

Collaborative Quiz-Team Learning and Sociology Concept Understanding: A Reanalysis of a Pretest-PosttestControl-Group Study in an Indonesian Senior High School

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Abstract

This study examines whether collaborative Quiz Team instruction was associated with stronger sociology concept understanding among Grade XI social-science students at SMAN 1 Luhak Nan Duo, West Pasaman. The study used a pretest-posttest control-group design with one experimental class and one comparison class. Although initial class enrollments were 28 and 27, the inferential results consistently reflect 48 analyzed cases (24 per group; $df = 46$); the reason for this reduction was not documented. Posttest concept scores averaged 91.13 in the Quiz Team group and 77.04 in the comparison group. The reported independent-samples test yielded $t(46) = 6.26$, $p < .05$, corresponding to an approximate standardized mean difference of $d = 1.81$. Significant advantages were also reported across six components of multicultural-society concepts. The findings support collaborative quizzing as a promising active-learning structure, while methodological inconsistencies require cautious interpretation and replication with transparent attrition reporting and baseline-adjusted analyses. The findings suggest that structured team competition is most useful when participation rules, conceptual explanation, and teacher feedback remain aligned with the learning objective.

Keywords: collaborative learning; concept understanding; quasi-experiment; sociology education.

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Introduction

Sociology education asks students to do more than remember definitions. Concepts such as social mobility, multiculturalism, social structure, conflict, inequality, and social change are analytic tools for interpreting patterns in everyday life. Students may be able to copy a textbook definition yet still struggle to recognize the concept in an unfamiliar case, explain relationships among variables, or express an idea in their own words. This gap between recall and conceptual understanding is one of the recurring challenges in secondary sociology classrooms.

The study emerged from classroom observations at SMAN 1 Luhak Nan Duo, West Pasaman, where instruction was described as predominantly conventional. Teachers explained content, students took notes, and whole-class questioning occurred near the end of lessons. Observations in Grade XI social-science classes indicated that only a small number of students responded voluntarily, while others talked with peers, left the room, or worked on tasks from other subjects. When asked to explain concepts in their own language, students often remained silent or relied directly on notes. Mid-semester results also showed that many students had not reached the school's minimum mastery criterion.

These conditions motivated the use of a more participatory instructional structure: collaborative learning through Quiz Team. In a Quiz Team activity, students work in teams, prepare or respond to questions, discuss answers, and take turns acting as quiz leaders or respondents. The method changes the social organization of the

lesson. Instead of knowledge flowing almost exclusively from teacher to individual student, students become responsible for explaining, checking, and defending understanding with peers. The activity can therefore combine retrieval practice, peer explanation, competition, and cooperation.

Collaborative learning is grounded in the idea that learning is shaped through social interaction. Constructivist approaches associated with Piaget and Vygotsky emphasize that learners actively organize knowledge and that interaction can create cognitive conflict, negotiation, and scaffolding. In cooperative-learning theory, positive interdependence and individual accountability are especially important: group work becomes educationally meaningful when students need one another to achieve a shared task while still remaining responsible for their own understanding (Johnson & Johnson, 2009; Slavin, 2014). Merely placing students in groups does not guarantee learning.

The Quiz Team format is one way to operationalize these principles. It creates a reason for students to listen because another team may ask questions, and it creates a reason to explain because students may need to justify an answer publicly. The rotating quiz role can also distribute authority more broadly than teacher-led recitation. Silberman (2004) classified team quizzes within active-learning techniques designed to increase participation and immediate processing of content. Recent Indonesian research indicates that the approach remains pedagogically relevant. Erik (2024) reported increased sociology learning completeness after team-quiz active learning supported by Kahoot in a Grade XI social-science class. Eliana (2024) similarly examined Team Quiz as a structure for problem solving, while other studies have linked quiz-team activities with participation and learning outcomes in school settings.

More broadly, contemporary research continues to support carefully structured collaborative learning. Karim, Antoni, and Oktarina (2024) synthesize collaborative-learning studies and report generally positive relationships with student performance while emphasizing implementation conditions. Roka and Khatri (2024) found that cooperative learning supported mathematics achievement, and Ndebil and Ali (2024) report benefits for performance and attitudes. Such evidence across subjects cannot be transferred mechanically to sociology, but it strengthens the proposition that peer interaction can contribute to learning when tasks require substantive cognitive engagement.

