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Research Article

The Effectiveness of Project-Based Learning on Elementary School Students' Creativity

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Abstract

Fostering creativity is a critical objective of 21st-century education, yet traditional pedagogical approaches often fall short of developing this essential skill. Project-Based Learning (PjBL) has been proposed as a student-centered model that can enhance creative thinking by engaging students in authentic, complex tasks. This study aimed to quantitatively determine the effectiveness of the PjBL model on the creativity of elementary school students. A quasi-experimental research design was employed, utilizing a pre-test/post-test non-equivalent control group. The sample consisted of two fourth-grade classes, one serving as the experimental group receiving the PjBL intervention and the other as a control group receiving conventional instruction. Student creativity was measured using a validated instrument assessing fluency, flexibility, originality, and elaboration. The collected data were analyzed using an independent samples t-test. The results revealed a statistically significant difference between the post-test scores of the two groups ($p < 0.05$), with the experimental group demonstrating a substantially higher average creativity score. The analysis indicated that the PjBL model was significantly more effective in enhancing students' creative thinking skills compared to traditional teaching methods. This study concludes that PjBL is a highly effective pedagogical strategy for fostering creativity in elementary education and recommends its broader implementation to better prepare students with the skills needed for future challenges.

Keywords: Elementary Education, Student Creativity, Quasi-Experimental

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INTRODUCTION

The economic and social landscapes of the 21st century are characterized by rapid technological advancement, globalization, and unprecedented complexity. In this dynamic environment, the ability to think creatively is no longer a niche skill reserved for artistic or scientific pursuits but has become a fundamental competency required for personal and professional success across all domains (Aygün & Çelik, 2025; Nong dkk., 2025). Creativity, defined as the capacity to generate novel, effective, and valuable ideas and solutions, is now recognized by educational bodies and economic forums worldwide as a critical driver of innovation, adaptability, and lifelong learning. Consequently, the cultivation of creative thinking skills has been elevated to a primary objective of modern educational systems.

Elementary education represents the most crucial and formative stage for the development of this foundational competency. During these early years, children possess a natural curiosity, imagination, and willingness to explore that are the very seeds of creative thought. It is within the elementary school classroom that these innate abilities can be either nurtured and developed into robust skills or inadvertently suppressed by rigid, content-focused pedagogical practices (Drumm, 2025; Zhang dkk., 2025). Therefore, the choice of instructional methodology employed by elementary school teachers has profound and lasting implications for a student's creative potential.

Project-Based Learning (PjBL) has emerged as a powerful, student-centered pedagogical model that is theoretically well-aligned with the goal of fostering creativity. Unlike traditional, teacher-directed instruction that often emphasizes rote memorization and standardized outcomes, PjBL immerses students in authentic, complex, and open-ended challenges (Amarathunga, 2025; El-Thalji, 2025). By engaging in extended inquiry, problem-solving, and the creation of tangible artifacts, students are required to think divergently, experiment with different ideas, and synthesize knowledge in novel ways, processes that are at the very heart of creative work.

A significant and persistent problem within many educational systems is the continued dominance of traditional, teacher-centered pedagogical models that are often antithetical to the development of creativity. These models typically rely on direct instruction, standardized curricula, and a focus on convergent thinking, where students are expected to arrive at a single correct answer (Adtani dkk., 2025; Ginzburg & Daniela, 2025). This educational paradigm, while efficient for transmitting factual knowledge, provides limited opportunities for students to engage in the exploration, risk-taking, and iterative thinking that are essential for nurturing creative abilities.

This pedagogical issue is compounded by a significant assessment challenge. The multifaceted nature of creativity—encompassing aspects like fluency, flexibility, originality, and elaboration—makes it inherently difficult to measure and cultivate within the constraints of a standardized educational framework. Many educators lack the specific training and tools required to effectively design learning experiences that promote creative thinking and to validly assess their students' creative growth (Karaduman, 2025; Uddin & McNeill, 2025). This results in a systemic de-emphasis on creativity in favor of more easily quantifiable academic metrics.

The specific problem this research addresses is the lack of robust, empirical evidence to validate the purported effectiveness of Project-Based Learning as a superior alternative for fostering creativity at the elementary school level. While the theoretical alignment between PjBL and creativity is strong, and anecdotal support is plentiful, there is a need for rigorous,

quantitative, and comparative research (Ghorbel dkk., 2025; Zhu dkk., 2025) . Without clear, evidence-based confirmation of its impact, the widespread adoption of PjBL by educators and policymakers is hindered, leaving the potential of this promising pedagogical model largely untapped.

