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THE EFFECTIVENESS OF THE CRH METHOD ASSISTED BY PjBL IN IMPROVING AUTOCAD UNDERSTANDING AND LEARNING OUTCOMES OF BUILDING UTILITY CONSTRUCTION

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Abstract

The study aims to identify how effective the application of the *Course Review Horay* (CRH) method assisted by *Project Based Learning* (PjBL) is in optimizing students' understanding of AutoCAD and student learning outcomes. This research uses a quantitative approach with a quasi-experimental type. Covering two sequences with four main procedures namely design, action, observation, and reflection. The population in this study is all students of class XI DPIB SMK Negeri 1 Kemlagi which includes 3 classes totaling 99 people. The sample was selected as many as 66 people using *purposive sampling* technique, namely class XI DPIB 2 as the experimental class and class XI DPIB 3 as the control class. Data were collected through observation, tests, and documentation. Item analysis using t test and obtained the value of learning outcomes Sig. 0.000 <0.005, meaning that learning methods have an influence on student learning outcomes. The correlation coefficient obtained an R Square score of 0.960, while N-Gain testing produced an average of 0.5245 or 52.45%, proving that the implementation of learning methods can optimize student learning outcomes effectively. The findings of this study prove that the *Course Review Horay* method is effective in optimizing students' understanding and learning achievement of AutoCAD.

Keywords: AutoCAD, *Course Review Horay,* Learning Outcomes, Building Utility Construction

Introduction

Vocational education is designed to equip graduates with practical skills needed in the world of work (Zhang et al., 2024). However, a significant gap continues to exist between the skills possessed by vocational graduates and the competencies required by industry (Rahayu et al., 2025). This gap occurs in vocational graduates of engineering-based expertise programs such as construction and building modeling which require work readiness and technical skills (Pesa & Mukhaiyar, 2021). The Department of Building Modeling and Information Design (DPIB) plays an important role in preparing workers who have the expertise needed in the industrial sector (Nugraha et al., 2020). One of the competencies that must be possessed is in the field of building design and modeling (Anisa et al., 2021; Huda & Roesdiana,2025). However, in reality there is still a gap in student competence in mastering and understanding *AutoCAD* (Sunardi, 2024). This statement is relevant to the pre-observation that took place at SMK Negeri 1 Kemlagi, there are still many students majoring in Building Modeling and Information Design (DPIB) who have difficulty in understanding *AutoCAD* and understanding the concept of building utility construction appropriately. Many students still have difficulties in drawing building utility installations such as water, sanitation, and electrical systems. This can be seen from the results of daily tests and practical assignments, most of which have not reached KKM 75, thus indicating that the level of understanding is still low. This is caused by still using demonstrative and monotonous learning which is dominated by the role of the teacher who only explains the material in one direction so that it does not motivate students to be active in the classroom (Phalguna & Saputra, 2020). Therefore, in order to solve this problem, active, creative, innovative, and effective learning methods are needed (Rodiya, 2024). One of them is using the CRH method combined with PjBL and AutoCAD based learning.

Course Review Horay (CRH) is a learning method used in measuring students' understanding through providing practice questions to stimulate students to pay attention, analyze, and think (S. Sari, 2020). CRH is a cooperative learning method that makes the situation in the classroom more interesting, making it easier for students to digest learning materials effectively (Wahyuningtyas & Wulandari, 2020). According to research (S. Andini & Miaz, 2022) the *Course Review Horay* (CRH) method can make the situation in the classroom more interesting so that students can digest the material taught effectively. CRH not only shapes students to be responsive, but also creates a collaborative learning atmosphere (Ramli et al., 2024).

In line with the demands faced, the application of innovative learning models is one of the main keys in improving the quality and learning outcomes (Gilang Septian Wandiatama, 2020). This is supported by research (Dalimunthe & Siregar, 2022) that the CRH method can significantly improve learning outcomes and foster cooperation, responsibility, and increase student concentration. In addition to being proven to improve student learning outcomes, this method obtained positive responses from students who participated in KBM (S. F. Ashari et al., 2024). CRH also makes students more active during KBM and makes it easier to understand difficult material through discussions between students and teachers (I. P. Sari & Adriyani, 2023). This method encourages two-way communication between students and teachers through discussions, questions and answers, and direct evaluation (Sari Wijayanti, 2023). This positive interaction is useful to optimize their understanding and learning outcomes so that they are able to master the materials they receive to be more directed and achieve the expected goals. Research (Ningrum et al., 2019) has presented that the CRH learning method affects student learning outcomes, so that the strategy can be used as an option to be implemented in the classroom. Studies by (Halidin & Ansar, 2021) show the findings of data analysis of substantial comparison of students' learning outcomes using the CRH method along with the usual conventional method. *Project Based Learning* (PjBL) is an approach by channeling broad insights to learners when facing direct problems by developing critical thinking skills (Pratiwi et al., 2025). According to (Zega, 2022) PjBL emphasizes the mastery of core concepts and principles in a field, by encouraging students to learn

