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Vocational High School Students' Learning Outcomes Using Number Head Together Model: A Comparative Study

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Abstract : *This study aims to describe the difference in student learning outcomes using the numbered head together (NHT) learning model and the problem based learning model. the type of research used is quasi experiment research with non-equivalent control group design using a quantitative approach. The research was carried out at State Vocational High School 1 Kediri Building Modeling and Information Design Expertise Program and took place in the odd semester of the 2025/2026 school year. The sampling technique used for this study was with a purposive sampling technique of 36 students as an experimental group and 33 students as a control group. The instrument used in this study is a test of 20 multiple-choice questions in measuring student learning outcomes. The data analysis technique in the study used a different test (t-test). The results of the study showed a significant difference in student learning outcomes using the Numbered Heads Together model (0.000) compared to the Problem-Based Learning model. The NHT model prioritizes collaboration and active participation, which has been proven to improve student learning outcomes. The NHT model prioritizes collaboration and active participation, proven to improve student understanding. This is shown by the interaction between students can strengthen their understanding through explaining to each other. In addition, the NHT model also encourages students to be more confident in expressing their opinions. Thus, the results of this study confirm the interactive and collaborative NHT model in improving student learning outcomes in the future.*

Keywords : *Numbered Head Together; Problem Based Learning; Vocational High School.*

INTRODUCTION

Vocational High Schools have a very important role in the formal education system in Indonesia. With a focus on developing practical skills and relevant theoretical knowledge, Vocational High Schools aims to prepare students to face challenges in an increasingly complex global era (Muhadhi & Sutadji, 2025). In this context, vocational schools not only function as educational institutions, but also as a vehicle to build students' professional character and attitude (Chotimah et al, 2025). However, behind this noble goal, there are a number of challenges that must be faced, especially in the implementation of an effective learning model (Zhou et al., 2022).

One of the main goals of vocational schools is to help students keep up with developments in the fields of art, science, and technology independently. In an ever-changing world, the ability to adapt and learn independently has become crucial (Hikmah

et al., 2023). For example, in the field of information technology, vocational school students are expected to master the latest software and understand emerging digital trends. With the right training, they can become professionals who are ready to compete in the job market (Kurniawati et al., 2023). However, often the curriculum implemented is not in line with the needs of the industry, so students feel less prepared when entering the world of work. This shows the need for periodic evaluation and updating of the curriculum to remain relevant to the times (Soeprijanto et al., 2023).

However, the biggest challenge facing vocational schools today is the implementation of less effective learning models. Many teachers still use traditional teaching methods that focus on lectures and memorization, without providing opportunities for students to actively engage in the learning process (Fadlilah, 2024). This results in a lack of student motivation and not optimal learning outcomes. For example, in practical subjects, students should be given the opportunity to get directly involved in real projects, rather than just learning from books. By applying a more interactive and group discussion-based learning method, students will more easily understand the material and be able to apply it in a more real context (Wijnia et al., 2024).

Based on the results of observations at State Vocational High School 1 Kediri on February 10 – June 5 2025, learning activities are weak in problem solving using the model Problem Based Learning. Students are more likely to discuss in groups in solving problems than when students are given an example case of a problem. This finding is strengthened by the proof of documentation in the previous material, students do not understand and the learning objectives have not been achieved in each meeting. Student learning outcomes were at an average of 72.63. This shows the weak knowledge of students, especially in the elements of engineering mechanics. As a form of triangulation, an unstructured interview session was conducted with teachers and students who concluded that it was necessary to experiment with a learning model with a group discussion method. The Numbered Head Together model was chosen because it was considered more suitable to be applied.

The Numbered Head Together (NHT) model is an innovative approach developed by Spencer Kagan in 1992 (Sahida, 2023). This model is designed to create an interactive and collaborative learning atmosphere, where students not only act as recipients of information, but also as processors and disseminators of knowledge. In the context of education that increasingly emphasizes 21st-century skills, such as collaboration communication, and problem-solving, NHT offers effective solutions to meet those needs (Bella et al., 2024). One of the advantages of the NHT model is its ability to encourage students to share ideas with each other (Escajayanti, 2023). In practice, each student in a small group is assigned a number, and when the teacher asks a question, the student with a specific number is chosen to answer. This creates a tense atmosphere while also encouraging students to discuss their answers with their group mates before giving a final

answer. This process not only increases student engagement, but also strengthens their understanding of the material being studied.

