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Research paper

The Effectiveness of the Reading, Mind Mapping, and Sharing (RMS) Learning Model in Improving Students' Learning Outcomes in Road and Bridge Construction

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ABSTRACT

Background: The principal aim of this study was to evaluate the impact of employing the Reading, Mind Mapping, and Sharing (RMS) learning strategy on student learning outcomes within a course focused on road and bridge construction. The motivation for c conducting this research arose from the observation that SMK Negeri 1 Sumedang students exhibited inferior performance compared to their KKM peers in the context of road and bridge construction.
Methods: Furthermore, limited research has explored the implementation of student-centred educational models within this specific realm. To address these concerns comprehensively, researchers opted to utilize a quasi-experimental strategy encompassing a non-equivalent control design. Data collection involved gathering information before the implementation of intervention methods through pre-tests and subsequently following up with post-tests post-intervention.
Result: A detailed analysis of the gathered data demonstrated clear discrepancies in learning outcomes between both experimental and control groups. Additionally, A notable discovery involved calculating normalized gain (N Gain) values for participants utilizing RMS model techniques. Such calculations indicated a moderate level of enhancement, as apparent through median value determinations yielding 0.553. Additionally, outcomes among exceptionally effective participants yielded impressive N gain percentages, standing at around 55.26 percent.
Conclusion: Accordingly, it can be concluded without doubt that implementing teaching techniques based on RMS (Reading, Mind Mapping, and Sharing) principles hold substantial promise in enhancing student comprehension levels within road and bridge construction curriculums.

INTRODUCTION

Based on Law No. 20 of 2003 regarding the National Education System in Indonesia, vocational education falls under the category of secondary education and aims to equip students with job-specific skills. The objective is for Vocational High Schools (SMK) to cater to various skill requirements demanded by both business and industrial sectors (DU/DI). In the book titled "Improving the Learning Process and Assessment of the 21st Century in Improving the Quality of" by (Sajidan, 2018), it is emphasized that SMKs play a vital role in preparing students to meet the growing demand for skilled labor in line with the expansion of Indonesia's business and industrial landscape.

As a result of the expansion of the business and industrial worlds, Indonesia has entered the 21st century, which is expected to create more employment opportunities. Education in SMK, as launched by the Directorate of Vocational Development in the development of long-term education (2005–2024), is geared toward enhancing international competitiveness in preparation for global competition, where students are expected to possess 21st-century skills.

The provision of modernized teaching materials, learning media, facilities, and learning models can aid in the development of 21st-century skills in students (Mardhiyah et al., 2021). To better prepare their students for global competition, Vocational High Schools (SMK) are encouraged to improve the quality of their education with a focus on 21st-century skill development. The efficacy of this education can be determined by analyzing successful learning outcomes in the classroom. The success of learning activities itself can be used as a benchmark for student success in participating in learning activities and also for evaluating learning outcomes. In addition, research (Rahayu & Iswardhany, 2020), shows that a person's success is not only seen from hard skills, but soft skills also play a role in mastering skills in the 21st century. The learning process oriented to 21st century skills should no longer be teacher-centered but should instead focus on students (student-centered) with the aim of making students more active in the learning process. This approach ensures that the aspects of 21st century skills can be achieved, and students can obtain optimal learning outcomes. In line with this perspective, (Greenstein, 2012) explains that students in the 21st century must possess wisdom, metacognitive skills, the ability to think critically and creatively, and the capacity to communicate and collaborate effectively. Several categories of expertise competencies adapted to the development of employment in the business and industrial sectors (DU/DI) will be the focus of Vocational High Schools (SMK).

In observations conducted at SMK Negeri 1 Sumedang, it was noted that many teachers still implement a teacher-centered learning approach, particularly in subjects related to road

and bridge construction, focusing on the competence of building modeling and information design skills (DPIB). The teacher-centered learning system makes teachers dominant, less innovative, and monotonous, resulting in passive student engagement (Pangabean et al., 2021). This is evident in the field, where the mid-term examination (UTS) results for bridge road construction subjects show that less than 50% of students achieve learning outcomes that meet or exceed the Minimum Competency Criteria (KKM) scores.