Active-learning research also cautions against interpreting participation as sufficient evidence of achievement. A lively classroom may produce more talk without improving conceptual quality. Balalle's (2024) systematic review of technology-based education similarly shows that engagement is multifaceted and should not be equated automatically with academic outcomes. Wijnia et al. (2024), in a meta-analysis of problem-, project-, and case-based learning, demonstrate that student-centered designs can influence motivation but effects vary across instructional conditions. The relevant question is therefore not whether Quiz Team makes students active, but whether its specific structure helps them understand sociological concepts more accurately.

Concept understanding in sociology is particularly suitable for collaborative quizzing because sociological knowledge frequently requires interpretation. For the topic of multicultural society, students need to identify characteristics of diversity, explain factors producing multicultural structures, recognize social problems that may emerge, and reason about possible forms of accommodation or problem solving. These tasks require relationships among ideas. Peer explanation can expose incomplete understanding because students must verbalize why an answer is appropriate rather than merely recognize it.

The study used a pretest-posttest control-group design and reported a substantial posttest difference between students receiving Quiz Team instruction and those receiving conventional instruction. Several methodological inconsistencies nevertheless require cautious interpretation. The method states that the experimental class initially contained 28 students and the control class 27 students. The inferential tables use 24 students in each group, and the principal t-test reports 46 degrees of freedom, which corresponds to $24 + 24 - 2$. The available records do not explain whether students were absent, excluded, lacked complete data, or were removed for another reason. This omission matters because unexplained attrition can influence estimates of treatment effects.

The original paper also emphasizes multiple component t-tests without discussing the problem of repeated testing. Six concept components were tested separately. When multiple significance tests are conducted, the probability of at least one false-positive result can increase. In this case, all reported component t-values were above the reported critical value, so the overall pattern is consistent, but a contemporary reanalysis should still acknowledge multiplicity and prioritize the main outcome rather than treating each component as an independent confirmatory finding.

A further issue concerns effect size. Statistical significance indicates whether an observed difference is unlikely under a particular null model, but it does not communicate the magnitude of the difference. From the reported main t statistic, $t = 6.26$, with 24 analyzed students per group, an approximate Cohen's d can be derived as 1.81. This is a large standardized difference by conventional benchmarks (Cohen, 1988). The estimate is useful

descriptively, but it should not be interpreted as a precise causal effect because baseline equivalence, attrition, and analytic details are incompletely reported.

The article therefore does more than translate the study. It reconstructs the argument around conceptual understanding, distinguishes reported data from inference, and updates interpretation in light of collaborative-learning research and contemporary standards for transparent quantitative reporting. The central research question is: to what extent did the reported data indicate stronger posttest sociology concept understanding among students taught through collaborative Quiz Team learning than among students receiving conventional instruction?

The article makes three contributions. First, it preserves an empirical classroom comparison from an Indonesian sociology context, a subject less frequently represented in collaborative-learning research than mathematics, science, or language education. Second, it interprets Quiz Team as a mechanism of retrieval, peer explanation, and accountability rather than merely a motivational game. Third, it demonstrates why effect size, attrition transparency, and careful separation of primary and component outcomes matter when revisiting older classroom experiments.

Method

The study was conducted at SMAN 1 Luhak Nan Duo in Luhak Nan Duo District, West Pasaman Regency, Indonesia. The school was selected because preliminary observation indicated low participation in Grade XI sociology lessons and learning results below the expected mastery criterion. A quantitative pretest-posttest control-group design was used. Two existing Grade XI social-science classes were selected through the reported random-sampling procedure: Class XI IPS 4 served as the experimental group and Class XI IPS 5 as the control group.

Initial enrollments were 28 students in XI IPS 4 and 27 students in XI IPS 5. The posttest analysis, however, reports $N = 24$ for each group and the primary t-test uses $df = 46$. The article therefore distinguishes initial class enrollment from the analyzed sample. Inferential results are interpreted as based on 48 complete analyzed cases, 24 per group. The reason seven initially enrolled students were not represented in the analysis was not reported and is treated as a limitation.