independently and build their own understanding of complex problems. In line with research (Zakiyyah et al., 2024) which shows a significant increase in students' understanding of concepts, skills, and creativity after the application of PjBL. The application of this method is able to encourage students to be more independent, critical and skilled in solving technical problems (Athaya, 2024). PjBL is proven to be able to improve mastery of software such as AutoCAD in increasing the liveliness of the learning process (Murow, 2024). This method significantly has a positive effect on learning outcomes and learners' readiness to receive lessons (Lara-Bercial et al., 2024). Although previous studies have shown that the Course Review Horay (CRH) and Project Based Learning (PjBL) approaches can separately improve student participation, educational outcomes, and technical skills, there are still several shortcomings that can be found. In addition, although PjBL combined with CAD software has been shown to significantly improve technical drawing skills among students studying in vocational fields (Fauzansyah et al., 2025), These studies usually prioritize cognitive outcomes in a limited educational context and do not specifically explain the use of AutoCAD in building utility systems. In addition, research on the influence of PjBL on CAD skills, such as cognitive and psychomotor skills, is still general in nature and not directed at building utility systems (Hidayat & Widiyanti, 2026), Other vocational studies show beneficial effects on related subjects such as electrical installation without covering CRH or AutoCAD (H. Ashari et al., 2025). Unlike previous studies that focused more on Course Review Horay (CRH) and Project Based Learning (PjBL) as separate instructional methods, this study integrates both approaches into a comprehensive learning framework driven by AutoCAD. In addition, this study emphasizes AutoCAD-based learning specifically applied in building utility construction, which includes water supply, sanitation, and electrical systems, in the context of the Building Model and Information Design (DPIB) vocational program. The integrated and context-specific framework is a key innovation in this study. Therefore, this study was designed to identify the effectiveness of applying *Course Review Horay* (CRH) method assisted by *Project Based Learning* (PjBL) to optimize AutoCAD understanding and learning outcomes of building utility construction for students of SMK Negeri 1 Kemlagi.

Research Methods

This research uses a quantitative approach with a quasi-experimental type. The research was conducted durig the odd semester of the 2024/2025 academic year at SMK Negeri 1 Kemlagi, Mojokerto Regency, East Java. The population of this study included all students of class XI DPIB SMK Negeri 1 Kemlagi which includes 3 classes totaling 99 students. The sample of this study was 66 students selected through *purposive sampling* technique*, namely* class XI DPIB 2 as the experimental class and class XI DPIB 3 as the control class. Data were collected through observations, tests, and documentation. This study was carried out in two series through four main procedures, namely planning, action, observation, and reflection. Each series had two meetings, where the whole research process involved four meetings. Each cycle focused on the application of *Course Review Horay* (CRH) method assisted by *Project Based Learning* (PjBL) during AutoCAD learning activities. In the first cycle, the planning stage was carried out by preparing AutoCAD materials and building utility construction, observation sheets, pre-test instruments, and learning method. The action implementation stage is applied by determining the project, planning work steps, implementing, and reporting results. The third stage is observation by observing student activities, such as activeness, enthusiasm, cooperation, and ability to do tasks. The last stage is reflection by analyzing learning outcomes and learner engagement in the classroom. After phase I is carried out, then proceed with the implementation of phase II through a similar procedure, namely planning is carried out by compiling updates from the findings of phase I evaluation. The second step, namely action, students by reapplying the AutoCAD project and following the evaluation session with a more interactive CRH method assisted by PjBL. Furthermore, the observation stage is carried out by taking data from post test results and observation notes to compare with cycle I. The last stage is reflection by analyzing data to see the improvement of

AutoCAD understanding and learning outcomes. Data analysis is applied in a series of stages. The initial stage tested the research instrument which included a validity test to determine the accuracy of each item in measuring student abilities and a reliability test to measure the consistency of the test instrument. Then continued a series of classical assumption tests, including normality test, autocorrelation test, heteroscedasticity test, and multicollinearity test to ensure that the data had met the necessary criteria before further statistical analysis. Item analysis was conducted to determine the quality of the questions through the calculation of comparisons and difficulty levels of the questions. The main analysis used t-test to identify the comparison of average learning achievement before and after the action, and F-test to see the simultaneous effect between variables. In addition, the correlation coefficient was calculated to determine the relationship between *AutoCAD* understanding and students' learning outcomes, and N-Gain testing to assess the increase in learning outcomes from phase I to phase II.