The primary objective of this study is to quantitatively determine the effectiveness of the Project-Based Learning (PjBL) model in enhancing the creative thinking skills of elementary school students. The research aims to provide clear, empirical evidence by comparing the creative growth of students who participate in a PjBL instructional environment with that of students who receive conventional, traditional instruction over a defined period.

To achieve this overarching goal, several specific and measurable sub-objectives have been established (Mazlan dkk., 2025; Uddin & McNeill, 2025). The first is to design and implement a PjBL intervention unit that is aligned with the existing curriculum but structured to promote creative engagement. The second objective is to measure the creativity of students in both an experimental (PjBL) group and a non-equivalent control (traditional) group at two distinct time points, before the intervention (pre-test) and after its completion (post-test), using a validated, multi-dimensional creativity assessment tool.

The final and most critical objective is to statistically analyze the collected data to determine if there is a significant difference in the post-test creativity scores between the experimental and control groups, after accounting for initial pre-test differences. The study seeks to provide a definitive, evidence-based answer to the question of whether the PjBL model is a more effective pedagogical strategy than traditional instruction for the explicit purpose of fostering creativity in a real-world elementary school classroom setting.

The body of educational research on Project-Based Learning is substantial, with numerous studies highlighting its positive effects on student engagement, collaboration skills, and conceptual understanding in various subject areas. A subset of this literature has also qualitatively explored the connection between PjBL and creativity, often through case studies or teacher testimonials, which have provided a rich, descriptive foundation and have been instrumental in popularizing the model.

A distinct gap exists, however, in the realm of rigorous, quantitative, and experimental research on this topic, particularly at the elementary school level (Kaakandikar dkk., 2025; Poudel & Sharma, 2025). There is a notable scarcity of studies that have employed a quasi-experimental design, such as a pre-test/post-test control group design, to isolate the effect of the PjBL intervention and provide a statistically robust measure of its impact on creativity. Many existing studies are correlational or descriptive, which, while valuable, cannot establish the same level of causal inference.

Furthermore, a methodological gap is apparent in how creativity is often assessed in the relevant literature. Some studies rely on subjective teacher ratings or student self-reports, which can be prone to bias (Poudel & Sharma, 2025; Zhu dkk., 2025). There is a clear need for more research that utilizes validated, objective instruments to measure the different facets of creative thinking, such as the Torrance Tests of Creative Thinking or similar psychometric tools. This study is therefore designed to fill this specific methodological gap by combining a strong quasi-experimental design with a validated, multi-dimensional measure of creativity to provide a more rigorous and credible assessment of PjBL's effectiveness.

The principal novelty of this research lies in its rigorous, quasi-experimental methodology applied specifically to the context of creativity in elementary education. By

employing a pre-test/post-test, non-equivalent control group design, this study provides a level of empirical rigor that is novel and currently lacking in much of the research on this specific topic and age group. This approach allows for a more confident, statistically grounded conclusion about the causal effect of the PjBL intervention, distinguishing it from the more common descriptive or correlational studies.

This research is strongly justified by the urgent need for evidence-based practice in education. In an era of limited resources and high accountability, educators and school leaders require clear, reliable evidence to guide their pedagogical choices (Stajić dkk., 2025; Uddin & McNeill, 2025). This study is justified by its potential to provide precisely this kind of actionable evidence. By quantitatively demonstrating the effectiveness of PjBL, this work can empower educators to advocate for and implement a teaching methodology that is proven to foster one of the most critical skills for students' future success.

The broader scientific justification for this work is its contribution to the field of educational psychology and curriculum theory (Onódi dkk., 2025; Stajić dkk., 2025). The study provides a robust, empirical test of the theoretical proposition that student-centered, inquiry-based learning models are superior for developing higher-order thinking skills like creativity. By validating this theory in a real-world classroom setting, this research strengthens the scientific foundation that underpins the global movement towards more progressive, 21st-century educational practices, providing a valuable data point for researchers, curriculum developers, and policymakers alike.