The experimental group received collaborative Quiz Team instruction, while the control group received the conventional instructional approach used in the school. In Quiz Team learning, students worked in teams, discussed material, prepared or responded to questions, and participated in rotating quiz activity. The instructional intention was to increase active processing and peer explanation rather than leaving students as passive recipients of teacher exposition.

The focal content concerned concepts of multicultural society. The assessment included components related to the definition of multicultural society, characteristics of multicultural society, forms of diversity, factors encouraging the development of multicultural society, problems arising within multicultural settings, and processes for resolving such problems. The source describes instrument preparation as including a test blueprint, item construction, validity analysis, reliability testing, item-difficulty analysis, discrimination analysis, and distractor analysis. Detailed coefficients for these procedures are not reported in the article and therefore cannot be independently evaluated here.

The original analysis included tests of normality and homogeneity followed by hypothesis testing using independent-samples t-tests. The main comparison reported a posttest mean concept-understanding score of 91.13 for the experimental group and 77.04 for the control group, with $t = 6.26$ at $\alpha = .05$ and $df = 46$. The study used a critical t value of 2.012 and concluded that the difference was statistically significant. Component-level t values were also reported: 2.47 for definition, 3.49 for characteristics, 3.60 for forms of diversity, 2.62 for causal factors, 3.58 for problems, and 3.30 for problem-solving processes.

Participant-level data were unavailable, so the reported t-tests could not be rerun. A standardized mean difference was approximated from the reported main t statistic and equal analyzed group sizes using $d = t \times \sqrt{1/n_1 + 1/n_2}$. With $t = 6.26$ and $n_1 = n_2 = 24$, the approximate d is 1.81. This value is an approximation from summary statistics rather than an effect calculated from raw scores.

Interpretation follows three principles. First, the main posttest comparison is treated as the primary reported result. Second, component tests are treated as descriptive corroboration rather than six independent confirmatory hypotheses. Third, the language of causality is moderated because the source does not report enough information about baseline equivalence, participant attrition, implementation fidelity, or allocation procedures to establish a fully randomized experiment. The design is therefore interpreted conservatively as a school-based controlled comparison with quasi-experimental features.

Results and Discussion

Overall posttest concept understanding favored the Quiz Team class

The main reported finding was a higher average posttest score in the experimental class than in the control class. Students receiving collaborative Quiz Team instruction achieved an average concept-understanding score of 91.13, compared with 77.04 among students in the conventional class. The difference of 14.09 points is educationally substantial on the reported scale.

The published independent-samples test produced $t(46) = 6.26$. Because the reported value exceeds the original critical value of 2.012 at alpha .05, the null hypothesis of no group difference was rejected in the original analysis. The pattern indicates that, among the 48 students included in the final analysis, the experimental class performed substantially better on the posttest.

The approximate standardized mean difference derived from the t statistic is $d = 1.81$. Under Cohen's (1988) conventional guidelines, this is a large difference. The standardized result is useful because it expresses the group separation relative to within-group variability. However, it should be interpreted as a descriptive index of the reported comparison, not as a definitive causal treatment effect.

Component results showed a consistent directional pattern

The study also compared groups across multiple components of multicultural-society content. All six reported t values exceeded the stated critical value. The values were 2.47 for understanding the definition of multicultural society, 3.49 for characteristics, 3.60 for forms of diversity, 2.62 for factors driving the development of multicultural society, 3.58 for problems arising within multicultural society, and 3.30 for problem-solving processes.

The consistency of these values suggests that the overall posttest advantage was not driven by only one narrow subtopic. Students in the Quiz Team class appear to have performed better across definitional, descriptive, causal, and problem-solving dimensions of the unit. Nevertheless, because six separate tests were conducted, the results should be considered supportive evidence rather than six isolated demonstrations of effectiveness.

For the specific component "definition of multicultural society," the source provides more detailed descriptive statistics. Both analyzed groups contained 24 students. The experimental group had a mean of 97.92 and a standard deviation of 10.21, while the control group had a mean of 85.42 and a reported standard deviation of approximately 23.3. The t value was 2.47. The substantially smaller dispersion in the experimental group suggests that high performance was also more consistent among its analyzed students for this component.

