Peer Teaching to Improve Student Construction Cost Estimation Learning Outcomes in Differences of Cognitive Style

Gde Agus Yudha Prawira Adistana, Universitas Negeri Surabaya, Indonesia
Mirotus Sakdiah, Universitas Negeri Surabaya, Indonesia
Heri Suryaman, Universitas Negeri Surabaya, Indonesia

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Abstract
The implementation of Peer Teaching (PT) is carried out by appointing students as tutors and tutees to improve the learning outcomes of construction cost estimation. Improved learning outcomes are needed to produce competent planners in construction cost estimation as one of the keys to the success of construction. In this study, the effect of PT to improve learning outcomes of Vocational High School students with different cognitive styles, namely Field Independent (FI) and Field Dependent (FD) classified through Group Embedded Figure Test (GEFT) instrument with a score range of 1-25. This study aims to determine the differences in learning outcomes with different learning models and different cognitive style, as well as the interaction of learning models and cognitive styles. Applying Quasi Experimental Design-Posttest Only Control Design-Factorial Experimental 2x2 with 60 samples taken randomly with probability sampling and has passed the homogeneity test which is divided into 30 control and 30 experimental classes. The results of post-test analysis after normality and homogeneity tests showed that there were differences in learning outcomes between experimental and control classes and differences between FI and FD, and there was an interaction between learning models and cognitive styles. Based on these results, it can be concluded that PT is effectively applied supported by the superior post-test of the experimental class. In its application, the teacher monitors and guides the tutor in helping the tutee to understand the calculation of construction costs with the freedom to interact without awkwardness so that all students can explore their abilities.

Keywords: Peer Teaching, Cognitive Styles, Learning Outcomes, Construction Cost Estimation

Introduction

Learning outcomes are data obtained after learning activities through evaluation activities using instruments tailored to learning materials. Through learning outcomes, something related to learning material that has been known, understood and able to be applied by students can be identified. Learning outcomes are also able to inform learners about what needs to be achieved and clarify the objectives of learning outcomes (Haris & Clayton, 2019). Learners with learning outcomes that have reached the minimum criteria are indicated to have mastered the learning material and vice versa, students with learning outcomes less than the minimum criteria are considered not to have mastered the learning material. In learning vocational students majoring in Building Construction, Sanitation, and Maintenance, it is expected that students are able to maximise their learning outcomes by exceeding the minimum criteria standards, especially in pre-productive subjects to ensure the quality of graduates. Construction cost estimation is one of the productive subjects that students need to master to produce competent planners in planning accurate construction costs as one of the keys to a successful construction project (Hamid & Dash, 2023).

To achieve the expected learning outcomes, it is necessary for educators to implement learning activities that can encourage student exploration to learn complex construction cost estimation learning materials. Through student-centered learning, students will more easily accept and increase their interest in learning materials in accordance with the benefits obtained, namely increased learning motivation, critical thinking, problem solving, communication skills, and independence (Minalla, 2023). These benefits can be obtained by students from the characteristics of student-centered learning which are closely related to the application of technology, interaction, gamification, simulation, and feedback that can encourage active learning (Tang, 2023). Active learning is realised by improving communication between students, increasing optimistic attitude, and academic performance. This orientation is relevant to Peer Teaching (PT) activities, where students with similar backgrounds develop understanding through group discussions reciprocally by sharing knowledge and experiences and learning a concept described as learning by teaching (Wang & Gao, 2021). The implementation of PT is by appointing students who have understood and completed the learning material as tutors and students who have not completed the material or are in the process of understanding as tutees and the teacher acts as a facilitator and can help develop student motivation and confidence.

In learning, it is necessary to review and manage student characteristics as a consideration in designing learning activities. Student characteristics are patterns of student behaviour and abilities formed from their environment that affect the achievement of learning objectives. The diversity of student characteristics also influences students' information reception in learning, allowing differences to be found such as group learning patterns and individual learning, as well as structured and unstructured learning activities. Identification of characteristics based on differences in student information reception in learning refers to the characteristics of cognitive styles that distinguish individual ways to receive information that is crucial to learning, problem solving ability, and making decisions (Vranic et al., 2019).

Based on the above background, this study aimed to analyse the success of the application of PT in learning construction cost estimation with different cognitive styles of students to improve student competence through improved learning outcomes with the following problem formulation: (a) How is the difference in learning outcomes of experimental and

control class students?; (b) How is the difference in learning outcomes of FI and FD students?; (c) How is the interaction of learning models and cognitive styles?