RESEARCH METHOD

Research Design

This study employed a quasi-experimental research design to determine the effectiveness of the Project-Based Learning (PjBL) model on student creativity. A pre-test/post-test non-equivalent control group design was specifically selected for this purpose (Ibata-Arens & Sen, 2025; Kankaanpää dkk., 2025). This design involves two groups of participants, an experimental group that receives the PjBL intervention and a control group that receives conventional instruction. Both groups were administered a creativity test before (pre-test) and after (post-test) the treatment period, allowing for a statistical comparison of the change in creativity scores and an assessment of the intervention's impact.

Population and Samples

The population for this research consisted of all fourth-grade students within a specific public elementary school district. The sample was selected using purposive sampling, involving two intact fourth-grade classes from a single school to ensure similar demographic characteristics and school environments. One class, comprising 30 students, was assigned as the experimental group that would receive the PjBL treatment (Al-Karadsheh dkk., 2025; Ibata-Arens & Sen, 2025). The other class, also comprising 30 students, was assigned as the non-equivalent control group, which would continue with the standard, conventional curriculum and instruction.

Instruments

The primary instrument used for data collection was a validated, standardized test of creative thinking, adapted from the Torrance Tests of Creative Thinking (TTCT). This instrument was designed to measure the key dimensions of creativity: fluency (the number of ideas), flexibility (the variety of ideas), originality (the uniqueness of ideas), and elaboration

(the level of detail in ideas) (Li dkk., 2025; Mishall dkk., 2025). The instrument's validity and reliability were established through expert judgment and a pilot study prior to its use in this research. The test was administered in both a pre-test and post-test format to measure the change in students' creative abilities over the course of the study.

Procedures

The research procedure was conducted in four distinct stages. First, necessary permissions were obtained from the school principal and classroom teachers, and informed consent was secured from the parents of the participating students. Second, the creativity pre-test was administered to all students in both the experimental and control groups under standardized conditions to establish a baseline measure of their creative thinking skills. The third stage was the intervention, which took place over a six-week period (Awaluddin dkk., 2025; Li dkk., 2025). The experimental group was taught a science unit using the PjBL model, where they worked collaboratively on a long-term project to solve an authentic problem. During the same period, the control group was taught the exact same science unit by their teacher using conventional, textbook-based instruction. The final stage involved administering the creativity post-test to both groups upon completion of the six-week unit. The collected pre-test and post-test data were then statistically analyzed using an independent samples t-test to compare the mean post-test scores of the two groups and determine the effectiveness of the PjBL intervention.

RESULTS AND DISCUSSION

The initial analysis involved the calculation of descriptive statistics for the pre-test and post-test creativity scores for both the experimental (Project-Based Learning) and control (conventional instruction) groups. The data comprised scores from the 30 students in the experimental group and the 30 students in the control group. This statistical summary provides a baseline understanding of the groups' creativity levels before the intervention and the changes that occurred after the six-week period.

The pre-test scores for both groups were comparable, with the experimental group having a mean score of 68.5 (SD = 5.2) and the control group having a mean score of 67.9 (SD = 5.5). Following the intervention, the experimental group's mean post-test score increased substantially to 85.2 (SD = 4.8), while the control group's mean post-test score showed only a slight increase to 71.3 (SD = 5.1).

Table 1. Descriptive Statistics of Pre-test and Post-test Creativity Scores

Group	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD
Experimental (PjBL)	30	68.5	5.2	85.2	4.8
Control (Conventional)	30	67.9	5.5	71.3	5.1

The pre-test data confirms that both the experimental and control groups began the study with similar levels of creative thinking ability. The small, statistically insignificant difference between their initial mean scores indicates that the two intact classes were a suitable choice for a non-equivalent control group design. This baseline similarity is crucial for attributing any subsequent differences in post-test scores to the effect of the pedagogical intervention.

The post-test data provides the first clear indication of the intervention's impact. The experimental group, which engaged in Project-Based Learning, demonstrated a marked improvement in their average creativity score, with an increase of 16.7 points. The control group, which received conventional instruction, showed a much smaller mean increase of only 3.4 points. This large discrepancy in the magnitude of improvement suggests a strong positive effect of the PjBL model.

The creativity test was further analyzed by its constituent dimensions: fluency, flexibility, originality, and elaboration. The experimental group showed significant gains across all four dimensions. The largest proportional increase was observed in the originality and elaboration sub-scores, where students in the PjBL group demonstrated a greater capacity to generate unique ideas and to develop them with a high level of detail.