To improve learning outcomes, the learning process must be of high quality (Fayakun & Joko, 2015). Applying a student-centred learning approach that incorporates 21st-century skills is one way to enhance learning outcomes. Research by Amin & Rahayu (2021) suggests that various methods, including the Drill learning method, can be employed to improve student learning outcomes, by allowing students to focus on problem exercises. One learning model that can be applied is the *Reading, Mind mapping*, and *Sharing* (RMS) learning model (Muhlisin, 2017).

The mind mapping technique itself was originally popularized by Tony Buzan in 1974. In his book entitled “Mindmap Smart Book” in 2007, Tony Buzan suggested that *mind maps* are a creatively and effectively way to take notes while still being able to map our thoughts. According to Ganiev & Abdunazarova (2021), the process of constructing a mind map employs graphics and visuals to improve information retention in memory, particularly in the brain. The ability to visualize information enhances the brain's inherent propensity to recognize and process images. Findings from a 2019 study titled "Effect of RMS (Reading, Mind Mapping, and Sharing) Models Based on E-Learning on Student Learning Outcomes in Teaching and Learning Subjects," suggest that RMS models are highly effective in learning. Through collaboration, students are able to generate topic-encompassing mind maps. In addition Widyaningsih et al. (2019) found that a significant effect size value is associated with the implementation of the RMS model, indicating its efficacy in improving student learning outcomes.

Based on the description provided earlier, the author is interested in conducting research related to the effectiveness of the Reading, Mind mapping, and Sharing (RMS) model applied to students in learning road and bridge construction. The choice of the road and bridge construction subject is grounded in the findings that, in this area, teachers have not explored the use of *a* student-centered approach, and student learning outcomes still fall below the Minimum Competency Criteria (KKM). Consequently, the author has proposed the title "The Effectiveness of the Application of the *Reading, Mind Mapping, and Sharing* (RMS) Learning Model in Improving Student Learning Outcomes in Road and Bridge Construction Subjects".

METHODS

The research was carried out using an experimental approach in the form of pseudo-experiments or Quasi-Experimental Design, which is an adaptation of True Experimental Design. In this research design, there were two classes: the experimental class and control class. According to Sugiyono(2019) in his book 'Research Methods: Quantitative, Qualitative, and R & D', the presence of the control class serves as a means to control variables that may influence the research. However, even with a pseudo-experimental design, the control class cannot fully control these variables. The pseudo-experimental design employed in this study took the form of N on- Equivalent *Control Group Design*. This choice aligned with the research needs and conditions in the field, where researchers cannot randomize classes to create new classes, but must select from pre- existing classes.

In this research design, both the experimental and control groups would undergo a pre-test to evaluate their initial abilities. The initial test results will serve as a benchmark against which the final test results of the experimental class will be compared. The primary objective of this study was to assess the effectiveness of the Reading, Mind Mapping, and Sharing (RMS) learning model in the context of road and building construction. The aim was to gather data on changes in learning outcomes within the experimental class after the implementation of the intervention.

The population in this study consisted of grade XI students specializing in Building Modeling and Information Design at SMK Negeri 1 Sumedang, totaling 106 students across three classes. These classes include DPIB 1 class with 35 students, DPIB 2 class with 3 students, and DPIB 3 class with 35 students. The research sample was determined using a purposive sampling technique. initially, a trial sample of 20 students was selected from class XI DPIB 2. Subsequently the research samples included class XI DPIB 1, with 35 students assigned to the experimental group, and class XI DPIB 3, with 35 students designed as control group.

This study used a research instrument in the form of multiple- choice test questions administered as both a pre-test and a post-test. The test questions underwent a series of validation processes, including a validity test using the product moment correlation from Karl Pearson to determine appropriateness. Additionally, reliability test was conducted using the Kuder Richardson formula to determine the level of confidence in the use of test questions. Analysis of question items included assessments of difficulty level and differentiating power. According to Arikunto (2015), this analysis is employed to gather information about the effectiveness of a question and to provide guidance on potential corrections.

