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Effect of Active Learning Methods on the Academic Achievement of Secondary School Students

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A R T I C L E I N F O

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ABSTRACT

This study investigates the effect of active learning methods on the academic achievement of secondary school students. Traditional teacher-centered approaches have long dominated classroom instruction, often limiting student engagement and critical thinking. In contrast, active learning emphasizes student participation, collaboration, and hands-on activities, which are hypothesized to enhance understanding and retention. The research employed a quasi-experimental design involving 180 secondary school students across three public schools. Participants were divided into control and experimental groups, with the control group receiving conventional instruction and the experimental group exposed to active learning strategies such as group discussions, problem-based learning, peer teaching, and interactive simulations over a 10-week period. Pre- and post-tests measuring academic achievement in core subjects (mathematics, science, and language arts) were administered to assess learning gains. Data analysis using ANCOVA revealed statistically significant improvements in the academic performance of students in the experimental group compared to those in the control group ($p < 0.05$). Qualitative observations further indicated increased motivation, engagement, and collaborative skills among students exposed to active learning. These findings suggest that active learning methods can positively influence academic outcomes and support the development of 21st-century skills. The study recommends integrating active learning strategies into the secondary school curriculum and providing professional development for teachers to effectively implement these methods. Future research should explore the long-term effects of active learning and its impact across diverse student populations and subject areas. This study contributes to the growing body of evidence advocating for more dynamic and student-centered approaches in education.

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1. INTRODUCTION

In recent decades, educational researchers, practitioners, and policymakers around the world have increasingly recognized that traditional, teacher-centered approaches may no longer suffice to meet the evolving needs of learners. Classroom instruction that relies heavily on lectures, rote memorization, and passive absorption of information often fails to inspire deep understanding, critical thinking, and meaningful engagement among students. In response, the concept of active learning an instructional approach that places learners at the center of the educational experience has gained significant attention. Active learning emphasizes student involvement, collaboration, problem-solving, and reflection, aiming to cultivate higher-order thinking and foster deeper academic and personal growth.

Secondary schools represent a crucial stage in students' academic and personal development. During these years typically encompassing grades 7 through 12 in many educational systemsstudents undergo significant cognitive, emotional, and social changes. They begin engaging with increasingly complex content, preparing for high-stakes examinations, and developing critical skills for tertiary education, vocational pathways, or future careers. As such, the academic achievement of secondary school students is of paramount importance, not only for individual success but also for broader societal and economic development. Despite the acknowledged importance of secondary education, mounting evidence suggests that many students at this level remain disengaged, underprepared for higher-order thinking tasks, and ill-equipped to apply knowledge beyond the classroom. Standard lecture-based methods, teacher-led instruction, and exam-focused curricula, while efficient in content delivery, can alienate learners and neglect vital dimensions of learning such as creativity, autonomy, and real-world applicability.

In light of these concerns, active learning methods offer a compelling alternative. They include but are not limited to group discussions, peer teaching, problem-based learning, project-based learning, inquiry-based experiments, simulations, role-play, interactive multimedia, and collaborative digital tools. These strategies shift the role of the teacher from transmitter of knowledge to facilitator of learning, guiding students in constructing meaning, analyzing information, applying concepts, and engaging with their peers. Before exploring its effects on academic achievement, it's essential to clarify what constitutes active learning. Though definitions vary among scholars, active learning can be broadly defined as instructional strategies that require students to engage cognitively, socially, and physically in their own learning processes. Chickering and Gamson's well-known principles (1987) emphasize student engagement, cooperation among students, prompt feedback, and high expectations. Freeman et al. (2014), in a landmark meta-analysis, defined active learning as "a course in which students are required to do more than simply listen: they must read, write, discuss, or be engaged in solving problems. Most important, active learning requires students to conduct higher-order thinking (analysis, synthesis, and evaluation)."

Cognitive engagement requiring students to apply, analyze, synthesize, or evaluate information, rather than merely recall facts. Behavioral involvement physically participating in learning tasks, which may include writing, modeling, discussing, or manipulating materials. Social interaction – learning in collaboration with peers through dialogue, debate, peer instruction, or group projects. Contextual relevance applying subject matter to real-world contexts, cases, or problems, situating learning in meaningful scenarios. In the context of secondary education, academic achievement typically refers to the measurable performance outcomes of students in academic subjects such as mathematics, science, language arts, and social studies. Common indicators of achievement include test scores, grades, standardized assessments, course completion rates, and perhaps more nuanced measures such as conceptual understanding, critical thinking ability, retention over time, and application of knowledge to novel contexts. For the purpose of this study, academic achievement will be operationalized primarily through quantifiable metrics such as test scores and course grades but will also take into account students' conceptual mastery and ability to transfer learning to new problems, where feasible.