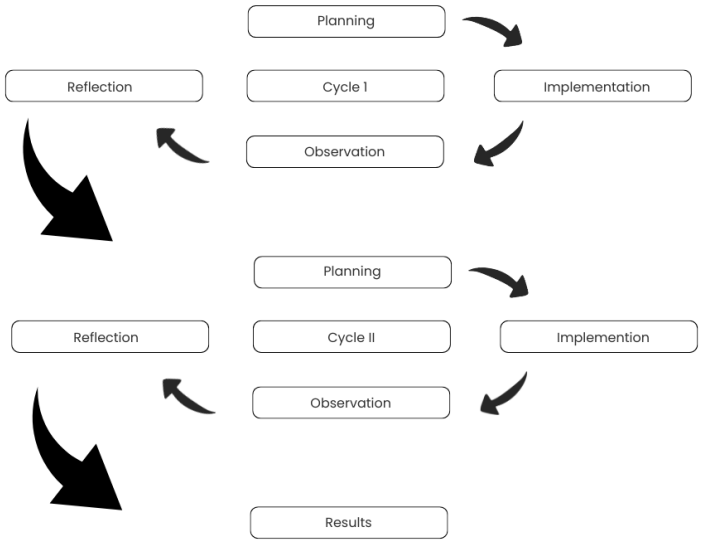

Figure 1. Flowchart of Classroom Action Research (PTK)

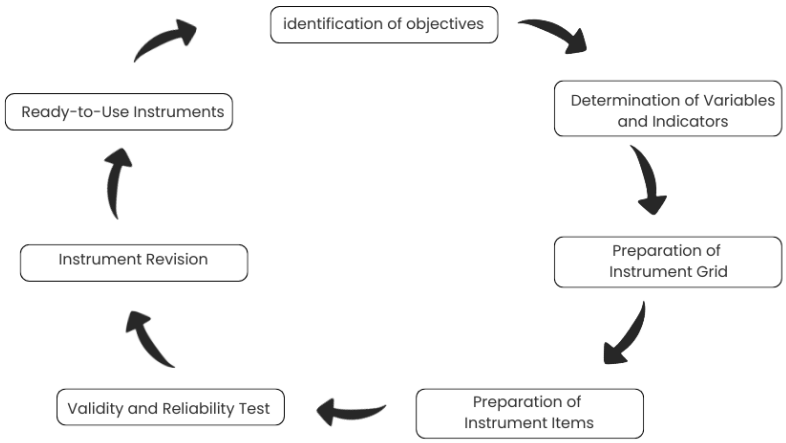

Figure 2. Research Instrument Cycle

Research Results and Discussion

T test

Table 1. T-test

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Learning Method	.127	.026		4.816	.000
	AutoCAD Understanding	.005	.002	.190	3.025	.003
	AutoCAD Learning Outcome	.019	.001	.796	12.655	.000
a. Dependent Variable: X						

Source: Processed Primary Data, 2025

In this table, the pre-test variabe1 has a t score = 3.025 with Sig. 0.003 <0.005, meaning that the pre-test has a significant effect on the learning method. The post test variable has a t value = 12.655 with a significance score of 0.000 < 0.005, meaning that the post test has a substantial effect on the learning method. The constant value has a value of t - 4.816 with a value of Sig. 0.000, meaning that it shows that when the pre test and post test are zero, the learning method variable still has a positive influence on the constant.

F-test

Table 2. F-tes

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	31.667	2	15.833	1532.149	.000[b]
	Residual	1.333	129	.010		
	Total	33.000	131			

Source: Primary data processed, 2025

As presented in the table, the calculated F score is 1532.149 with a significance level of 0.000 <0.05. The output proves that the pre-test and post-test simultaneously have a substantial effect on the learning method variable. Thus, the regression model applied is suitable for explaining the relationship between the independent and the dependent variable.