Literature Review

Peer Teaching

Peer teaching is one of the collaborative learning models implemented with the aim to increase learning activities, learner engagement, and improve graduate abilities through active assistance and support from peers to acquire knowledge and skills (Sridharan et al., 2023). In another sense, PT is a group of students of equal ability who help each other to teach and learn (Byl, 2023). In its application, collaboration between students is needed so as to create feedback in sharing their knowledge with different perspectives which is an important requirement in collaborative learning PT (Bouwer & Fernandes, 2023). Feedback from peers acts as a consideration for reflection materials to improve and enhance student learning outcomes (Vakkou et al., 2023). The complex learning of construction cost estimation is the reason why an effective learning design is needed to develop students' competence, namely by presenting the material that has been understood to their peers (Ginkel & Sichterman, 2023). The learning design is relevant to PT activities where students selected as tutors present and discuss lessons and actively ask questions to their peers to solve problems (Rosier, 2023).

In addition to the benefits of PT implementation mentioned above, Wu & Schunn's (2020) research showed that peer learning is not considered to have concrete goals because the peer tutor is not an expert who fully masters the lesson and also other peers have a tendency to give positive feedback to the tutor. So it can be said that peer learning is considered less effective because in its implementation the educator remains the decision maker. Therefore, in this study, PT was applied with the most effective syntax possible and adjusting the conditions of the learning class. The application of PT is done by appointing students as tutors and tutees in a learning group (Gordon, 2005). Gordon also explained the syntax of PT is as follows: (a) Selecting tutors and tutees either randomly or based on student achievement and learning outcomes, students selected as tutors are required to understand the quality or standard of learning outputs that must be achieved because a tutor is trusted to evaluate the tutee's understanding; (b) Designing learning programmes containing learning activity plans, learning plans according to feedback, and treatment given in the learning process; (c) Monitoring; (d) Evaluation. The procedure for implementing PT is also explained in Tullis & Goldstone's (2020) research as follows: (a) Providing questions by the educator; (b) Students answer these questions independently; (c) Students discuss questions with their peers. The study also proved that PT had a positive impact on improving learning accuracy and increasing self-confidence.

Cognitive Style

Cognitive style is a difference in individual abilities in thinking, problem solving and receiving and processing information (Marjuwita et al., 2020). Through the analysis of cognitive style learning variables, information on cognitive processes and student learning processes can be known as a consideration for selecting learning models (Cintamulya et al., 2019; Salwah et al., 2020). Cognitive style is one of the characteristic dimensions that can inform different thinking processes and problem solving in exact sciences (Setyana et al., 2019; Cahyono et al., 2019), which is relevant to the analysis of the application of learning

models with different cognitive styles in construction cost estimation subjects. In addition, cognitive style is also one of the psychological aspects that contribute to improving student learning outcomes in understanding exact sciences (Saputra et al., 2018).

In this study, the analysis was conducted on the type of cognitive style of psychological aspects, namely field dependent (FD) and field independent (FI) from several other types of cognitive styles that can be known from the cognitive style test Group Embedded Figure Test (GEFT) because it has a high level of relevance to education and has been widely applied in the world of education (Susandi et al., 2019). In the exact sciences, the characteristics of students with FD cognitive style tend to take longer in problem solving because of the difficulty in processing information to meet the indicators of problem solving, while students with FI cognitive style have the ability to meet the indicators of problem solving with a shorter time with the ability to process information better although there are still some errors (Setyana et al., 2019; Susandi et al., 2019; Panjaitan, 2018).

Construction Cost Estimation Learning Outcomes

Learning outcomes are achievements obtained by students after the learning process which represents the quality of the learning process related to the absorption of material by students as indicated by test scores given by teachers which are influenced by internal and external factors (Eriyanto et al., 2021; Sihotang et al., 2020). Learning outcomes are also defined as students' abilities in the form of behavioural changes obtained from the learning process which are classified based on Bloom's Taxonomy theory into three domains, namely cognitive, affective, and psychomotor (Ashary et al., 2023). In this study, the learning outcomes of construction cost estimation are focused on the learning outcomes of the cognitive domain. Cognitive learning outcomes are learning outcomes that focus on mastering concepts to solve everyday life problems by emphasising thinking skills, application of learned knowledge, interpretation, analogy, and creating ideas (Ilma et al., 2022).

