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Optimization of Building Statics Learning Outcomes Through the Peer Teaching Models

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ABSTRACT

Education plays a fundamental role in developing intelligent, competent, and characterful human resources. Efforts to improve the quality of learning are essential, particularly at the vocational high school level, which prepares students to face global competition. Observations at Vocational School 1 Percut Sei Tuan revealed that students' understanding of building statics calculations remains low. This problem is partly due to the lack of optimal interaction between teachers and students during the learning process. Therefore, innovative and participatory learning strategies are needed to improve the quality of learning outcomes. This study aims to improve student learning outcomes through the implementation of the Peer Teaching learning models. The method used is Classroom Action Research (CAR) which is implemented in two cycles. The research subjects were 30 students in the Building Statics Calculation subject. Each cycle consists of planning, action implementation, observation, and reflection. Data were collected through learning outcome tests and student activity observation sheets, then analyzed using quantitative and qualitative descriptive techniques. The results of the study showed a significant increase in learning outcomes. In cycle I, the average student score was 75.67 with a completion rate of 73.33%. In cycle II, the average score increased to 83.34%, with a completion rate of 83.33%. Thus, the Peer Teaching Models is suitable as an alternative learning strategy for material that requires conceptual understanding.

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1. INTRODUCTION

Education is a vital means of developing intelligent individuals who are ready to face challenges worldwide. Education, especially in technical and vocational fields, is crucial for modern progress (Amin, 2023). Ki Hajar Dewantara argued that education is a prerequisite for achieving happiness in life. Education encompasses spirituality, character, emotional intelligence, social skills, and cognitive abilities (Ujud et al., 2023). Education itself, as a value and character education, aims to help individuals understand, care about, and act according to ethical principles. We certainly hope that children can recognize what is right, care about it, and have the courage to act according to their beliefs, despite pressure or temptation. The process of character formation should also consider family culture, life experiences, and environmental conditions at the national and global levels (Harahap & Isya, 2020) .

Education serves as the primary foundation for honing students' thinking skills, skills, and morality (Humeirah et al., 2023). In Vocational School, learning focuses on preparing students for the world of work through mastery of competencies, the development of professional work attitudes, and the development of entrepreneurial potential. The curriculum in vocational school is designed to align with industry needs, emphasizing a balance between theoretical and practical learning. As part of the educational institution under the auspices of the North Sumatra Provincial Government, Vocational School 1 Percut Sei Tuan plays an active role in supporting vocational education through the implementation of 14 fields. competence . One of the areas of expertise offered is Building Information Modeling and Design (DPIB), which focuses on mastering building technical skills, from the design planning stage to structural calculations. Graduates of this program are prepared for careers in the construction sector, such as architects, drafters, or estimators. One of the important materials taught in the DPIB program is Building Statics Calculation.

Initial observations showed that many students had difficulty understanding the basic concepts of building static calculations. This is caused by less than optimal relations. from the teacher and students, resulting in less active and engaging learning. Learning completion is determined by a minimum score of 75 as the classical minimum completion. 61.29% of students did not achieve the minimum completion, indicating low learning achievement. This situation highlights the importance of updating learning models to encourage increased student understanding and engagement. Data related to the summary of student learning outcomes are arranged in **Table 1.**

Table 1. Learning Outcomes of Building Statics Calculation Elements for Class X DPIB Vocational School 1 Percut Sei Tuan

School year	Mark	Number of Students	Presentation	Information
2024-2025	80-85	5	16.13%	Good
	75-79	7	22.58%	Pretty good

School year	Mark	Number of Students	Presentation	Information
	< 75	19	61.29%	Not enough
Total:		**31**	**100%**	**-**

Referring to **Table 1,** it can be seen that almost all students have not achieved optimal achievement in the Building Statics Calculation element, because their scores are below the KKM limit, where 75 percent of the total 31 students showed learning outcomes that did not meet the standards based on the daily test scores of the odd semester of the 2024/2025 academic year. The highest percentage of scores obtained was recorded at 16.13% (5 students), 22.58% (7 students), and 61.29% (19 students). This finding makes it clear that the majority of students have not achieved the expected learning targets. This phenomenon occurs due to the implementation of a traditional learning approach, where the primary focus of learning is centered on the teacher. As a result, teachers often deliver material expositorily in front of the class, but only a small percentage of students can understand it well. Some students appear less active and reluctant to ask questions about material they still don't understand. This condition leads to a tendency for students to avoid asking questions to the teacher and choose to discuss with other students as an alternative.