Determination Coefficient Test

Table 3. Determination Coefficient Test

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.980[a]	.960	.959	.102

Source: Processed Primary Data, 2025

As shown in the table, the R Square score is found to be 0.960. This means that 96% of the changes that occur in variable X can be explained by changes in variables Y_1 and Y_2 together, while the remaining 4% is affected to other factors not included in this study model.

N-Gain Test

Table 4. N-Gain Test

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
NGAIN_SCORE	131	-.49	4.00	.5245	1.02384
NGAIN_PERSEN	131	-48.57	400.00	52.4466	102.38441
Valid N (listwise)	131				

Source: Primary data processed, 2025

Referring to the N-Gain calculation, the average score is 0.5245. According to Hake's criteria (1998), this value is categorized as moderate ($0.3 \leq g < 0.7$). while the percent N-Gain score obtained the result of 52.45% with the range ($30\% < g < 70\%$), it can be said that this study falls into the moderate category. This proves that the teaching method used has succeeded in optimizing students' learning outcomes quite effectively, although it has not been categorized as strong. Thus, the conclusion is that the treatment has a positive impact on improving students' understanding.

Based on the results of the study that CRH method assisted with PjBL get a sig value. 0.003 which shows that 0.003 <0.005 so that CRH assisted by PjBL is proven effective on AutoCad understanding. Relevant to the studies researched (Novera et al., 2021; Safitri et al., 2024) that the CRH type cooperative teaching model is effective in optimizing activities and learning outcomes. The results of this study are consistent with the findings of several researchers that the CRH model can make it easier for students to be interested in teaching material which can optimize their learning outcomes (Imami et al., 2023; Munib & Wulandari, 2021). This learning model is effective as a new variation during KBM because students become active in the classroom (Absari et al., 2021). Previous research also provides evidence in the same direction, where the CRH learning model has a positive and substantial effect on students' learning outcomes, so this teaching model is effective to apply (Khairiyah Nur Hasanah & Indah Pratiwi, 2025). The increase in learning outcomes from phase I and phase II is increasingly seen to experience significant increases so that the implementation of the CRH model is proven effective (Jannah et al., 2025) . Increasing in each cycle with increasing classical completeness, CRH is considered a creative and appropriate learning strategy in optimizing learning outcomes (Santi et al., 2025). This finding is reinforced by further research, that the CRH learning bodel assisted by PjBL is proven to improve student learning outcomes (Sitorus, 2024). The results of research on CRH show that this research is effective in optimizing student learning outcomes, which is in line with the principles of PjBL which also places students at the center of learning. The PjBL method is effectively applied in SMK because it is able to improve learning outcomes and improve *soft skills* such as creativity, independence, and critical thinking which are needed in the world of work (Abdili & Anggriani, 2025; Lesman et al., 2023). The PjBL learning model has proven successful in encouraging students' analytical thinking skills with collaboration activities, solving problems, and exploring projects (Andini & Muhammad, 2025; Kantri et al., 2024). The application of the PjBL model is proven to increase the participation and learning outcomes of students during the KBM. Therefore, the PjBL model is recommended to be implemented according to the characteristics of each child, so as to create an effective, fun, and meaningful learning process (Puspitasari et al., 2025; Putri & Setiyoko, 2022).

Conclusion

Based on the research findings involving students of class XI Building Modeling and Information Design (DPIB) of SMK Negeri 1 Kemlagi, it can be concluded that the implementation of the *Course Review Horay* (CRH) method assisted with *Project Based Learning* (PjBL) is proven to be effective in optimizing *AutoCAD* understanding and learning outcomes of building utility construction. This effectiveness is supported by statistical data showing a significance value of 0.003, an R Square value of 0.960, and an N-Gain score of 52.45%, which falls into the moderate category. In addition, combining CRH with PjBL not only strengthens students' cognitive abilities in applying AutoCAD commands, but also encourages participation, cooperation, and enthusiasm for learning throughout the educational process. Therefore, this teaching method can be an innovative and practical alternative for vocational teachers in creating an interactive, engaging, and skill-focused learning environment. However, this study has limitations in its scope because it was concluded at only one educational instution and focused on a specific field of study. It is recommended that additional research be concluded involving a broader population, diverse vocational skills, and additional factors such as learning motivation and psychomotor skills so that the research findings can be strengthened and expanded.

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