In exact sciences, cognitive learning outcomes play a role in developing students' character and thinking skills. In construction cost estimation learning, learning outcomes are limited to the aspects of remembering, understanding, and applying construction knowledge including labour and material cost estimates (Idan & Dheyab, 2019). Results that have reached the minimum criteria indicate that learning has been achieved optimally, otherwise if there are still weaknesses in learning activities, low learning outcomes will be obtained (Adijaya et al., 2022). This happens because of the relationship between learning outcomes and learning activities so that the application of effective and innovative learning models is needed to improve learning activities and outcomes (Baziat et al., 2024).

Conceptual Framework

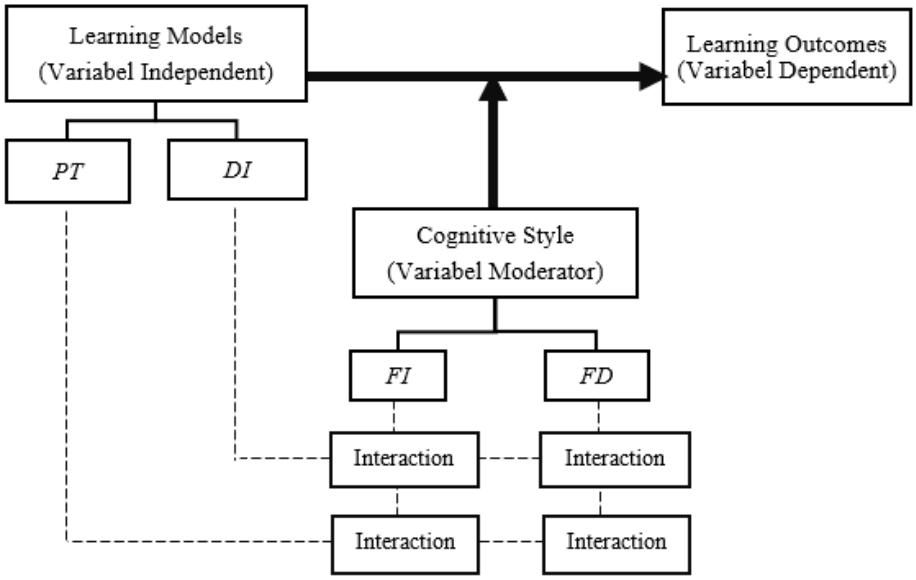

Figure 1: Conceptual Framework

Based on the literature study, the author argues that the application of learning models, which in this study focuses on PT, affects student learning outcomes. The correlation of the two variables is also influenced by moderator variables in the form of psychology of students' cognitive styles that are relevant to the field of education. The influence of the moderator variable is likely to increase learning outcomes or cause a decrease in learning outcomes after the implementation of PT. For this reason, it is necessary to conduct further analysis to determine whether or not there is an interaction between the learning model variables and cognitive styles that have a significant effect.

Methodology

Quasi-experimental was chosen based on the subjects in the study that had been previously formed by the school, namely class XII building construction, sanitation, and maintenance (KGSP) 1, KGSP 2, and KGSP 3 where the subjects were not randomly selected to show the effect between interventions and outcomes with a Posttest-only design with nonequivalent groups, namely experimental research (X O1) using a control group (O2) which was reviewed from the pre-test results (Campbell & Satanley, 1966; Harris et al., 2006; Leatherdale, 2019).

Participants were taken from a population of 104 vocational high school students majoring in KGSP and 60 students were taken as samples.

Data Collection

In this study, the data taken after determining the sample is the data classification of students' cognitive style. This data was taken by giving the GEFT instrument by Witkin consisting of 25 cognitive questions divided into 7 questions for session 1 for simulation, 9 questions for session 2, and 9 questions for session 3 which were run within 19 minutes before learning began. Classification is based on the following score range:

Table 1: Cognitive Style Analyst Score Range

No.	Score	Cognitive Style
1	0-11	*Field Dependent*
2	12-18	*Field Independent*

After obtaining student cognitive style data, PT learning was carried out with Heating, Ventilation, and Air-Conditioning (HVAC) material in accordance with a validated lesson plan in the experimental class and Direct Instruction (DI) conventional learning model in the control class at the first meeting for 180 minutes and learning outcomes data were taken in both classes at the second meeting.