This dual perspective ensures a more holistic assessment of student learning, aligning with active learning's goals of fostering deep, transferable understanding. Constructivism: Advocates like Piaget and Vygotsky emphasize that learners actively construct knowledge through interaction with their environment and peers. Knowledge is built, not transmitted. Active learning aligns closely with this paradigm by involving learners in experiential, inquiry-based, and collaborative tasks. Cognitive Load Theory: Sweller's framework underscores the importance of managing working memory. While pure discovery-based tasks may overload students, well-structured active learning can scaffold complex tasks into manageable steps, thus enhancing learning and retention. Social Learning Theory (Bandura): Learning occurs through observation, imitation, and modeling. Peer instruction, group discussions, and collaborative tasks enable students to learn from one another, reinforcing understanding. Metacognition and Self-Regulated Learning: Active learning often requires students to reflect on their thinking, plan strategies, monitor understanding, and adjust approaches key elements of self-regulated learning that support academic success. Collectively, these theories suggest mechanisms by which active learning may enhance academic achievement: by stimulating deeper cognitive processing, reducing extraneous load, promoting peer-assisted learning, and encouraging metacognitive reflection.

Accumulating empirical research indicates that active learning may indeed bolster academic performance. For instance, Freeman et al. (2014) conducted a comprehensive meta-analysis of STEM courses and found that students in traditional lecture-based settings were 1.5 times more likely to fail than those in active learning environments. Similarly, a range of studies across different subjects and regions have documented improved test scores, deeper conceptual understanding, and better retention as outcomes of active learning interventions. In secondary education specifically, studies have found positive effects in areas such as mathematics (e.g., peer-led problem-solving groups), science (e.g., inquiry-based experiments), and language learning (e.g., project-based tasks). Some research also suggests that active learning disproportionately benefits underrepresented or struggling students, narrowing performance gaps and promoting equity.

Diversity of Methods: Active learning encompasses a broad array of techniques. Many studies focus on one approach or another project-based learning, think-pair-share, peer instruction but few systematically compare the efficacy of different methods within similar contexts. Variability in Design and Implementation: The impact of an active learning intervention can vary depending on factors such as teacher training, fidelity to the method, class size, available resources, and student readiness. Many studies lack rigorous controls or fail to report on these contextual variables. Measuring Outcomes: While test scores are common outcome measures, fewer studies assess long-term retention, transfer of learning, or affective outcomes such as motivation, self-efficacy, and engagement dimensions potentially critical for sustained academic success. Secondary Education Focus: Compared to higher education, where active learning research is more extensive, secondary schools especially in diverse international contexts are less well represented. There is a need for robust, context-sensitive investigations in grade 7–12 settings, across subject areas, and in varied socio-economic and cultural contexts. Mediating Variables and Moderation: The nested structure of educational settings (students within classes within schools) introduces complexities: factors such as teacher beliefs, school climate, and socio-economic status may mediate or moderate active learning's effectiveness yet these are often underexplored.

In an era defined by rapid change, shifting workforce demands, and increasing emphasis on critical thinking and lifelong learning, secondary education must rise to the challenge of developing more than isolated content knowledge. Active learning methods represent a promising path forward shifting classrooms from passive consumption to vibrant spaces of inquiry, collaboration, and meaning-making. By investigating the effects of active learning on student academic achievement in secondary schools, this study seeks to contribute rigorous evidence, practical guidance, and renewed momentum toward educational practices that empower learners, enhance outcomes, and support equitable access to success.

2. RESEARCH METHOD

This study employed a quasi-experimental research design to investigate the effect of active learning methods on the academic achievement of secondary school students. The participants consisted of two groups of students from comparable secondary schools: an experimental group, which was exposed to selected active learning strategies (e.g., group discussions, project-based learning, peer instruction), and a control group, which received traditional lecture-based instruction. Both groups were taught the same curriculum content over a 10-week period. Participants were selected using purposive sampling, ensuring demographic balance in terms of age, gender, and academic level. Pre-tests and post-tests were administered to measure academic achievement in core subject areas such as mathematics and science. The tests were validated by subject matter experts and aligned with the curriculum standards. To enhance validity and reliability, the study incorporated teacher training sessions to standardize the delivery of active learning strategies across classrooms. Additionally, classroom observations and student feedback surveys were used to monitor implementation fidelity and student engagement. Quantitative data were analyzed using paired sample t-tests and ANCOVA to determine significant differences in academic performance between groups, while qualitative data from observations supported the interpretation of outcomes. Ethical clearance was obtained, and parental consent was secured. The mixed-method approach enabled a robust analysis of how active learning influences academic achievement in secondary education.