Furthermore, the NHT model serves as a tool to foster the spirit of cooperation between students. In a cooperative learning environment, students are taught to respect each other's opinions and work together to achieve common goals (Efendi, 2023). This is crucial in building the social skills necessary in daily life. A real-life example of this can be seen in a group project where students have to plan and execute a presentation. Using NHT, each group member contributes to the creation of the presentation material, so they learn to support each other and appreciate each other's contributions (Le, 2025). This learning model also requires students to be active in searching, processing, and reporting information from various sources. In today's information age, the ability to access and evaluate information is essential. By implementing NHT, students are trained to not only get information from textbooks, but also from articles, videos, and other online resources(Tristaningrat, 2024). For example, in an engineering mechanics lesson, students may be asked to look up information about force changes from various sources and then discuss their findings in groups. This not only enriches students' knowledge, but also trains them to think critically and analytically.

The NHT model is a form of structural cooperative learning that emphasizes the use of special patterns in building interaction between students (Almumen, 2025). These patterns are designed to facilitate effective communication and productive collaboration. In its implementation, teachers need to design activities that are not only engaging but also challenge students to think deeply. An example of a workable activity is a group discussion on relevant issues, where students can share perspectives and argue based on the data they collect (Hamid, 2022). The application of the NHT model also requires students to work together in small groups cooperatively. In small groups, students have the opportunity to contribute without feeling pressured by a large number of members. This creates a more comfortable and supportive atmosphere for students who may find it awkward to speak in front of a larger class (Pebriana et al., 2025). Thus, this model not only improves academic skills, but also interpersonal skills that will be useful in the future. In conclusion, the NHT model is an effective approach to creating an interactive and collaborative learning environment. By encouraging students to share ideas, work together, and process information from a variety of sources, this model not only enhances students' academic understanding but also important social skills (Laamena et al., 2021).
Several previous studies have proven the success of the application of the NHT model in improving student learning outcomes which shows that there is a positive and significant influence. The above findings are supported by the results of research conducted by (Agustin et al., 2024) where the NHT model is able to improve students' critical thinking skills during the discussion process in class. The ability of students to process knowledge from several learning sources is shown through the application of the NHT model. Based on the background description and supported by several relevant previous research

results, this study aims to describe the differences in student learning outcomes through the Numbered Head Together learning model and the Problem Based Learning model in the engineering mechanics elements of class 10th Building Modeling and Information Design (BMID) State Vocational High School 1 Kediri. The Problem Based Learning model is used because previously in the classroom the problem based learning model had been implemented. While effective in improving critical thinking skills, it often results in uneven understanding among students. For example, students who catch the material faster may dominate the discussion, while others lag behind.

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METHOD

The type of research used is quasi experiment research with non-equivalent control group design using a quantitative approach. The research was carried out at State Vocational High School 1 Kediri BMID Expertise Program and took place in the odd semester of the 2025/2026 school year. The population used in this study is all students of the BMID Expertise Program at State Vocational High School 1 Kediri from grade 10th to grade 12th with a total of 200 students. The sampling technique used for this study is purposive sampling technique. According to , "Sudjana, (2005) purposive sampling is also known as consideration sampling, occurs when sampling is carried out based on individual considerations or the consideration of the researcher." The selection of purposive sampling techniques in this study is based on the consideration that classes 10th BMID-1 and 10th BMID-2 have been determined by the school with balanced academic ability. This is because the subject of engineering mechanics at State Vocational High School 1 Kediri is in phase E or only taught in class 10th. Therefore, class 10th BMID-1 was chosen as an experimental class using the NHT model with a total of 36 students and 10th BMID-2 as a control class using the Problem Based Learning model with a total of 33 students, because both are considered to have equivalent characteristics, So that it is in accordance with the basic principles of purposive sampling which prioritizes the consideration of the researcher in selecting the right sample. Each learning model is applied for 2 meetings. The research design to be implemented is presented in Figure 1 below.

Group	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_1	-	O_2

Where :
O_1 : Score of *Pre Test*
O_2 : Score of *Post Test*
X : Learning using Numbered Head Together
- : Learning using Problem Based Learning (before being given treatment, the class has implemented Problem Based Learning)

Figure 1. Non-Equivalent Control Group Design

The instrument used in this study is a test of 20 multiple-choice questions in measuring student learning outcomes. The instrument has undergone validity and reliability testing so that it can be used for proof. The data analysis technique in this study was conducted through a descriptive analysis stage to describe the collected data. Furthermore, before testing the hypothesis using a t-test, prerequisite analysis tests were first conducted, including a normality test to determine whether the data were normally distributed and a homogeneity test to ensure equality of variance between groups.