In an effort to strengthen the active role of students in learning activities, it is necessary to implement a models that can facilitate their direct involvement. Learning models encompass various steps, techniques, and models designed to make teaching activities more effective, enabling students to master and understand the lesson comprehensively. The scope of learning models includes curriculum development, use of instructional media, material development, evaluation, and classroom management (Riza & Barrulwalidin, 2023) . Some of the capability models are implemented in achieving the peer teaching models . According to (Khoiriyah, 2021), peer teaching is a learning system approach in which students play an active role and become more adept at conveying information, concepts, or material to their classmates during the learning process. Meanwhile, according to Haris in (Hertiavi & Kesaulya, 2020), peer teaching is an approach in which students exchange insights. With this models, students are given the opportunity to hone their skills by teaching material to their peers in small groups (Kurniawan et al., 2023).

Peer teaching focuses on equal collaboration between students to deepen shared understanding, while peer tutoring emphasizes individual or small group assistance from more competent students. Both models are effective, but with different approaches. This is supported by interviews with several students who stated that learning with peers is more effective than learning with a teacher. Therefore, in this study, *peer teaching* was chosen as the more appropriate models. Previous research has shown that the peer teaching models does not always produce optimal results on the first try, but its effectiveness increases in subsequent cycles (Selly, 2021). Similarly, research findings (Yunita, 2022) show an increase in scores for the majority of students from the first cycle to the next, indicating the effectiveness of the peer teaching models in optimizing learning outcomes.

Research (Nurhasanah & Gumiandari, 2021) has shown that the peer teaching models can improve student achievement and motivate them to continue developing. Furthermore, this models contributes to increased student self-confidence, particularly in terms of the courage to speak up and actively participate during the classroom learning process. Peer teaching models must be implemented according to its objectives, namely encouraging active learning, increasing students' courage to ask questions, motivating them, and developing students' academic, social, and thinking skills. Not only that, this models is also effective in improving students' behavior, attitudes, communication, and skills. (Yusanti & Dewi Nirmala, 2025) proved that after participating in learning using the peer teaching models, students experienced a significant increase in conceptual understanding compared to before.

Several studies indicate that collaborative learning systems have the potential to improve student learning outcomes at various levels because the material is easier to understand. However, there are still limited studies examining the application of this models, especially on statics elements in vocational schools. In relation to the challenges faced, this study aims to fill the gaps in previous studies by evaluating the role of the peer teaching models in improving learning achievement . students in the material on building statics calculations for class X DPIB in the 2024/2025 academic year at Vocational School 1 Percut Sei Tuan. X DPIB students of Vocational School 1 Percut Sei Tuan. This research focuses on the material of building statics calculation elements according to the program curriculum. The study was limited to evaluating students' cognitive aspects in understanding the concepts and applications of building statics calculations, excluding affective and psychomotor aspects from the research scope. This limitation aimed to maintain the research focus and to produce a comprehensive picture of the effectiveness of the peer teaching models in improving students' cognitive understanding of the material being taught.

2. METHOD

The research took place in the 2024/2025 academic year period. involving 30 participants from class X at Vocational School 1 Percut Sei Tuan, located at Jl. Kolam No.3, Kenangan Baru, Percut Sei Tuan . The design uses Classroom Action Research (CAR) with a quantitative approach for data collection and analysis. According to Sugiyono in (Suwarsa, 2021), quantitative data is data in the form of numbers that are analyzed statistically. According to Kunandar in (Nurulanningsih, 2023), Classroom Action Research (CAR) is a strategic effort to optimize the quality of learning by involving teachers as researchers and agents of change. Classroom Action Research (CAR) is research carried out by teachers in the classroom to improve professionalism through actions in learning. CAR aims to improve and develop the learning process and student services, while also providing solutions to classroom problems and a means of improving teacher competency. A good CAR report is compiled systematically according to the rules, so it has both technical and substantive characteristics (Utomo et al., 2024) .