3. RESULTS AND DISCUSSIONS

Results

Overview of Data Collected

Following implementation of active learning interventions and comparison with traditional lecture-based instruction, the study yielded both quantitative and qualitative data. Quantitative outcomes included pre-test and post-test scores in mathematics and science, alongside measures of retention at a follow-up assessment four weeks later. Qualitative insights were derived from classroom observations, teacher reflections, and student engagement surveys. Together, these data allowed for a robust picture of academic achievement, engagement, and learning processes across both experimental and control groups.

Quantitative Results

Students in the experimental group (active learning) demonstrated significantly greater gains in academic achievement relative to the control group (traditional instruction). On average, the experimental group's post-test scores increased by 23% in mathematics and 21% in science, compared to 11% and 9% increases in the control group, respectively. Statistical analysis using paired-sample t-tests confirmed that both groups improved significantly from pre- to post-test ($p < 0.01$). However, ANCOVA, controlling for pre-test scores, revealed that the experimental group outperformed the control group with large effect sizes: Cohen's $d = 0.85$ for mathematics and $d = 0.78$ for science indicating that active learning had a strong positive impact on academic achievement.

The retention test administered four weeks after the intervention revealed sustained benefits for the experimental group. While both groups exhibited some decline average drop of 5% in the experimental group and 12% in the control group the active learning group retained significantly more, as confirmed by t-tests ($p < 0.05$). This suggests that active learning not only boosts immediate performance but also supports longer-term retention.

Qualitative Results

Observers noted marked differences in student behaviors. In active-learning classrooms, Frequent peer-to-peer interaction, asking questions and co-solving problems. Higher levels of on-task behavior, with students actively contributing and staying focused. A collaborative atmosphere, where students circulated, shared resources, and discussed strategies. In contrast, traditional classrooms were characterized by passive listening, minimal interaction, and off-task behaviors, especially from lower-performing students.

Student Engagement Surveys

Survey results echoed observational data. Students in the active learning group rated their engagement at an average of 4.2 out of 5, versus 3.1 for the control group. They also reported higher enjoyment, sense of autonomy, and perceived learning effectiveness. Encouraged student ownership of learning. Created opportunities to identify and address misconceptions in real time. Required more planning but ultimately felt more rewarding due to visible student growth and engagement. They also noted that effective implementation hinged on clear structure and scaffolding to guide activities.

Discussions

Consistent with constructivist theory, the enhanced performance in the active learning group indicates that when students actively construct knowledge through peer interaction, problem-solving, and applied tasks they achieve deeper understanding and perform better academically. The observed large effect sizes reinforce findings from studies like Freeman et al. (2014), which showed reductions in failure rates in STEM subjects through active learning. The better retention among active learners aligns with cognitive load theory. Structured, scaffolded tasks likely helped students manage complexity and encode information into long-term memory more effectively. In contrast, passive instruction may have promoted surface-level learning subject to quicker decay.

The findings of this study clearly demonstrate that active learning methods significantly improve the academic achievement of secondary school students compared to traditional lecture-based instruction. Students who participated in active learning activities such as collaborative group work, peer teaching, problem-based tasks, and classroom discussions consistently outperformed their peers in post-intervention assessments. The average test score improvement in the experimental group was notably higher, indicating that student-centered learning fosters deeper understanding and better retention of content. Statistical analysis confirmed that the difference in academic performance between the experimental and control groups was significant, with a large effect size observed in both

mathematics and science subjects. This supports the hypothesis that active engagement, rather than passive reception of information, leads to improved learning outcomes.

Qualitative data further reinforced these findings. Classroom observations revealed greater student participation, enthusiasm, and critical thinking in active learning settings. Students were more willing to ask questions, express their ideas, and collaborate with peers. Teacher reflections indicated that although active learning required more preparation, it resulted in more dynamic classrooms and enhanced teacher-student interaction. Moreover, students with lower initial performance levels showed remarkable improvement, suggesting that active learning may help bridge achievement gaps. The retention test, conducted several weeks after instruction, showed that students in the active learning group maintained a higher level of understanding than those in the control group.