RESULT AND DISCUSSION

1. Results

The results of the research on the experiment of obtaining student learning outcomes in learning engineering mechanics with materials on the arrangement and calculation of forces in the building structure have increased. This is seen based on descriptive statistical tests and the results of the pretest and posttest measurement tests consist of the lowest score, highest score and average. Table 1 presents the student learning outcome scores obtained through the application of the NHT model.

Table1. Descriptive Statistic Results of Pretest and Posttest Scores of ExperimentalGroups

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	36	30	65	45.4167	8.81354
Posttest	36	70	100	85.2778	8.53099

Based on the data of Table 1, it shows that the average value of the pretest measurement test or before being given treatment with the application of the NHT model is 45.4167 and the standard deviation is 8.81354 with the lowest result with a score of 30 and the highest score of 65. After being treated with the NHT modelget an average score (Posttest score) of 85.2778, and obtain a foreign exchange standard 8.53099, in addition to the highest score achieved in the posttest to be 100 and the lowest score is 70. The number of students who participated in the application of the NHT model during the pretest and posttest measurement tests was 36 students. In the control group with the PBL model, there was also an increase based on the results of descriptive statistical analysis, pretest scores and posttest scores were obtained consisting of average, highest score, and lowest score.

Table 2 Descriptive Statistic Results of *Pretest* and *Posttest Scores* of Control Group

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	33	25	60	39.5455	8.78241
Posttest	33	60	90	74.2424	8.11261

Based on the data of Table 2 ,the average score of the pretest measurement test or before being given treatment with the application of the PBL model is 39.5455 and the

standard deviation is 8.78241 with the lowest score with a score of 25 and the highest score of 60. After being treated with the PBL model obtained an average score (Posttest score) of 74.2424, and obtained a standard deviation of 8.11261, in addition to the highest score achieved in the posttest to 90 and the lowest score was 60. The number of students who participated in the application of the PBL model during the pretest and posttest measurement test was 33 students. Based on the results of the descriptive statistical analysis of the experimental group and the control group, the comparison of pretest and posttest scores from the two learning models that have been applied will be analyzed.

Table 3 Comparison of Measurement Results Experiment and Control Group

Measurement Stage	**Group Average**		**Score Difference**
	Eksperimen	**Control**	
Pretest	45.4167	39.5455	5.8712
Posttest	85.2778	74.2424	11.0354

Based on the Table 3, it can be seen the difference in average score at the beginning before being given the treatment of the NHT and PBL models. The pretest score of the experimental group was 45.4167 while the control group was 39.5455. So that the difference between the average score of the experimental group and the control group was 5.8712. After being given the treatment of the Numbered Head Together and Problem Based Learning models, the Posttest score of the experimental group was 85.2778 and the posttest score of the control group was 74.2424. The normality test is used to determine whether it is normal or not, the normality test uses the Kolmogorov Smirnov category with the provision that if the significance number is > 0.05, then the data is distributed normally, while if the significance number is <0.05, then the distributed data is abnormal.

Table 4 Distribution Normality Test Results using One-Sample Kolmogorov-Smirnov

		Pretest NHT	**Posttest NHT**	**Prestest PBL**	**Posttest PBL**
N		36	36	33	33
Normal Parameters	Mean	45,4167	85.2778	39.5455	74.2424
	Std. Deviation	8.81354	8.53099	8.78241	8.11261
Most Extreme Absolute		0.130	0.126	0.146	-0.143
Differences	Positive	0.130	0.124	0.146	0.129
	Negative	-0.120	-0.126	-0.127	-0.143
Kolmogorov-Smirnov Z		0.130	0.126	,146	-0.143
Asymp. Sig. (2-tailed)		0.130	0.161	0.072	0.083

Based on the results of the Table 4, it can be seen that significant numbers from the results of the pretest score–Posttest of the experimental group and the control group through the Kolmogorov Smirnov test were obtained >0.05 so that it can be concluded that

the population of pretest and posttest score data of the experimental group and the control group is normally distributed. The variance homogeneity test is used to find out whether the variants of the two groups are homogeneous or not. A data is said to be homogeneous if the significance number > 0.05. The results of the homogeneity test of variance of the data used are as follows:

Table 5 Test of Homogeneity of Variances

	Levene Statistic	**df1**	**df2**	**Sig.**
Pretest	0.047	1	67	0.830
Posttest	0.087	1	67	0.769

Based on the Table 5 of variance homogeneity test results, it can be seen that the significant number of pretest scores on the basis of the pretest score on the basis of the mean shows the significance 0.830 and 0.769. The results of the analysis concluded that the pretest score data population of the experimental group and the control group showed a significance of > 0.05, meaning that the pretest score data population had a homogeneous variance. In addition to the pretest score variance homogeneity test, the variance homogeneity test is also carried out on posttest scores. The following is a Table 5 of the homogeneity test of posttest score variance for the experimental group and the control group.

The data that has been analyzed is distributed normally and homogeneous so that data analysis to test the hypothesis can use parametric statistics, namely with an independent sample t-test. The t-test uses posttest scores as a reference to test the difference in learning outcomes between students who use the NHT model and the PBL model.

Table 6. Independent Samples Test Results

		t-test for Equality of Means					
						Std. Error Difference	**95% Confidence Interval of the Difference**
		t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Lower**	**Upper**
Postest Score	Equal Variances assumed	5.494	67	0.000	11.03535	2.00844	7.02649
	Equal variances not assumed	5.507	66.903	0.000	11.03535	2.00399	7.03526

Based on the Table 6 of the results of the Independent Sample Test t, the number t calculated is 5.494 with sig. (2-tailed) 0.00. The probability value < 0.05 it can also be said

that there is a significant difference in student learning outcomes using the Numbered Head Together learning model and the Problem Based Learning learning model.

2. Discussion

The results of the study showed that there was a significant difference in student learning outcomes using the Numbered Head Together model compared to the Problem Based Learning model. The findings of this study are in line with research conducted by Ristono, (2022) The NHT model can improve student learning outcomes, not only improve student understanding but also encourage active student involvement in the learning process. The NHT model succeeds in creating a collaborative learning atmosphere, where students discuss and share knowledge. Then the research conducted by Imam & Taufik, (2022) the results of the research conducted shows that there is a significant influence of the NHT model on the improvement of student learning outcomes, through the NHT model students not only gain knowledge but also develop important skills that will be useful in their lives in the future.

Then the research conducted by Anggriani & Murtini, (2023) the results of the research conducted show that the application of the NHT model has been proven to have a significant positive impact on the results of improving student learning outcomes, and also developing students' social and critical skills. Furthermore, the research conducted by Nurkhatima et al., (2024) the results of the research conducted show that the use of the NHT model is proven to improve student learning outcomes, the learning process becomes more interactive and interesting so that students are more motivated to participate. Other research conducted by Nurohmah et al., (2025)the results of the research obtained can be concluded that student learning outcomes using the Numbered Head Together experiencing significant improvements, through active and collaborative interactions, students not only acquire new knowledge but also develop social and critical thinking skills that are essential in education.

In this study, it was found that students who applied the Problem Based Learning model did not fully understand the material evenly. This can be seen from the learning outcomes that tend to be lower when compared to the NHT model. Problem Based Learning, while effective in improving critical thinking skills, often results in unequal understanding among students. For example, students who catch the material faster may dominate the discussion, while others lag behind. Instead, NHT encourages the active involvement of the entire student in a more structured way. In this model, each student is given the opportunity to contribute, so that collective thinking can emerge. Thus, it can be concluded that although PBL has advantages in the development of certain skills, NHT is more effective in ensuring an even understanding of the material among all students. This is in line with the findings from (Rijal et al., 2021) where students who learn to use NHT are mode effective in understanding the material in groups.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that there is a significant difference in student learning outcomes using the Numbered Head Together model compared to the Problem Based Learning model. The NHT model prioritizes collaboration and active participation, proven to improve student understanding. This is shown by the interaction between students can strengthen their understanding through explaining to each other. In addition, the NHT model also encourages students to be more confident in expressing their opinions. Thus, the results of this study confirm the interactive and collaborative NHT model in improving student learning outcomes in the future. This study focuses on the difference in learning outcomes between the two learning models that have their own characteristics and advantages. The suggestion for the next research is that there are other variables that support and interact between the learning model and learning outcomes.

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