Review of applying the PTK approach From Kurt Lewin's design , which focuses on a cycle of experimental action and reflection as an effort to optimize learning quality (Bernadetta Purba et al., 2021) . This models is based on four main stages: planning, implementation, monitoring, and review. In this stage, preparation of plans , implementation of idea designs and implementation designs which are the initial basis for implementing research, stages of preparing idea designs such as preparing learning designs and research instruments. To ensure its effectiveness, observations are conducted after the action or implementation of the plan. The observation stage begins with a pre-test to measure students' abilities before the peer teaching models is implemented, followed by providing teaching materials and discussions, and ending with a post-test for comparison. Finally, reflection is used to modify the results and determine further steps or improvements. According to Purwono in (Dewi et al., 2023) , the success of classroom action research is determined when the majority of students achieve a minimum score of 75 as the completion limit. In this context, it is considered successful when 80% to 100% of students achieve a score exceeding the Minimum Competency (KKM) reached 75.

The data collection procedure in this study involved the use of instruments and documentation. The instruments used in this study aimed to assess students' mastery of the pre- and post-implementation stages of the peer teaching models. The instrument contained 30 questions, with a score of 1 for correct responses and 0 for incorrect responses. Before being used on research participants, this instrument underwent several stages of testing, namely instrument validation, difficulty level testing, question discrimination testing, and reliability testing in each cycle. In the Validity Test treatment using the biserial formula contained in (Sanaky, 2021) , the results of the first cycle were 24 valid questions. and 6 invalid questions . Meanwhile, in cycle II, the number of valid questions was 21, with 9 invalid questions. These valid questions were used as the instrument in this study. The next testing stage was the level of preference testing using the criteria according to Witherington (Magdalena et al., 2021) . The results obtained in cycle I included 3 easy questions, 20 medium questions, and 1 difficult question. not easy , where the total is 24 questions. Cycle II has 17 medium questions, 3 difficult questions, and 21 questions.

The next step is to test the differentiating power of the questions using the formula proposed by Supranto (2012) in (Magdalena et al., 2021) which is contained in the results obtained in cycle I cycle II which has 24 questions, including 3 superior questions , 17 question items. good , and 4 sufficient questions . In the second cycle, there were 21 questions, including 1 question with a very good description, 16 good questions, and 4 sufficient questions. The final step in the instrument test was the reliability test which obtained results that the reliability of the research instrument was classified as very high, namely with a score of 0.840 in the first cycle and 0.800 in the second cycle. Based on this , the instrument is ready to be used for research, with data processing techniques such as calculating the passing percentage and conducting a hypothesis test using a one-sample t-test. This research is considered successful if the proportion of students who obtain a minimum score of 75 as completion increased and reached a minimum of 80%.

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3. RESULTS AND DISCUSSION

The results of research conducted on students of Vocational School 1 Percut Sei Tuan to improve learning outcomes in the elements of building statics calculations in cycles I and II using the *peer teaching* models showed the following results:

3.1 Research result

The level of learning success in cycle I through *the post-test* obtained a fairly satisfactory score but could not yet be said to be successful. The research results data are summarized in **Table 2.**

Table 2. Percentage of Success of Cycle I

School year	Mark	Number of Students	Presentation	Information
Learning outcomes TA 2024-2025	86-100	2	6.67	Very Superior
	80-85	13	43.33	Superior
	75-79	7	23.33	Quite Superior
	< 75	8	26.67	Not enough
Total:		**30**	**100%**	
Percentage of completion >75			**73.33%**	
Percentage of incomplete <75			**26.67%**	