Data Analysis

Data learning outcomes of each class with differences in cognitive styles that have been collected then analysed with a two-way Anova approach through SPSS software that is widely used in factorial design with two independent variables to compare the effect of two variable factors with minimum error and efficient (Verma, 2013). Through two-way Anova also obtained information on the interaction of two independent variables that can only be obtained from cells with more than one subject (Verma, 2013).

Table 2: Factorial Variables 2x2

Cognitive Style Learning Models	Y_1	Y_2
X_1	X_1Y_1	X_1Y_2
X_2	X_2Y_1	X_2Y_2

From the two-way Anova analysis SPSS will produce a Significance value (Sig.) to interpret the hypothesis which if the Sig value. <0.05 H_a is accepted, H_0 is rejected, if Sig. > 0.05 H_a is rejected H_0 is accepted (Landau & Everitt, 2003; Verma, 2013). In the ANOVA study, the hypothesis of each factor and the interaction hypothesis were determined (Verma, 2013).

Table 3: Hypothesis

No.	Hypothesis null (H_0)	Hypothesis alternative (H_a)
1	There is no difference in learning outcomes between the control and experimental classes.	There is a difference in learning outcomes between the control and experimental classes.
2	There is no difference in learning outcomes between students with FI and FD cogitive styles	There are differences in learning outcomes between students with FI and FD cogitive styles
3	There is no interaction between learning model and students' cognitive style.	There is an interaction between learning model and students' cognitive style.

Result

The results of post-test analysis showed the value of Sig. 0.001 <0.05 which indicates that Ha is accepted and H0 is rejected with the interpretation that there are differences in learning outcomes between experimental and control classes, students with FI and FD cognitive styles, and there is an interaction between learning models and cognitive styles of students.

Table 4: Anova Results

Tests of Between-Subjects Effects					
Dependent Variable: Learning Outcomes					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6595.430[a]	3	2198.477	5.285	.003
Intercept	337728.989	1	337728.989	811.898	.000
Model	5258.107	1	5258.107	12.640	.001
Characteristic	295.656	1	295.656	.711	.403
Model*Characteristic	498.107	1	498.107	1.197	.279
Error	23294.570	56	415.974		
Total	376450.000	60			
CorrectedTotal	29890.000	59			
a. R Squared = .221 (Adjusted R Squared = .179)					

The hypothesis of the accepted learning model factor is also evidenced by the superiority of the average value of learning outcomes of the experimental class compared to the control class of 85.147> 66.256 which shows a significant difference.

Table 5: Estimated Marginal Means Learning Model

1. Learning Model				
Dependent Variable: Learning Outcomes				
Learning Model	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
PT	85.147	3.757	77.620	92.674
DI	66.256	3.757	58.729	73.782

On the cognitive style factor, the existence of significant differences is also indicated by the average learning outcomes of FI students are superior compared to FD students with a value of 77.941 > 73, 462.

Table 6: Estimated Marginal Means Cognitive Style

2. Cognitive Style				
Dependent Variable: Learning Outcomes				
Cognitive Style	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
FI	77.941	3.498	70.934	84.948
FD	73.462	4.000	65.449	81.474

The accepted hypothesis on the interaction hypothesis is also reinforced by the Estimated Marginal Means graph which shows the lines intersect, which means there is an interaction between the learning model and cognitive style factors.