The process of data analysis involved calculating scores based on the initial (pre-test) and concluding (posttest) results to evaluate the improvement in student learning outcomes. Each correct response to the multiple-choice questions was assigned one point, while incorrect responses were given zero points. The data were then presented through tables, graphs, and diagrams, along with calculations of measures such as mode, median, mean, standard deviation, and percentage.

Afterward, an independent t test was carried out prerequisite for calculating N-Gain. In the preceding independent t test, the data must undergo a prerequisite test, including a normality test to determine the normal distribution of data and a homogeneity test to assess whether the data exhibit homogeneous variations. In this study, the independent t test compared the pre-test and posttest values between the experimental group and the control group.

Once it was determined that there was a significant difference between the learning outcomes of the experimental class and the control class, the N-Gain calculation was performed. This calculation helps determine the extent of improvement in student learning outcomes before and after the treatment, as indicated by the results of the pre-test and post-test (Hake, 1998). The N-Gain calculation is used to evaluate the efficacy of the applied learning model in enhancing learning outcomes.

RESULTS AND DISCUSSION

One of the goals of this study is to determine the effectiveness of the Reading, Mind Mapping, and Sharing (RMS) learning model in enhancing learning outcomes for fundamental skills in in road and bridge construction courses. Using predetermined statistical methods, the study calculates the frequency of students' data related to horizontal and vertical road infrastructure content. The learning outcomes in both the experimental and control classes are then presented as frequency data corresponding to the criteria for competency mastery defined in the guideline for assessing learning outcomes and character development in vocational high schools. In addition, a descriptive analysis is performed to provide an overview of the learning outcomes achieved by students in both experimental and control classes.

Table1.
Pre-test Data Frequency of Experimental Class Students

Range of Values	Information	Experimental Class		Control Class	
		Pre-test	Post-test	Pre-test	Post-test
N ≥ 85	Very Competent	-	6	-	-
85 > N ≥ 70	Competent	-	18	-	11
70> N ≥ 65	Quite Competent	-	7	-	12

Range of Values	Information	Experimental Class		Control Class	
		Pre-test	Post-test	Pre-test	Post-test
N < 65	Not Competent Yet	35	4	35	12
Percentage of students completing learning		0%	68.57%	0%	31.42%

Table 2.
Learning outcomes of experimental and control class students

No	Assessment Items	Experimental Class		Control Class	
		Pre-test	*Post-test*	*Pre-test*	*Post-test*
1	Lowest student grades	26.09	52.17	26.86	47.83
2	Highest student grades	56.52	91.30	60.87	82.61
3	Average learning outcomes	42.98	74.66	42.86	65.96

Judging from the percentage of students who have completed learning based on pre-test scores in both the experimental and control classes, none of the students have been able to get scores above the Minimum Competency Criteria (KKM). The average pre-test scores between the two classes showed no significant difference; in general, the initial abilities of the two groups were relatively similar. According to Sugiyono's book, "Quantitative, Qualitative, and R&D Research Methods," a positive pre-test result is indicated when there is no statistically significant difference between the experimental class and the control class.

A greater proportion of students in the experimental class have completed their coursework compared to the control group. Table 2 demonstrates a statistically significant difference between the final ability scores (post-test) of the experimental group and the control group. A t-test was conducted to determine the significance of the difference between the pre- and post-test scores of the experimental class and the control class.