Table 2 shows the *post-test results* obtained from 24 multiple-choice questions. A total of 2 students received scores with excellent criteria, 13 students received good information, 7 received fairly good information, and 8 students received less information. The number of students who completed the category was 73.33 %, this indicates an increase in learning outcomes from before. However, the research has not been said to be successful because it has not reached the success indicator of 80%. By carrying out the reflection that has been produced in the first cycle. Then the second cycle was carried out with the test achievement scores in as seen in **Table 3.**

Table 3. Percentage of Success in Cycle II

School year	Mark	Number of Students	Presentation	Information
Learning outcomes TA 2024-2025	86-100	14	46.67%	Very good
	80-85	8	26.67%	Good
	75-79	3	10%	Pretty good
	< 75	5	16.66%	Not enough
Total:		**30**	**100%**	
Percentage of completion >75			**83.34%**	
Percentage of incomplete <75			**16.67%**	

The post-test results were obtained from 21 multiple-choice questions. Of the total students, 14 were included. In the very good description, 8 students were in the good description , 3 students were in the sufficient description , and 5 students were in the less detailed description .

The percentage of completion reached 83.34%, which indicates that this research has been successfully implemented. Furthermore, **Table 4** presents the analysis of the results between cycle I and cycle II.

Table 4. Analysis of Results of Cycle I and Cycle II

Student Learning Outcomes	Cycle I	Cycle II
Average Value	75.67	83.5
Success Percentage %	73.33	83.34
Percentage of Success Indicator %	**80**	**80**

The **Figure 1** illustrates data on the improvement in learning outcomes of students in Vocational School 1 Percut Sei Tuan based on **Table 4.**