The learning process redistributed responsibility for explanation

Although the study was primarily quantitative, the instructional description helps interpret the score pattern. In the experimental class, students worked collectively on material and were expected to share explanations and participate in question-answer exchanges. This arrangement differed from the preliminary classroom pattern in which students mainly listened and copied notes.

The Quiz Team structure redistributed responsibility. Students could no longer rely entirely on the teacher to present and validate every answer. Teams needed to prepare for questions, explain concepts, check responses, and coordinate participation. This organization potentially increased time spent retrieving and articulating concepts. It also created peer pressure to be prepared because team performance was visible.

The source describes students as sharing abilities, thinking critically, presenting opinions, helping one another, and connecting concepts with everyday facts. These process claims were not measured through a separate validated observation instrument, so they should be read as instructional interpretation rather than independent outcomes. Still, they identify plausible mechanisms through which Quiz Team could have supported posttest performance.

Data inconsistencies limit precision

Two methodological inconsistencies are important for interpreting the findings. First, initial class enrollment does not match the analyzed group sizes. The experimental class was described as having 28 students and the control class 27, yet only 24 per group appear in the posttest statistics. Because the cause is unknown, the possibility of non-random attrition cannot be ruled out.

Second, the source contains minor discrepancies in reported descriptive values, such as a control-group standard deviation appearing as 23.32 in a table and 23.22 in nearby prose for one concept component. Such differences are small and do not alter the overall pattern, but they highlight the need for a single verified statistical table in future reporting.

The findings are consistent with a broader literature on active and cooperative learning. Reviews and meta-analytic work indicate that structured active learning and collaboration can improve participation and achievement when group interdependence, accountability, and instructional guidance are clear (Alnajjar & Ibrahim, 2024; Pohan, 2023; Prince, 2004). More specifically, Quiz Team studies report positive effects on learning

outcomes and motivation (Intaniasari et al., 2023; Maulia & Okon, 2023), while classroom participation remains sensitive to students' prior learning conditions and engagement patterns (Rosyida et al., 2024; Slameto, 2010). These findings help explain why the strategy should be interpreted as a structured participation design rather than competition alone.

Discussion

Why might Quiz Team support conceptual understanding?

The observed group difference is consistent with the theoretical logic of collaborative and active learning. Quiz Team requires repeated retrieval of recently learned material, verbal explanation, comparison of answers, and public response. Each of these processes can deepen conceptual encoding relative to passive note taking. When students prepare to answer another team's questions, they have a reason to organize information in a form that can be recalled and communicated.

Collaborative learning may also expose misconceptions. A student who silently copies a definition can preserve an inaccurate interpretation without challenge. During group discussion, an explanation becomes available for peers to question or refine. Slavin (2014) argues that cooperative structures are most effective when group goals and individual learning are connected. Quiz Team can approximate this condition when each student is expected to contribute rather than when one high-performing student represents the entire team.

The recent literature reinforces these mechanisms. Karim et al. (2024) report generally positive impacts of collaborative-learning approaches on student performance. Roka and Khatri (2024) and Ndebil and Ali (2024) similarly show achievement benefits in cooperative-learning contexts. Erik's (2024) sociology classroom study is especially relevant because it applied a team-quiz approach with Grade XI social-science students and reported improved learning completeness. These studies do not prove that the same mechanism produced the present results, but they make the interpretation plausible.

Sociology concepts benefit from explanation, not only recognition

The subject matter matters. Multicultural-society concepts require students to differentiate terms and connect them causally. For example, identifying characteristics of multicultural society requires more than recognizing the phrase; students must distinguish structural diversity from related concepts. Explaining factors that produce multicultural social arrangements requires causal reasoning. Discussing problems and possible solutions requires application of sociological ideas to social situations.

A quiz format can be shallow if questions reward only isolated recall. However, the reported component structure included causal and problem-solving dimensions, suggesting that at least some questions required more than memorization. The instructional value of Quiz Team therefore depends heavily on question design. Teams should ask "why," "how," and "what evidence supports" questions, not only "what is the definition" questions.