The results of the independent T-test on the pre-test scores of the two classes showed a significance of 0.949, which is less than 0.05. This implies that there is no significant difference, and it can be interpreted that the initial ability levels of the two classes are the same. The significance of the difference in post-test values between the experimental class and the control class, tested through an independent t test, showed a value of 0.000, which is less than 0.05. From this significance value, it can be concluded that there is a significant and real difference in the post-test values between the experimental class using the Reading, Mind mapping and Sharing (RMS) model and the control class. This difference is believed to occur due to variations in treatment given to the two classes. This is in line with previous research by Anzelina & Tamba (2020), which showed a significant difference between learning outcomes using the RMS learning model and those using the Problem-Based Learning model, with the study employing two different treatments. Furthermore, research conducted by Azizah & Kristiyanti (2019)

indicated a difference between the average post-test scores using the RMS learning model and the non-RMS learning model.

As mentioned previously, the pre-test scores of the experimental class and the control class did not differ significantly, indicating that they had comparable initial abilities. However, significant differences in post-test scores were observed. The N-Gain value can be calculated to evaluate the improvement in learning outcomes for both the experimental class and the control class. This calculation will shed light on the degree of improvement in learning outcomes for both categories.

Table 3.
Gain Values of Experimental Class and Control Class

Class	Number of students	Pre-test average	Post-test average	N-Gain	Information
Experiment	35	42.98	74.66	0.553	Keep
Control	35	42.86	65.96	0.411	Keep

The control group's N-Gain value of 0.411, falling within the medium range, indicates a moderate increase in learning outcomes. Similarly, the experimental class utilizing the Reading, Mind Mapping, and Sharing (RMS) learning paradigm had an N-Gain value of 0.553, also classified as medium. Both approaches effectively improved the academic performance of moderately performing students.

This happens because, in accordance with Yusuf (2017)'s statement, "learning is a combination of human elements (students and teachers), materials (learning media), facilities (rooms), and processes that influence each other in order to achieve learning objectives". Therefore, in improving learning outcomes, an appropriate combination of elements is needed. In this study, because both learning models turned out to have the same interpretation in improving student learning outcomes -namely in the medium category- the use of learning models in each class can be considered quite good. However, this interpretation has not been able to show the effectiveness of using the learning model.

As for theoretical considerations in the selection of learning models to be applied to students, it is necessary to consider several factors. According to Nurdyansyah & Fahyuni (2016), these factors include considerations of the learning objectives to be achieved, considerations of learning materials or resources, considerations from the perspective of students and non-technical considerations in the form of effectiveness and efficiency of using the learning model. Supported by research (Komang et al., 2020), the application of alternative learning models can improve learning outcomes and motivation in vocational schools.

Using N-Gain calculations, the efficacy of the learning model in both the experimental and control classes was evaluated. The experimental classes using the Reading, Mind Mapping, and Sharing (RMS) learning model obtained an N-Gain percentage of 55.26 percent, placing them in the moderately effective category. In contrast, the control class's N-Gain percentage averaged 41.05 percent, placing it in the less effective category. A learning model is deemed ineffective if its N-Gain is less than 40%. Both learning models were effective, but in distinct ways. Based on the interpretation of the N-Gain percentage, it is possible to conclude that the Reading, Mind Mapping, and Sharing (RMS) Learning Model is more effective at enhancing learning outcomes in the fundamental competence related to the principles of vertical and horizontal infrastructure in road and bridge construction subjects. This aligns with research conducted by Sapoetra (2019), which suggests that the application of mind mapping methods is effective in improving student learning outcomes, leading to increased students' engagement, creativity, and innovative in learning. Furthermore, Diani et al. (2018) showed that, based on data analysis, the Reading, Mind Mapping, and Sharing (RMS) model is more effective in improving concept mapping skills, making it easier for students to grasp the provided material. Kustian (2021) in his research concluded that *the* mind mapping method can improve student learning outcomes; however, each learning model always has its advantages and disadvantages.

CONCLUSION

The conclusion should be written in paragraphs as opposed to using numbers to summarize the results and discussion. The conclusions will address the research hypothesis, research objectives, and research findings. It should not consist solely of a summary of the results and discussion but should be a comprehensive summary of the research findings as anticipated by the author in the research objectives or hypothesis. In addition, the conclusion suggests future experiments and/or calls attention to those already in progress.

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