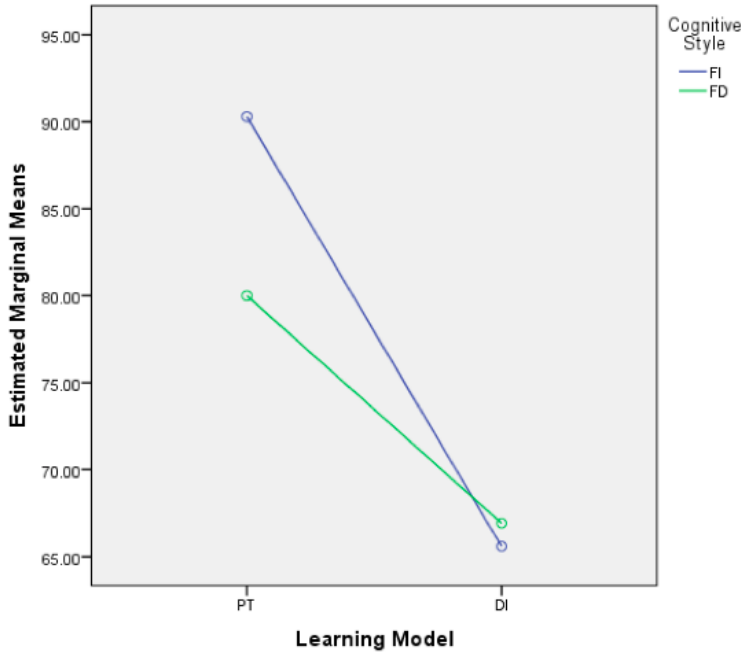

Figure 2: Estimated Marginal Means of Learning Outcomes

The interaction graph is translated by a Table 7 that shows the average learning outcomes of the experimental class with the PT model which shows a higher average than the control class with the DI model. The table also shows the difference in learning outcomes based on cognitive style which shows FI is superior in the experimental class and FD is superior in the control class.

Table 7: Estimated Marginal Means Learning Model*Cognitive Style

3. Learning Model * Cognitive Style

Dependent Variable: Learning Outcomes

Learning Model		Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
PT	FI	90.294	4.947	80.385	100.203
	FD	80.000	5.657	68.668	91.332
DI	FI	65.588	4.947	55.679	75.498
	FD	66.923	5.657	55.591	78.255

Discussion

The superior learning outcomes of the PT class indicate that both tutor and tutee students have a level of understanding of the material that is superior to DI class students because students are more free to explore their knowledge independently outside the learning process with the teacher and know their strengths and weaknesses through feedback from their peers to understand the learning material (Sukumaran and Dass, 2014). The running of learning activities by students in groups independently on construction cost estimation material occurs because the application of PT is able to improve students' metacognitive abilities to plan, monitor, and evaluate their own learning strategies so that students better understand the

learning material (Baltzersen, 2024). Metacognition is part of mathematical problem solving that helps students to formulate the right answer by identifying the problem that needs to be solved and determining the solution (Sutama et al., 2021).

In the implementation of PT, the improvement of metacognitive skills is obtained through the HVAC work calculation assignment activities in groups by planning the HVAC work description and materials, exchanging information related to the HVAC work volume calculation formulation, each group member monitors each other regarding the assignment indicators worked on, and evaluates the progress of the work that has been achieved between the tutor and tutee by checking the worksheet in Excel together. The implementation of learning is more effective by implementing PT which has a positive impact on both tutors and tutees compared to DI to improve student learning outcomes. Essiam et al. (2020) also mentioned in their research that PT has a positive impact on improving achievement and building student character. Dewantono & Murtisari (2023) also explained that the benefits received by tutees in the implementation of PT are increased evaluation skills from the feedback provided by tutors and students who are selected as tutors can also improve their understanding of the material through the delivery of material outlines to tutees.

However, in the experimental class there are still 5 students with learning outcomes below the standard which indicates that there is a need for intervention in the form of reviewing the implementation of learning, especially in the interaction between tutors and tutees in one group with the hope that tutors have an advantage in understanding the material to help tutees. Based on the results of previous research which states that interaction between tutors and tutees through discussion activities can improve tutee understanding which affects the achievement of learning outcomes (Tullis & Goldstone 2020; Safari et al., 2022). In addition to reviewing the interaction between tutors and tutees, another thing that needs to be considered is the quality of students selected as tutors who must meet the criteria of learning outcomes, ability to receive instructions from teachers, and good communication with classmates to achieve learning goals. The influence of tutor quality in the PT model is mentioned in Winterton et al.'s research, (2020) which states that suitable tutors are students with higher learning outcomes, have received or understood instructions from the teacher, and have good communication skills with their peers to create good relationships so that PT can run optimally. Not only the quality of tutors, tutees are also required to take initiative and be responsible for themselves in learning activities to achieve success and realise collaborative learning (Camayang & Bautis, 2020).