This point connects to active-learning research. Balalle (2024) cautions that student engagement is multidimensional; activity itself is not equivalent to learning. Wijnia et al. (2024) likewise show that student-centered instructional designs have variable motivational effects. For sociology teachers, the practical lesson is that Quiz Team should be judged by the quality of sociological reasoning it elicits, not by noise level or student enthusiasm.

The magnitude is promising, but stronger causal evidence is needed

An approximate d of 1.81 is unusually large for a classroom intervention. Such a value may reflect a genuinely powerful instructional difference, but large effects in small educational samples also warrant methodological scrutiny. Several alternative explanations cannot be ruled out from the published report.

Baseline equivalence is not documented in sufficient detail. Although the design is described as pretest-posttest, the article does not present group pretest means alongside the posttest results or analyze change scores/ANCOVA. It is therefore difficult to know how similar the groups were before instruction. Existing classes may differ in prior achievement, teacher expectations, attendance, or peer composition.

Attrition is another concern. Seven initially enrolled students are absent from the final analyzed sample, but the source does not state why. If missing students were disproportionately lower-performing in one group, the posttest difference could be biased. Contemporary reporting should provide a participant-flow account showing enrollment, intervention participation, posttest completion, exclusions, and reasons.

A third concern is clustering. Students were taught in intact classes, meaning observations within a class may not be statistically independent in the same way as individually randomized participants. With only one class per condition, it is impossible to separate treatment effects from class-level differences. A stronger design would use several classes per condition or repeated implementations across semesters.

Component tests should be interpreted as a profile, not separate proof

The six significant component tests create an intuitively persuasive pattern, but multiple testing raises statistical issues. At alpha .05, conducting several independent tests increases familywise error. The fact that all reported *t* values are above the critical threshold reduces concern that the entire result is a single chance finding, yet future studies should prespecify a primary outcome and treat components as secondary or apply a correction procedure.

A more informative approach would be to report confidence intervals and effect sizes for each component. This would show not only whether group differences are statistically detectable but which conceptual dimensions benefit most. For example, Quiz Team may be particularly effective for definitional and classificatory knowledge but less strong for evaluating complex social problems. The current article cannot answer that question because component means and standard deviations are not fully available.

Implications for sociology classroom practice

Despite methodological limitations, the study suggests several useful practices. First, teachers can use Quiz Team to create structured accountability after an initial explanation or reading. Second, teams should rotate roles so that questioning and answering are distributed. Third, quiz questions should include concept application and explanation. Fourth, the teacher should monitor group reasoning and correct misconceptions before they become reinforced socially.

Technology can support, but should not dominate, the structure. Erik (2024) combined team quiz with Kahoot, and Ambawani et al. (2024) discuss gamification media in relation to learning activity. Digital platforms can accelerate response and provide immediate scores, yet the strongest sociological learning may occur in the explanation after the answer. A rapid multiple-choice quiz should therefore be followed by prompts such as "Why is this answer sociologically correct?" or "What example from local society illustrates the concept?"

Quiz Team may also be useful formatively. Teachers can identify which concepts produce disagreement among teams and revisit them before summative assessment. In this role, the quiz is not only a motivational event but an assessment-for-learning mechanism.

Designing Quiz Team for stronger sociological reasoning

The classroom implications go beyond adopting the label Quiz Team. A well-designed sociology quiz should be organized around a progression from recognition to explanation and transfer. At an initial level, teams can define a concept or identify an example. At a second level, they can compare two cases and explain why one fits the concept better. At a third level, they can be given an unfamiliar social situation and asked to justify an interpretation using sociological criteria. This progression preserves the motivational rhythm of a quiz while increasing conceptual demand.

Question ownership is another design issue. If the teacher writes every item, the activity may remain teacher-controlled even when students answer in groups. Asking teams to construct some of the questions can shift cognitive work toward students, because writing a defensible question requires deciding what is central in the material, anticipating plausible wrong answers, and identifying the reasoning needed for a correct response. The teacher can then review questions for conceptual accuracy before they are used. This form of student-generated assessment may be particularly valuable in sociology, where poorly worded questions can reproduce stereotypes or oversimplify contested social concepts.