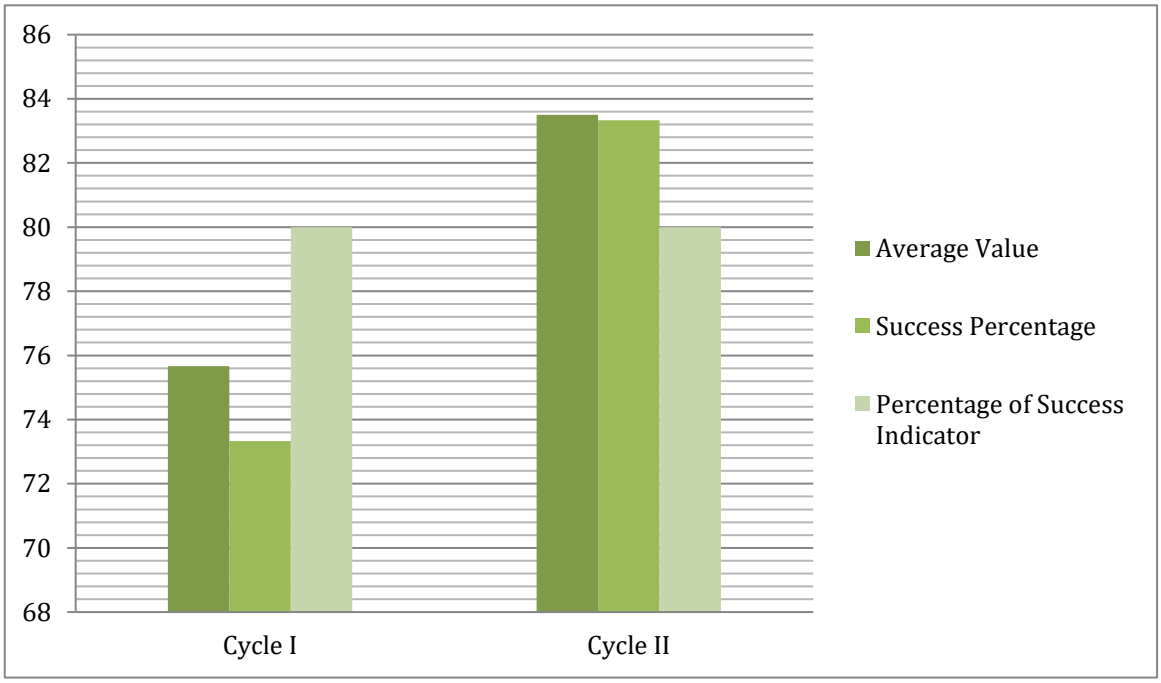

Figure 1. Graph of Learning Outcomes Development in Cycle I and Cycle II

Analysis of the data presented in the tables and graphs indicates that the implementation of the peer teaching models significantly improved achievement in the first and second cycles. an increase of 10.01% between the two cycles. Based on the post-test results, 25 out of 30 students achieved completion in the second cycle. This aspect indicates the success of the research by achieving the success criteria with a value of 80%. These findings show a satisfactory graph, consistent with previous research that has implemented peer teaching as a learning models to improve student learning outcomes. Previous research conducted by (Lestari et al., 2020), applied peer teaching to improve student learning outcomes, particularly in computer systems. The study, conducted over two cycles, found that student learning outcomes improved in cycles I and II.

Peer teaching was also applied to multiplication material to improve students understanding in third grade elementary school (Tulfauziah et al., 2024). This study revealed that peer teaching is effective in improving student understanding. Furthermore, the use of peer teaching as a learning method was also carried out on students for calculus courses, which found that this method could improve students calculus scores (Journal et al., 2020). From the explanation above, it can be concluded that the application of peer teaching can be done in various lesson contexts and school levels. Therefore, this study strengthens and confirms previous findings. Overall, the implementation of the *peer teaching* models was successful in improving students academic achievements statics calculation element material for class X DPIB Vocational School 1 Percut Sei Tuan building in the 2024/2025 Academic Year.

4. CONCLUSION

The results of data analysis in the study "Improving Building Statics Learning Outcomes through the Peer Teaching Models for Grade X DPIB Students" show that the *peer teaching learning strategy* has a significant effect on students' learning progress in the material on calculating building static elements for the 2024/2025 academic year. This conclusion is in line with the previous theoretical description which emphasizes the importance of implementing the peer teaching models in supporting students academic achievement, especially in the cognitive aspects of the subject.

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REFERENCES

Amin, R. (2023). Kontribusi penguasaan materi untuk menyelesaikan tugas terstruktur pada pendidikan menengah vokasi. *Jurnal Pendidikan Teknik Bangunan*, *4*(1), 71-82.

Bernadetta Purba dkk, P. (2021). Penelitian Tindakan Kelas. In *Penelitian Tindakan Kelas*.

Dewi, R. S., Indrawati, D., & Indah, A. (2023). Peningkatan Pemahaman Konsep Nilai Tempat Bilangan Melalui Media Kantong Bilangan Pada Peserta Didik Kelas I Sdn Sukodono 1 Sidoarjo. *Educatioanl Journal: General and Specific Research*, *3*(Juni), 211–219.

Harahap, S., & Isya, W. (2020). Model Pendidikan Nilai dan Karakter di Sekolah. *PEDADIDAKTIKA: Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, *7*(1), 21–33.

Hertiavi, M. A., & Kesaulya, N. (2020). Peer Teaching sebagai Upaya Meningkatkan Hasil Belajar Mahasiswa Program Sarjana Pendidikan Fisika. *PSEJ (Pancasakti Science Education Journal)*, *5*(1), 28–34.

Humeirah, M. S., Meirawan, D., & Purwanto, D. (2023). Analisis kesulitan pembelajaran pada mata pelajaran estimasi biaya konstruksi di smk kelas xii dpib. *Jurnal Pendidikan Teknik Bangunan*, *3*(2), 89-100.

Journal, D., Education, O., Ahmad, A., Yusup, M., Interdiana, A., & Sari, C. (2020). *Penerapan Metode Pembelajaran Peer Teaching Kuliah Kalkulus*. *6*(2), 1–12.

