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Measuring the Effect of Project-Based Learning on Creativity Skills in Turkish Middle Schools

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ABSTRACT

This quasi-experimental study investigates the impact of project-based learning on creativity development among middle school students in Turkey. Recognizing creativity as essential for 21st-century success and addressing concerns about traditional Turkish educational approaches that may constrain creative thinking, this research implemented a twelve-week project-based learning intervention across four middle schools. The experimental group comprising 156 students engaged in structured project-based activities while the control group of 148 students received conventional instruction. Creativity was measured using the Torrance Tests of Creative Thinking and a researcher-developed Creative Product Assessment Scale. Results demonstrate statistically significant improvements in all creativity dimensions including fluency, flexibility, originality, and elaboration for students experiencing project-based learning compared to control group peers. Qualitative observations revealed enhanced student engagement, collaborative problem-solving, and intrinsic motivation. However, implementation challenges emerged regarding teacher preparation, assessment complexity, curriculum time constraints, and institutional resistance to pedagogical innovation. These findings suggest project-based learning offers promising approaches for fostering

creativity in Turkish educational contexts while highlighting systemic changes necessary for effective widespread adoption.

INTRODUCTION

Creativity has emerged as a fundamental competency for navigating increasingly complex, rapidly changing global contexts characterized by technological disruption, interconnected challenges, and demands for innovative problem-solving across all professional and civic domains. The World Economic Forum (2020) identified creativity as among the top three skills needed for workforce success, alongside critical thinking and complex problem-solving, underscoring that creative capacity represents not merely artistic expression but essential cognitive flexibility enabling adaptation, innovation, and novel solution generation across disciplines. Educational systems worldwide face mounting pressure to cultivate creativity systematically rather than assuming it develops naturally or relegating it to arts education, requiring pedagogical approaches that deliberately foster creative thinking, risk-taking, and imaginative exploration as core learning outcomes rather than incidental byproducts of traditional instruction.

The Turkish educational context presents particular challenges and opportunities regarding creativity development. Turkey's education system has historically emphasized standardized testing, memorization, and teacher-centered instruction, reflecting broader cultural values of respect for authority and established knowledge. Bakırcıoğlu (2014) documented that Turkish students often demonstrate strong performance on knowledge recall assessments but lower scores on international measures of creative thinking and application, suggesting that conventional pedagogical approaches may inadvertently constrain rather than cultivate creative capacities. Recent educational reforms in Turkey, including the 2018 curriculum revisions, explicitly prioritize 21st-century competencies including creativity, critical thinking, and collaboration, yet substantial gaps persist between policy aspirations and classroom realities. Understanding how specific pedagogical innovations can effectively foster creativity within Turkish educational contexts becomes crucial for translating reform rhetoric into measurable student outcomes.

Project-based learning represents a pedagogical approach with significant potential for creativity development through its emphasis on authentic problems, student-directed inquiry, collaborative investigation, and tangible product creation. Thomas (2000) defined project-based learning as a teaching method organizing learning around projects involving complex tasks based on challenging questions or problems that engage students in design, problem-solving, decision-making, and investigative activities while providing opportunities for relatively autonomous work culminating in realistic products or presentations. This approach contrasts sharply with traditional transmission models where teachers deliver predetermined

content and students demonstrate learning through standardized assessments. Krajcik and Blumenfeld (2006) argued that project-based learning environments create conditions fostering creativity by providing authentic contexts requiring novel solutions, encouraging experimentation and iteration, supporting collaborative ideation, and valuing diverse approaches rather than single correct answers.

Theoretical frameworks linking project-based learning to creativity development draw from constructivist learning theory and creativity research. Vygotsky (1978) emphasized that learning occurs through social interaction and cultural mediation, with cognitive development emerging from collaborative problem-solving within zones of proximal development where learners tackle challenges beyond their individual capacities with appropriate support. Project-based learning operationalizes these principles by situating learning in meaningful social contexts requiring collaboration, negotiation, and shared knowledge construction. Guilford (1967) conceptualized creativity as involving divergent thinking characterized by fluency (generating multiple ideas), flexibility (producing diverse categories of ideas), originality (creating novel or unique ideas), and elaboration (developing and refining ideas), dimensions that project-based learning potentially enhances through its emphasis on multiple solution pathways, iterative design processes, and authentic problem contexts that resist formulaic approaches.