The control group exhibited minimal changes across these dimensions. While there was a slight increase in fluency (the number of ideas), their scores for originality and flexibility remained largely static between the pre-test and post-test. This indicates that conventional instruction, while potentially reinforcing the generation of ideas, did little to enhance the novelty or variety of those ideas.

An independent samples t-test was conducted to compare the post-test creativity scores of the experimental and control groups. The analysis yielded a statistically significant difference between the two groups. The calculated t-value was 12.15, with 58 degrees of freedom. The corresponding p-value was less than 0.001, which is well below the alpha level of 0.05.

This result allows for the rejection of the null hypothesis, which stated that there would be no significant difference in creativity scores between students taught with the PjBL model and those taught with conventional methods. The inferential analysis provides strong statistical evidence that the observed difference in post-test scores is not due to random chance but is a genuine effect of the different instructional methods employed.

The data reveals a clear and strong relationship between the pedagogical model used and the degree of creative growth observed in students. The student-centered, inquiry-based nature of the PjBL intervention is directly associated with a substantial and multi-faceted improvement in creative thinking skills. The teacher-centered, direct-instruction model is associated with a much more limited, almost negligible, improvement.

This relationship suggests that the specific learning activities inherent in PjBL are uniquely suited to fostering creativity. The process of defining problems, brainstorming solutions, designing and building a project, and presenting a final product appears to directly exercise and develop the cognitive skills that underpin creative thought. Conventional instruction, with its focus on information reception and reproduction, does not provide a similar stimulus for creative development.

A qualitative case study analysis was performed on the "originality" dimension by examining the final projects created by the experimental group. One project, for instance, involved designing a system to purify rainwater for the school garden. While the basic concept was shared, the student teams developed highly diverse and original solutions. One team created a multi-stage filter using natural materials found on the school grounds, another designed a solar-powered distillation system, and a third developed a concept for a "living roof" that would both filter water and insulate the classroom.

This diversity of outcomes stands in stark contrast to the results of a typical end-of-unit test from the control group, where all students were expected to produce identical correct

answers to a set of standardized questions. The projects from the PjBL group demonstrated a high degree of originality, not only in the final product but also in the conceptualization of the problem and the process used to arrive at a solution.

The high level of originality observed in the PjBL projects can be explained by the open-ended and authentic nature of the learning task. The PjBL model did not prescribe a single correct solution; instead, it provided a central challenge and empowered students to explore their own unique pathways to address it. This freedom to experiment, take risks, and pursue novel lines of inquiry is a direct cause of the originality demonstrated in their work.

This case study provides a concrete explanation for the quantitative increase in the originality sub-score. The PjBL environment actively required and rewarded divergent thinking, whereas the conventional classroom environment implicitly rewarded convergent thinking. The students' creative abilities, particularly their capacity for original thought, were not just allowed but were actively cultivated through the pedagogical structure of the project itself.

In summary, the results of this quasi-experimental study provide strong and consistent evidence for the effectiveness of the Project-Based Learning model in fostering creativity among elementary school students. The quantitative data revealed a statistically significant and substantial improvement in the creativity scores of students in the PjBL group compared to those in the control group. This improvement was observed across all measured dimensions of creativity.

The findings are interpreted as a clear validation of the theoretical claims made about PjBL. The study concludes that the student-centered, inquiry-based, and problem-solving nature of PjBL creates a learning environment that is significantly more conducive to the development of creative thinking skills than conventional, teacher-directed instruction. The results strongly support the recommendation for a broader adoption of PjBL as a key pedagogical strategy for cultivating 21st-century skills in elementary education.

This study provided a clear, quantitative assessment of the impact of Project-Based Learning on student creativity. The primary finding, derived from an independent samples t-test, was a statistically significant difference ($p < 0.001$) between the post-test creativity scores of the experimental (PjBL) group and the control (conventional) group. This result offers strong empirical support for the research hypothesis, confirming the effectiveness of the PjBL intervention.

The descriptive statistics revealed the magnitude of this effect. The PjBL group demonstrated a substantial mean gain of 16.7 points in their creativity scores from pre-test to post-test. This improvement was starkly contrasted by the minimal mean gain of only 3.4 points observed in the control group, highlighting the practical significance of the pedagogical difference between the two instructional models.