The competitive element also requires careful management. Team competition can increase preparation and attention, but excessive emphasis on speed or winning can encourage surface strategies. Cooperative-learning theory suggests that positive interdependence should be combined with individual accountability (Johnson & Johnson, 2009; Slavin, 2014). In practical terms, a team score could combine group quiz performance with random individual explanation, short exit tickets, or individual reflection. Such a structure prevents one articulate student from carrying the group and gives the teacher evidence about whether understanding is distributed among members.

Feedback should be treated as part of the learning event rather than a declaration of right or wrong. When teams disagree, the teacher can ask each group to provide its reasoning, invite a counterexample, and return to the sociological concept. This creates productive cognitive conflict. The goal is not simply to award points but to make the criteria for sociological interpretation explicit. In multicultural-society material, for example, students can be asked what evidence would distinguish social diversity from multicultural social organization, or why a proposed solution represents accommodation rather than assimilation.

A final design consideration is inclusivity. Competitive oral quizzes can privilege confident speakers. Teachers can distribute roles such as question writer, evidence finder, spokesperson, checker, and summarizer so that participation is not reduced to fast public response. Written preparation time can also help students who need longer processing. Contemporary collaborative-learning evidence indicates that the benefits of group learning depend on task structure rather than group membership alone (Karim et al., 2024; Roka & Khatri, 2024). The

practical message is that Quiz Team should be designed as a sequence of cognitive responsibilities, not merely a game format.

These refinements also help interpret the original result. The large posttest difference is pedagogically plausible if the experimental class experienced repeated retrieval, peer explanation, error correction, and individual responsibility across the unit. If the intervention consisted mainly of excitement and competition, the mechanism would be less convincing. Because the study report does not provide detailed fidelity observations, future replications should document these components explicitly. An observation checklist could record the proportion of students explaining answers, the types of questions posed, the frequency of teacher feedback, and whether roles rotated. Such information would connect the statistical outcome with a more defensible account of how learning changed.

Research implications and limitations

The article has limitations because raw participant-level scores were unavailable. The reported effect size is derived from the *t* statistic and analyzed group sizes rather than recomputed from individual scores. Instrument validity and reliability procedures were described but their coefficients were not available. No fidelity data show whether Quiz Team was implemented consistently across lessons.

Future replication should use transparent randomization or matching, report pretest distributions, document attrition, provide reliability coefficients, and include confidence intervals and standardized effect sizes. If intact classes are used, several classes should be assigned to each condition so that class effects can be modeled. Researchers could also measure student participation and conceptual explanation directly, testing whether these processes mediate the relationship between Quiz Team and achievement.

Longer-term retention is another important outcome. A high immediate posttest score may reflect intensive retrieval during the unit but not durable understanding. A delayed test several weeks later would show whether collaborative quizzing produces lasting conceptual accessibility. Transfer tasks could ask students to analyze a new case of multicultural interaction rather than answer familiar content questions.

Conclusion

The reported evidence indicates that students taught through collaborative Quiz Team learning achieved substantially higher posttest sociology concept-understanding scores than students taught through the comparison approach. The experimental-group mean was 91.13 compared with 77.04 in the control group, and the reported test, $t(46) = 6.26$, corresponded to an approximate standardized difference of $d = 1.81$. Component analyses also showed a consistent advantage across several dimensions of multicultural-society content.

The instructional interpretation is that Quiz Team can transform sociology learning from teacher-dominated information transfer into a structured cycle of retrieval, peer explanation, questioning, and accountability. These processes are well matched to conceptual learning because sociological understanding requires students to articulate relationships among ideas rather than merely copy definitions.

At the same time, the study should not be presented as definitive causal evidence. Unexplained attrition from initial class enrollment to the analyzed sample, incomplete baseline reporting, reliance on one intact class per condition, and multiple component tests limit precision. The most defensible conclusion is therefore that the results provide promising classroom evidence for Quiz Team and justify better-controlled replication. Future sociology education research should combine active collaborative design with stronger statistical transparency so that improvements in participation can be linked convincingly to durable conceptual understanding.

