2024). In this study, the homogeneity test used was the Levene's test. The dataset was regarded as homogeneous when the significance value met or exceeded 0.05, which justified the acceptance of the null hypothesis (H_0), whereas the data were classified as non-homogeneous when the significance value was below 0.05, thereby leading to the rejection of the null hypothesis (H_0). The results of the homogeneity test using SPSS version 26 are presented below:

Table 4. Homogeneity Test Results of Students' Numeracy Skills

	Levene Statistic	df1	df2	Sig.
Posttest Results Based on Mean	0,057	1	40	0,813

Based on **Table 3**, the significance value for numeracy skills was 0.813. Since the significance value is ≥ 0.05, H_0 is accepted, indicating that the data are homogeneous. This suggests that both groups have equal data variances, allowing the hypothesis testing used to compare the two groups to be conducted on an equal basis

3.3 Hypothesis Testing

Hypothesis testing was conducted using the Mann–Whitney test, as not all data were normally distributed. The Mann–Whitney test was used to determine whether there is an effect of the Connecting, Organizing, Reflecting, Extending learning model assisted by Wordwall media on students' numeracy skills. When the significance value fell below 0.05, the null hypothesis (H_0) is rejected in favor of the alternative hypothesis (H_1), suggesting the presence of a statistically significant effect. In contrast, a significance value equal to or above 0.05 resulted in the acceptance of the null hypothesis (H_0) and the rejection of the alternative hypothesis (H_1), signifying the absence of a statistically significant effect. The results of the Mann–Whitney test using SPSS version 26 are presented below:

Table 5. Hypothesis Test Results of Students' Numeracy Skills

Test Statistics[a]	
	Posttest Score
Mann-Whitney	99.000
Wilcoxon W	330.000
Z	-3.068
Asymp.Sig. (2-tailed)	0,002

Based on **Table 5**, the Asymp. Sig. (2-tailed) value for the posttest data was 0.002, which is less than 0.05. This indicates that H_0 is rejected and H_1 is accepted, leading to the conclusion that the Connecting, Organizing, Reflecting, Extending learning model assisted by Wordwall media has a significant effect on students' numeracy skills.In this context, the experimental group outperformed the control group, suggesting that the application of the Connecting, Organizing, Reflecting, and Extending learning model supported by Wordwall media had a positive impact on students' numeracy skills. These findings are supported by the results of hypothesis testing, which indicate that students' numeracy skills in the experimental class were better than those in the control class. This result is in line with the study conducted by Crismono et al, (2024), which showed that the experimental class using the Connecting, Organizing, Reflecting, Extending learning model achieved high learning outcomes, while the control class using the conventional model achieved average results. Research by Nasrulloh et al, (2023) Further evidenced that the implementation of the Connecting, Organizing, Reflecting, and Extending model exerted a statistically significant influence on students' numeracy performance. In addition, a study by Thoyyibah et al, (2024) revealed that Wordwall media can increase students' engagement and enthusiasm during learning activities, as well as enhance their numeracy skills.

The Connecting, Organizing, Reflecting, Extending learning model is a discussion-based instructional model that incorporates components such as expressing opinions, peer questioning, and critique (Husna et al., 2024). This model emphasizes students' ability to connect, organize, reflect on, and extend the information they have acquired. It also has a positive impact by encouraging active student engagement in the learning process. According to Friscillia et al, (2021), the implementation of the Connecting, Organizing, Reflecting, Extending learning model can make students more active, as each stage of the model requires active student participation. Consequently, implementing the Connecting, Organizing, Reflecting, and Extending model facilitates students' structured cognitive development through a sequential process of linking, organizing, reflecting upon, and deepening their conceptual comprehension.

In addition, the use of Wordwall as an interactive medium in the learning process can encourage students' active participation (Oktaviyana et al., 2025). The visual display and game-based features offered by Wordwall help students stay focused and more engaged when completing numeracy tasks. Wordwall provides a variety of interactive features, such as quizzes, anagrams, and matching activities, which can be adapted to suit numeracy questions. According to Herta et al., (2023), using Wordwall can enhance students' learning engagement because of its interactive and enjoyable nature. Furthermore, Wordwall allows teachers to conduct real-time assessments during the learning process. This aligns with the view of Zaen & Fauzi Miftakh, (2022) who stated that Wordwall helps students understand numeracy concepts in an engaging and non-monotonous way through enjoyable learning experiences. Therefore, implementing the Connecting, Organizing, Reflecting, Extending learning model supported by Wordwall media not only provides meaningful learning experiences but also fosters active student engagement in developing a deeper understanding of numeracy concepts.

4. CONCLUSION

The findings of this research demonstrate that the Connecting, Organizing, Reflecting, and Extending learning model, when integrated with Wordwall media, exerts a significant positive influence on students' numeracy proficiency. This conclusion is substantiated by the Mann–Whitney test results, which produced a posttest significance value of 0.002. According to the predetermined hypothesis testing criteria, an Asymptotic Significance (2-tailed) value below the α threshold of 0.05 warrants the rejection of the null hypothesis (H_0) in favor of the alternative hypothesis (H_1). Therefore, it can be affirmed that the application of the Connecting, Organizing, Reflecting, and Extending learning model supported by Wordwall media effectively enhances students' numeracy skills.

RECOMMENDATIONS

Based on the results of the study, the following suggestions are proposed: In implementing the Connecting, Organizing, Reflecting, Extending learning model, teachers are encouraged to adjust the learning materials and allocate sufficient time, as this model requires relatively longer instructional periods. For future researchers, it is recommended to further develop the Connecting, Organizing, Reflecting, Extending learning model assisted by Wordwall media at different educational levels or in other subject areas. Additionally, it is advised to provide supporting facilities such as a stable internet connection and adequate technological devices to optimize the implementation of the model.

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