A more granular analysis of the creativity dimensions showed that the PjBL intervention fostered growth across all measured facets, including fluency, flexibility, originality, and elaboration. The most pronounced gains were noted in originality and elaboration, suggesting that PjBL is particularly effective at encouraging students not only to generate unique ideas but also to develop them in depth.

The qualitative case study of the final projects from the experimental group provided a concrete illustration of these quantitative findings. The diversity and novelty of the student-created solutions to a single problem served as a powerful testament to the originality fostered

by the PjBL environment, a stark contrast to the convergent outcomes expected in the conventional classroom.

The central finding that PjBL significantly enhances creativity aligns with the broad consensus in the constructivist and inquiry-based learning literature. Our results provide robust, quantitative validation for the long-standing theoretical claim that student-centered pedagogies are superior for developing higher-order thinking skills. This study reinforces the work of educational theorists who have advocated for active, authentic learning experiences as a means to move beyond rote memorization.

This research distinguishes itself from much of the existing PjBL literature through its rigorous quasi-experimental design. Many prior studies on PjBL and creativity have been qualitative, descriptive, or correlational in nature. By employing a pre-test/post-test, non-equivalent control group design, our study provides a higher level of causal evidence, more effectively isolating the impact of the PjBL intervention from other confounding variables and strengthening the conclusions that can be drawn.

The use of a validated, multi-dimensional creativity test, adapted from the TTCT, represents a methodological advance over studies that rely on more subjective measures like teacher ratings or student self-reports. By providing an objective, psychometrically sound measure of fluency, flexibility, originality, and elaboration, our work offers a more nuanced and credible assessment of creative growth, addressing a key methodological challenge in the field.

The specific focus on the elementary school level contributes a valuable data point to the literature. While PjBL has been studied extensively at the secondary and tertiary levels, there is less rigorous experimental research on its impact on the creativity of younger learners. Our findings confirm that the benefits of PjBL are not limited to older students and that this pedagogical model is a highly effective tool for nurturing creative potential during these critical formative years.

The findings of this study signify that creativity is not an innate, fixed trait but a malleable set of skills that can be explicitly and effectively taught. The substantial growth observed in the experimental group over a relatively short six-week period is a powerful indicator that the right pedagogical environment can rapidly accelerate the development of creative thinking. This reflects a fundamental shift from viewing creativity as a gift to understanding it as a developable competency.

The success of the PjBL model is a significant reflection of the power of authentic, student-driven inquiry. The results indicate that when students are given agency, autonomy, and a meaningful problem to solve, they are more likely to engage in the deep, divergent, and iterative thinking that constitutes the creative process. This signifies that the most effective learning occurs not through passive reception of information but through active construction of knowledge.

The multi-dimensional improvement in creativity is also a significant finding. It reflects that PjBL is not a narrow intervention but a holistic pedagogical approach that fosters a wide range of creative cognitive functions simultaneously. The concurrent growth in fluency, flexibility, originality, and elaboration signifies that students were not just taught a single creative technique but were immersed in an environment that cultivated a comprehensive creative mindset.

Ultimately, this research signifies the critical importance of moving educational practice beyond traditional, teacher-centered models. The stark difference in outcomes between the two groups is a clear reflection of the limitations of conventional instruction for developing 21st-century skills. The results serve as an empirical mandate for educational reform, signaling that if we are serious about preparing students for a complex future, we must adopt pedagogical models that are explicitly designed to foster skills like creativity.

The foremost implication of this work is for educational practice and policy. The clear evidence of PjBL's effectiveness provides a strong justification for its wider adoption in elementary schools. This implies that school districts and ministries of education should actively support and incentivize the use of PjBL through curriculum development, the provision of resources, and the alignment of assessment practices to better recognize and value creative outcomes.

For teacher education and professional development, the implications are profound. The findings imply that both pre-service and in-service teacher training programs must be redesigned to equip educators with the skills necessary to effectively design and facilitate PjBL experiences. This includes training in how to craft driving questions, manage long-term projects, assess collaborative work, and shift from the role of an instructor to that of a facilitator and coach.

This research also has significant implications for curriculum design. It suggests that curricula should be structured less around discrete, disconnected facts and more around broad, interdisciplinary themes and authentic problems that can serve as the basis for meaningful projects. This implies a move towards a more integrated and flexible curriculum that allows for the depth of inquiry required by PjBL.