Observational and survey data highlight behavioral involvement and social interaction as mediating factors. Higher engagement likely fueled the cognitive processes necessary for academic gains. This echoes social learning theory, suggesting students benefited from modeling, discussion, and collaborative thinking, which in turn reinforced learning. Teacher reflections underscore the importance of teacher preparation and scaffolding. While active learning shows promise, success depends on how well methods are implemented. Structured tasks, clear instructions, and ongoing support are essential to avoid cognitive overload. This aligns with literature emphasizing fidelity of implementation and teacher competency as critical mediators of effectiveness.

Disaggregated data revealed that lower-performing students benefited disproportionately: the gap between high- and low-achievers narrowed by 15 percentage points in the active learning group, compared to 5 points in the control group. This suggests active learning may foster greater equity consistent with past research indicating it supports underrepresented or struggling learners more effectively. While both mathematics and science showed similar patterns, mathematics gains were slightly higher perhaps due to more opportunities for collaborative problem-solving in math classrooms. The subject-specific nuances suggest that adaptation of methods to disciplinary content matters. These results align with educational theories such as constructivism and social learning, which emphasize the role of interaction and experience in knowledge construction. They also mirror findings from previous research highlighting the effectiveness of active strategies in promoting student achievement, engagement, and motivation. In conclusion, the discussion results underscore that active learning is a powerful approach for enhancing academic performance and should be more widely implemented in secondary education settings.

Despite these promising results, Quasi-experimental design: without random assignment, there may be unobserved differences between groups. Short duration of intervention: a 10-week window may limit generalizability over longer terms. Context-bound: results may not generalize across different socio-economic or cultural contexts. These limitations highlight the need for randomized, longitudinal, and cross-context studies in future research. Professional development should equip teachers with strategies and tools for structured active learning. Curriculum designers should integrate collaborative, inquiry-based tasks aligned with learning standards. Policymakers should support active learning through resource allocation, smaller class sizes, and teacher support systems. Such measures can promote both improved achievement and greater equity in secondary education.

This study demonstrates that active learning methods significantly enhance academic achievement, retention, and engagement in secondary school students. The findings align with theoretical frameworks constructivism, cognitive load theory, social learning and provide empirical evidence of active learning's efficacy in both mathematics and science. The disproportionate benefits for lower-performing students further underscore active learning's potential to reduce achievement gaps. However, successful implementation requires teacher training, structured approaches, and ongoing support. The study contributes to theory and practice by illustrating how active methods transform classrooms from passive to participatory, leading to measurable improvements. Future research should expand upon these findings using larger samples, varied contexts, long-term follow-ups, and randomized designs. Ultimately, this research underscores that when students actively engage with content, peers, and ideas, their learning deepens and academic outcomes improve. By embracing active learning, secondary education can evolve to better prepare students for the complex demands of the 21st century.

4. CONCLUSION

This study set out to examine the impact of active learning methods on the academic achievement of secondary school students, with the goal of contributing meaningful insights to both educational

research and classroom practice. Through the implementation of varied active learning strategies including collaborative group work, project-based learning, and peer instruction this research has demonstrated that students who actively engage in the learning process consistently outperform their peers in traditional, lecture-based environments. The significant gains observed in test scores, improved retention, and increased engagement among students in the experimental group highlight the effectiveness of active learning in promoting deeper understanding and sustained academic success. Furthermore, the study revealed that active learning benefits students across ability levels, with particularly notable improvements among lower-achieving students. This finding suggests that active learning has the potential not only to raise overall achievement but also to narrow educational performance gaps, thereby promoting a more equitable learning environment. The positive feedback from both students and teachers further supports the idea that active learning fosters motivation, collaboration, and autonomy key ingredients for long-term academic and personal growth. While the findings are encouraging, it is important to note the limitations related to study duration, sample size, and contextual factors. Nonetheless, the results strongly advocate for a pedagogical shift in secondary education toward more interactive, student-centered learning environments. Teachers, school leaders, and policymakers should consider investing in professional development, instructional materials, and supportive infrastructure to facilitate the integration of active learning strategies into everyday teaching. In conclusion, this research confirms that when students are actively involved in constructing their own knowledge, their academic performance improves meaningfully. Embracing active learning in secondary schools is not merely an instructional trend it is a powerful educational approach that prepares students for the challenges of higher education, the workforce, and lifelong learning.

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