Based on cognitive style, PT is effectively applied to FI students as evidenced by the superior average post-test which is evidence that the selection of learning models that are in accordance with cognitive styles needs to be considered in learning activities to achieve learning success (Rezeki et al., 2020; Son et al., 2020; Surur et al., 2020). In the application of PT, students with FI cognitive style dominate learning in groups with a higher level of confidence in conveying the subject matter that has been understood to their peers in carrying out their role as tutors in tutoring activities which is able to improve their metacognitive abilities in planning, monitoring, and evaluating problems encountered in learning activities. Whereas in students with FD cognitive style, students still have difficulty solving problems in learning activities which are then assisted by peer tutors so that these students are able to catch up. In the control class, the average post-test results are superior obtained by FD students who tend to be in accordance with its characteristics, namely students need help from educators to explore their ability to learn material (Silma et al., 2024). For this reason, it can be said that cognitive style contributes to the implementation of PT which affects

learning outcomes (Sianturi et al., 2022). Students with FI cognitive style have the ability to solve problems more easily and quickly and have high confidence in carrying out their role both as tutors and tutees to make decisions and students with FD cognitive style who still have difficulty determining the formulation used to solve problems in solving construction cost estimation (Sutama et al., 2021).

In its application, it is known that the relationship between each learning model applied to the experimental class and the control class has an interaction with the cognitive style of students. In this case, cognitive style is not as a classification between the differences in the tendency of students to learning activities such as group and individual learning, but rather as an individual differentiator in receiving learning materials include reflection and impulsiveness, abstract attitudes and concrete attitudes, as well as dependence and independence (War & Kharbirymbai, 2024). In the control class (DI model), showed compatibility with FD cognitive style indicated by the superior average score that students need help from educators to prepare structured learning. Whereas in the experimental class, PT is able to reach both types of cognitive styles, namely FI who have the ability to think proactively so that they can easily understand the material which later these students will help and provide external reinforcement in the form of instructions to their peers or tutees or students with FD cognitive style. From the results of the interaction test between the learning model and cognitive style, it can be concluded that the PT model has suitability with material indicators and learning objectives of construction cost estimation that is effectively applied with different cognitive styles of students because of its characteristics that can reach all students with FI and FD cognitive styles. Nevertheless, in the experimental class there were still differences in learning outcomes between FI and FD students. For this reason, it is necessary to review the implementation of PT so that both different cognitive styles of students can achieve maximum learning outcomes.

Conclusion

Based on the results of research that has been known, there is a significant difference in learning outcomes between the experimental class with the PT model and the control class with the superiority of the average learning outcomes by the experimental class, there is a difference in learning outcomes between students with FI and FD cognitive styles with the superiority of the average learning outcomes by FI students, and there is an interaction between the learning model and the cognitive style of students who contribute to efforts to improve learning outcomes. So it can be concluded that PT is effectively applied to the learning of construction cost estimation that can improve student learning outcomes in cognitive style differences.

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References

Adijaya, M. A., Widiana, I. W., Parwata, I. G. L. A., & Antara, I. G. W. S. (2022). Bloom's Taxonomy Revision-Oriented Learning Activities to Improve Procedural Capabilities and Learning Outcomes. *International Journal of Educational Methodology, 9, 261-270.*

Ashary, L. A., Nurjanah, S., & Nikensari, S. I. (2023). The Influence of Learning Resources, Learning Intensity, and Discipline on Learning Outcomes of Class XI Students in Economics Subject at SMA Negeri Jakarta Selatan. *International Journal of Multidisciplinary Research and Literature, 2, 121-240.*

Baltzersen, R. K. (2024). *Effective Use of Collective Peer Teaching in Teacher Eduaction.* New York: Routledge.

Baziat, M. R., Nugroho, I. A., Handayani, G., Zakirah, S., & Maulidiya, A. (2024). Improving Student Learning Outcomes through the Numbered Head Together Learning Model on Always Saving Energy Material Grade IV Elementary School. *International Journal of Multicultural and Multireligious Understanding, 11, 78-84.*

Brouwer, J., & Fernandes, C. A. (2023). Using Stochastic Actor-Oriented Models to Explain Collaboration Intentionality as a Prerequisite for Peer Feedback and Learning in Networks. *Springer.103-120.*

Byl, E., Topping, K. J, Struyven, K., & Engels, N. (2023). Peer Interaction Types for Social and Academic Integration and Institutional Attachment in First Year Undergraduates. *Springer.305-323.*

Camayang, J.G., & Bautista, R. (2021). Learning together, learning deeper: A little teacher assisted learning engagement. *International Journal of Evaluation and Research in Education (IJERE), 10, 412-420.*

Campbell, D. T., & Stanley, J. C. (1966). *Experimental and Quasi-Experimental Designs for Research.* Boston: Houghton Mifflin Company.