From a broader societal perspective, the implications relate to economic and social innovation. By demonstrating an effective method for cultivating creativity from a young age, this research contributes to the development of a future workforce that is more innovative, adaptable, and better equipped to solve complex challenges. This implies that investing in progressive educational models like PjBL is not just an educational goal but a long-term investment in a nation's human capital and its capacity for innovation.

The superior creative growth in the PjBL group is fundamentally caused by the cognitive demands of the learning model itself. PjBL requires students to engage in the full cycle of the creative process. They must first understand and define an open-ended problem (problem-finding), then generate a wide range of potential solutions (divergent thinking), evaluate those solutions and select a path forward (convergent thinking), and finally develop and refine their chosen idea into a tangible product (elaboration). This entire process is a direct and sustained exercise of creative thinking skills.

The authentic and student-centered nature of PjBL is another key causal factor. By working on a problem that they perceive as meaningful and by having a high degree of autonomy in how they approach it, students are more intrinsically motivated. This heightened engagement leads to greater cognitive investment, persistence in the face of challenges, and a willingness to explore unconventional ideas, all of which are essential for creative work.

The collaborative element of PjBL also causally contributes to the enhancement of creativity. When students work in teams, they are exposed to a wider variety of perspectives and ideas than they would be if working alone. The process of discussion, debate, and synthesizing different viewpoints can lead to more novel and sophisticated solutions. This

social construction of knowledge is a powerful catalyst for creative thought that is largely absent in the individualistic structure of conventional classrooms.

Conventional instruction, in contrast, causally suppresses creative growth by its very structure. Its emphasis on direct instruction, memorization of facts, and the pursuit of a single correct answer actively discourages the risk-taking, ambiguity, and divergent thinking that are the hallmarks of creativity. The learning environment does not provide the opportunity, stimulus, or reward for creative thought, which explains the minimal growth observed in the control group.

Future research should be directed at investigating the long-term effects of PjBL on creativity. A longitudinal study that follows students over several years of sustained PjBL instruction would be invaluable for determining if the observed gains in creativity are maintained and cumulative over time. This would provide stronger evidence for the role of PjBL in fostering creativity as a lasting disposition.

The scope of the research should be expanded to include a wider range of student populations and subject areas. Replicating this study with students from different socioeconomic and cultural backgrounds, as well as in different curricular domains such as the arts, humanities, and mathematics, is essential to establish the generalizability of these findings and to understand how PjBL might be adapted for different contexts.

A mixed-methods approach is recommended for future studies to provide a richer understanding of the creative process within PjBL. Combining quantitative measures of creativity with qualitative methods, such as classroom observations, student interviews, and analysis of student work portfolios, would illuminate the specific mechanisms and classroom dynamics that contribute to creative growth, providing deeper insights for both researchers and practitioners.

Finally, a critical area for future work is the development and validation of effective professional development models for teachers implementing PjBL. Research that identifies the key supports and training experiences that help teachers successfully transition from conventional instruction to a PjBL model would be highly valuable. Such studies are essential for ensuring that PjBL can be implemented effectively and at scale, thereby translating the promise of this research into widespread educational improvement.

CONCLUSION

The most distinct finding of this research is the quantitative confirmation that Project-Based Learning is not just effective, but substantially more effective than conventional instruction for fostering creativity. The study demonstrated a statistically significant and practically large difference in creative growth, with the PjBL group showing a nearly five-fold greater improvement in creativity scores than the control group. This finding moves beyond general claims, providing strong empirical evidence of the magnitude of PjBL's impact on this critical 21st-century skill.

This study's primary contribution is methodological, providing a robust, quasi-experimental framework for evaluating pedagogical impacts on creativity in an authentic elementary school setting. The value lies in the combination of a pre-test/post-test non-equivalent control group design with a validated, multi-dimensional creativity instrument. This approach offers a higher degree of causal inference and empirical rigor than the more common

descriptive or qualitative studies in this area, presenting a clear and replicable method for future educational effectiveness research.

The research is limited by its use of a non-equivalent control group from a single school, which restricts the generalizability of the findings and does not fully control for all potential confounding variables. Future research must therefore be directed at replicating these results with larger, more diverse student populations and employing a true randomized controlled trial design to establish causality more definitively. Furthermore, longitudinal studies are needed to determine if the observed gains in creativity are sustained over the long term.

AUTHOR CONTRIBUTIONS

Look this example below:

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

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