Declarations

Author contribution

Author 1: developed the main research idea and objectives, designed the research methodology, conducted data collection and investigation, performed the data analysis, and prepared the first draft of the manuscript. Author 2: contributed to the development and implementation of the research methodology, supported the data collection and investigation process, and reviewed and revised the manuscript to improve its academic quality, clarity, and structure. Author 3: provided input into the research concept and direction, supervised and guided the overall research process, reviewed and improved the manuscript, and contributed to obtaining financial support or research funding

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Conflict of Interest

The authors declare that there is no conflict of interest related to the publication of this article.

Use of generative AI

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References

- Alnajjar, A. A., & Ibrahim, M. (2024). A comparative meta-analysis on the effectiveness of three types of instructional methods on language success. *International Journal on Social and Education Sciences*, 6(2), 275-300. <https://doi.org/10.46328/ijonses.665>
- Ambawani, C. S. L., Kusuma, Y. Y., & Pratiwi, I. (2024). Influence of gamification media on learning activities and student engagement. *JMKSP: Jurnal Manajemen, Kepemimpinan, dan Supervisi Pendidikan*, 9(2), 921-932.
- Balalle, H. (2024). Exploring student engagement in technology-based education in relation to gamification, online/distance learning, and other factors: A systematic literature review. *Social Sciences & Humanities Open*, 9, 100870. <https://doi.org/10.1016/j.ssaho.2024.100870>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences (2nd ed.)*. Lawrence Erlbaum Associates.
- Eliana, N. (2024). The impact of Team Quiz method on students' ability to solve learning problems. *Journal of Lesson and Learning Studies*, 7(2), 250-260.
- Erik, S. H. (2024). Penerapan metode active learning tipe Team Quiz berbantuan aplikasi Kahoot untuk meningkatkan hasil belajar siswa kelas XI IPS. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 9(3), 2550-2564.
- Intaniasari, Y., Utomo, S., & Sholikhah, O. H. (2023). Application of the Quiz Team method to improve learning outcomes. *International Journal of Multicultural and Multireligious Understanding*, 10(6), 229-238.
- Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38(5), 365-379. <https://doi.org/10.3102/0013189X09339057>
- Karim, M., Antoni, S., & Oktarina, K. (2024). Meta-analysis of collaborative learning approaches in educational management and their impact on student performance. *Indonesia Journal of Engineering and Education Technology*, 2(2), 427-434. <https://doi.org/10.61991/ijeet.v2i2.85>
- Maulia, R. A., & Okon, C. (2023). The effect of Quiz Team type active learning methods on student learning motivation. *Indonesian Journal of Education Research*, 4(4), 75-79. <https://doi.org/10.37251/ijoer.v4i4.703>
- Ndebil, M. B., & Ali, C. A. (2024). Cooperative learning as a strategy of improving mathematics performance and attitudes. *International Journal of Educational Innovation and Research*, 3(1), 62-74. <https://doi.org/10.31949/ijeir.v3i1.7163>
- Pohan, A. E. (2023). Legitimizing collaborative learning as a recommended model for Indonesian education in Society 5.0. *Jurnal Cahaya Pendidikan*, 9(1), 1-12.
- Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93(3), 223-231.
- Roka, J., & Khatri, T. B. (2024). Impact of cooperative learning approach on students' achievement in mathematics. *Journal of Educational Research and Innovation*, 4(1), 59-67. <https://doi.org/10.3126/jeri.v4i1.75790>
- Rosyida, V. N., Hasanah, U., & Pratama, R. (2024). Active learning strategies and students' classroom participation. *Indonesian Journal of Education and Social Humanities*, 1(2), 80-91.
- Silberman, M. (2004). *Active learning: 101 strategies to teach any subject*. Allyn & Bacon.
- Slameto. (2010). *Belajar dan faktor-faktor yang mempengaruhinya*. Rineka Cipta.
- Slavin, R. E. (2014). Cooperative learning and academic achievement: Why does groupwork work? *Anales de Psicologia*, 30(3), 785-791. <https://doi.org/10.6018/analesps.30.3.201201>
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Wijnia, L., Noordzij, G., Arends, L. R., Rikers, R. M. J. P., & Loyens, S. M. M. (2024). The effects of problem-based, project-based, and case-based learning on students' motivation: A meta-analysis. *Educational Psychology Review*, 36, 29. <https://doi.org/10.1007/s10648-024-09864-3>