Cintamulya, I., Warli, & Mawartiningsih, L. (2019). Critical Thinking Ability after Project-Based Learning: A Comparative Study on Students Who Have Different Cognitive Styles. *Jurnal of Physics: Conference.*

Dewantono, S., & Mutisari, E. T. (2023). Effects of Peer Teaching on Grammar Learning: Does It Enhance Learner Autonomy?. *LLT Journal: A Journal on Language and Language Learning, 26, 346-364.*

Eriyanto, M. G., Roesminingsih, M. V., & Soedjarwo, Soeherman, I. K. (2021). The Effect of Learning Motivation on Learning Independence and Learning Outcomes of Students in the Package C Equivalence Program. *IJORER: International Journal of Recent Educational Research, 2, 455-467.*

Essiam, C., Baidoo, F. A., Quansah, R. E., & Antwi, D. O. (2020). The Impact of Peer Learning Approach of Teaching in a Photosynthesis Class. *Journal of Teacher Action Research., 6, 42-56.*

Farani, R. (2022). Revisit Bloom's Taxonomy: A reflection of education in a digital era. *Journal of English Language and Pedagogy, 5, 59-64.*

Ginkel, S. V., & Sichterman, B. (2023). Constructing Computer-Mediated Feedback in Virtual Reality for Improving Peer Learning: A Synthesis of the Literature in Presentation Research. *Springer.145-163.*

Gordon, E. E. (2005). *Peer Tutoring A Teacher's Resource Guide*. Toronto: ScarecrowEducation.

Hamid, M. A., & Dash, K. E. (2023). Improving cost estimation in construction projects. *International Journal of Construction Management, 23, 135-143.*

Harris, A. D., McGregor, J. C., Perencevixh, E., Furuno, J. P., Zhu, J., Peterson, D. E., & Finkelstein, J. (2006). The Use and Interpretation of Quasi-Experimental Studies in Medical Informatics. *Journal of the American Medical Informatics Association, 13, 16–23.*

Harris, R., & Clayton, B. (2019). The current emphasis on learning outcomes. *International Journal of Training Research, 17, 93–97.*

Idan, M. F., & Dheyab, S. N. (2019). Estimate Costs Management in Construction Projects. *International Journal of Applied Engineering Research, 14, 3734-3741*.

Ilma, S., Al-Muhdhar, M. H. I., Rohman, F., & Sari, M. S. (2022). Promoting students' metacognitive awareness and cognitive learning outcomes in science education. *International Journal of Evaluation and Research in Education (IJERE), 11, 20-30.*

Landau, S., & Everitt, B. S. (2003). *A Handbook of Statistical Analyses using SPSS*. Florida: CRC Press LLC.

Leatherdale, S. T. (2019). Natural experiment methodology for research: a review of how different methods can support realworld research. *International Journal of Social Research Methodology, 22, 19-35.*

Marjuwita, Johar, R., & Zubainur, C. M. (2020). Students' critical mathematical thinking process based on their cognitive styles. *Jurnal of Physics: Conference.*

Minalla, A. A. (2023). The Effect of Shifting to Student-Centered Learning: Implementing Student-Centered Reading. *Journal of Curriculum and Teaching, 12, 107-115.*

Muahyimana, T., Kwizera, L., & Nyirahabimana, M. R. (2022). Using Bloom's taxonomy to evaluate the cognitive levels of Primary Leaving English Exam questions in Rwandan schools. *Curriculum Perspectives, 42, 51-63.*

Panjaitan, B. (2018). The reflective abstraction profile of junior high school students in solving mathematical problems based on cognitive style of field independent and field dependent. *Jurnal of Physics: Conference.*

Rezeki, R., Sitompul, H., & Situmorang, J. (2020). The Effect Of Learning Strategies and Cognitive Styles on Learning Outcomes of Mathematics after Controlling Intelligence. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal, 3, 1151-1163.*

Rosier, S. (2023). PeerTeach: Teaching Learners to Do Learner-Centered Teaching. *Springer.239-263.*

Safari, M., Yazdanpanah, B., Yazdanpanah, S., & Yazdanpanah, Y. (2022). The Experience and Attitudes of Student to Peer Tutoring in the Class Time of the Gynecology and Infertility Course. *Journal of Peer Learning, 15, 66-78.*