Khoiriyah, J. (2021). Peer Teaching as a Learning Method to Improve the Result of Learning of Industrial Clothing Manufacturing Subject. *Ideguru: Jurnal Karya Ilmiah Guru*, *6*(3), 329–338.

Lestari, A. W., Mangesa, R. T., & -, M.-. (2020). Penerapan Tutor Sebaya Dalam Implementasi Strategi CIRC Berbasis Active Learning Untuk Meningkatkan Hasil Belajar Siswa Pada Mata Pelajaran Sistem Komputer di SMKN 5 Makassar. *Jurnal MediaTIK*, *3*(3), 13.

Magdalena, I., Fauziah, S. N., Faziah, S. N., & Nupus, F. S. (2021). Analisis Validitas, Reliabilitas, Tingkat Kesulitan Dan Daya Beda Butir Soal Ujian Akhir Semester Tema 7 Kelas Iii Sdn Karet 1 Sepatan. *BINTANG : Jurnal Pendidikan Dan Sains*, *3*(2), 198–214.

Nurhasanah, L., & Gumiandari, S. (2021). Implementasi Metode Pembelajaran Tutor Sebaya Terhadap Hasil Belajar Siswa. *Pedagogik: Jurnal Pendidikan*, *16*(1), 62–68.

Nurulanningsih. (2023). Penelitian tindakan kelas (ptk) sebagai pengembangan profesi guru bahasa indonesia. *Didactique Bahasa Indonesia*, *4*(1), 50–61.

Riza, S., & Barrulwalidin, B. (2023). Ruang Lingkup Metode Pembelajaran. *ISLAMIC PEDAGOGY: Journal of Islamic Education*, *1*(2), 120–131.

Sanaky, M. M. (2021). Analisis Faktor-Faktor Keterlambatan Pada Proyek Pembangunan Gedung Asrama Man 1 Tulehu Maluku Tengah. *Jurnal Simetrik*, *11*(1), 432–439.

Selly, N. A. (2021). Pembelajaran Peer Teaching (Tutor Sebaya) Untuk Meningkatkan Hasil Belajar Kimia Pada Materi Elektrokimia. *SECONDARY: Jurnal Inovasi Pendidikan Menengah*, *1*(1), 38–47.

Suwarsa, T. (2021). Pengaruh Pajak Restoran Dan Pajak Hotel Terhadap Pendapatan Asli Daerah Kota Padangsidempuan Periode 2018-2020. *Jurnal Akuntansi*, *51*(1), 1–15.

Tulfauziah, A., Ardana, A. P., Khairunnisya, K., Wati, M., Wismanto, W., & Sakban, S. (2024). Peningkatan Kemampuan Siswa dengan Metode Pembelajaran Peer Teaching Materi Perkalian Matematika Siswa Kelas III SD. *MARAS: Jurnal Penelitian Multidisiplin*, *2*(2), 1084–1091.

Ujud, S., Nur, T. D., Yusuf, Y., Saibi, N., & Ramli, M. R. (2023). Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Hasil Belajar Siswa Sma Negeri 10 Kota Ternate Kelas X Pada Materi Pencemaran Lingkungan. *Jurnal Bioedukasi*, *6*(2), 337–347.

Utomo, P., Asvio, N., & Prayogi, F. (2024). Metode Penelitian Tindakan Kelas (PTK): Panduan Praktis untuk Guru dan Mahasiswa di Institusi Pendidikan. *Pubmedia Jurnal Penelitian Tindakan Kelas Indonesia*, *1*(4), 19.

Yunita, I. (2022). Peningkatan Hasil Belajar Peserta Didik Melalui Metode Tutor Sebaya Pada Pokok Bahasan Penyetaraan Reaksi Redoks. *LAMBDA : Jurnal Ilmiah Pendidikan MIPA Dan Aplikasinya*, *2*(3), 118–127.

Yusanti, D., & Dewi Nirmala, S. (2025). Pengaruh Model Peer Teaching Berorientasi Humanistik pada Pembelajaran Matematika. *Jurnal Global Ilmiah*, *2*(5), 1–9