Salwah, Ashari, N. W., & Ma'rufi. (2020). Mathematical critical thinking ability of students grade VII in solving one variable linear equation questions based on their cognitive style. *Jurnal of Physics: Conference.*

Saputra, E., Wahyudin, Dahlan, J. A. (2018). The enhancement of spatial levels reviewed from students' cognitive styles. *Jurnal of Physics: Conference.*

Setyana, I., Kusmayadi, T. A., & Pramudya, I. (2019). Problem-solving in creative thinking process mathematics student's based on their cognitive style. *Jurnal of Physics: Conference.*

Sianturi, M., Suliantin, R., & Fitrianti, H. (2022). Relationships Beetween Cognitive Styles and Indigenous Students' Mathematics Academic Outcomes. *Journal of Learning for Development, 9, 528-544.*

Sihotang, C., Saragih, A. H., & Abdul Hamid, K. (2020). Improvement of Student Learning Outcomes through Use Google Classroom Media in Class VIII-4 Students MTsN 1 Kota Subulussalam. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal, 3, 1182-1189.*

Silma, U., Sujadi, I., & Nurhasanah, F. (2019). Analysis of Students' Cognitive Style in Learning Mathematics from Three Different Frameworks. *AIP Conference Proceedings.*

Son, A. L., Darhim, & Fatimah, S. (2020). Students' Mathematical Problem-Solving Ability Based On Teaching Models Intervention and Cognitive Style. *Journal on Mathematics Education, 11, 209-222.*

Sridharan, B., McKay, J., & Boud, D. (2023). The Four Pillars of Peer Assessment for Collaborative Teamwork in Higher Education. *Springer.3-23.*

Sukumaran, K., & Dass, R. (2014). Students' Perspective on the Use of Peer Feedback In an English as a Second Language Writing Class. *Journal of Interdiciplinary Research in Education (JIRE), 4, 27-40.*

Surur, M., Degeng, I. N. S., Setyosari, P., & Kuswandi, D. (2020). The Effect of Problem-Based Learning and Cognitive Styles on Junior High School Students' Problem-Solving Abilities. *International Journal of Instruction, 13, 35-48.*

Susandi, A. D, Sa'dijah, C., As'ari, A. R., & Susiswa. (2019). Students' critical ability of mathematics based on cognitive styles. *Jurnal of Physics: Conference.*

Sutama, S. A., Prayitno, H. J., Narimo, S., Faudi, D., Sari, D. P., & Adnan, M. (2021). Metacognition of Junior High School in Mathematics Problem Solving Based on Cognitive Style. *Asian Journal of University Education (AJUE), 17, 134-144.*

Tang, K. H. D. (2023). Student-centered Approach in Teaching and Learning: What Does It Really Mean?. *Acta Pedagogia Asiana, 2, 72-83.*

Tullis, J. G., & Goldstone, R. L. (2020). Why does peer instruction benefit student learning?. *Cognitive Research: Principles and Implications.1-12.*

Vakkou, K. A., Hovardas, T., Xenofontos, N., & Zacharia, Z. C. (2023). Comparing Expert and Peer Assessment of Pedagogical Design in Integrated STEAM Education. *Springer.121-141.*

Verma, J. P. (2013). *Data Analysis in Management with SPSS Software*. New Delhi: Springer.

Vranic, A., Rebernjak, B., & Martincevic, M. (2019). Cognitive style: The role of personality and need for cognition in younger and older adults. *Current Psychology.*

Wang, C., & Gao, J. (2021). Peer Teaching as an Effective Method: A Case Study at ST University in China. *Journal of Higher Education Theory and Practice, 21, 189-199.*

War, H., & Kharbirymbai, B. B. (2024). Construction And Standardization Of The Cognitive Style Scale (Css) For Postgraduate Students. *Educational Administration: Theory and Practice, 30, 1114-1119.*

Winterton, C., Dunk, R. D. P., & Wiles, J. R. (2020). Peer-led team learning for introductory biology: relationships between peer-leader relatability, perceived role model status, and the potential influences of these variables on student learning gains. *Disciplinary and Interdisciplinary Science Education Research, 2, 1-9.*

Wu, Y., & Schunn, C. D. (2020). When peers agree, do students listen? The central role of feedback quality and feedback frequency in determining uptake of feedback. *Contemporary Educational Psychology.1-16.*