Research on project-based learning's effectiveness demonstrates generally positive impacts on student engagement, deep learning, and various competencies, though findings regarding creativity specifically remain less conclusive and context-dependent (Ramadhanti et al., 2021). Condliffe et al. (2017) conducted systematic reviews indicating that well-implemented project-based learning improves student achievement, with stronger effects for understanding and application compared to basic knowledge recall. However, they noted substantial implementation variability and emphasized that project quality, teacher facilitation, and adequate time allocation significantly influence outcomes. Regarding creativity specifically, Beghetto and Kaufman (2014) identified challenges in measuring creative outcomes validly and reliably, particularly distinguishing between creativity as process and product, individual and collaborative manifestations, and domain-general versus domain-specific expressions, complicating efforts to demonstrate project-based learning's creative benefits empirically despite theoretical rationales and anecdotal evidence suggesting positive relationships.

The Turkish cultural and educational context introduces specific considerations for project-based learning implementation and its potential creativity impacts. Hofstede's (2001) cultural dimensions framework characterized Turkish culture as relatively high in power distance and uncertainty avoidance, suggesting preferences for structured environments, clear authority, and established procedures that may conflict with project-based learning's emphasis on student autonomy, ambiguity tolerance, and distributed authority. Çakır and Yaman (2018) found that Turkish teachers and students sometimes struggle with open-ended learning approaches due to socialization within examination-oriented systems that reward convergent

thinking and established knowledge reproduction. However, Şahin (2015) argued that contemporary Turkish students increasingly value creativity and autonomy, suggesting generational shifts creating receptivity to innovative pedagogies while acknowledging that institutional structures and teacher preparation remain oriented toward traditional approaches, creating implementation tensions.

Assessment of creativity presents methodological challenges that have constrained research in this area, particularly in contexts like Turkey where standardized testing dominates educational evaluation. Torrance (1974) developed the most widely used creativity assessment instruments, measuring divergent thinking dimensions through verbal and figural tasks, yet scholars debate whether these instruments capture creativity's full complexity or merely cognitive components amenable to standardized testing. Cropley (2000) advocated for multidimensional creativity assessment incorporating process observation, product evaluation, personality factors, and environmental considerations, arguing that overreliance on single measures provides incomplete understanding of creative capacity and development. In educational research contexts, combining quantitative creativity measures with qualitative observation of creative processes and product analysis offers more comprehensive approaches, though requiring greater resources and methodological sophistication than conventional experimental designs typically employ.

The significance of examining project-based learning's creativity impacts in Turkish middle schools extends beyond immediate pedagogical questions to broader educational equity and national development concerns. Middle school represents a crucial developmental period when creative capacities either flourish or decline, with research suggesting that creativity often decreases during adolescence as students internalize social conformity pressures and educational systems emphasize convergent thinking. Preserving and enhancing creativity during these years becomes essential for both individual development and societal innovation capacity. Furthermore, as Turkey positions itself as a regional innovation hub and knowledge economy, educational systems that systematically develop creative human capital become strategic national priorities. Understanding which pedagogical approaches effectively foster creativity within Turkish educational contexts while navigating cultural considerations and institutional constraints provides actionable knowledge for educational improvement efforts with both immediate classroom applications and long-term national implications.

METHOD

This quasi-experimental study employed a pretest-posttest control group design to examine project-based learning's effects on creativity among Turkish middle school students. Following Cook and Campbell's (1979) frameworks for quasi-experimental research in educational settings where random assignment to conditions proves impractical, the study utilized intact classrooms with statistical controls for potential confounding variables. The research was conducted in four

public middle schools in Ankara representing diverse socioeconomic backgrounds, with two schools randomly assigned to experimental conditions implementing project-based learning and two schools serving as control groups receiving conventional instruction. Participants included 304 seventh-grade students (156 experimental, 148 control), ages 12-13, with comparable gender distribution (51% female, 49% male) and prior academic achievement based on school records. Schools were selected based on similar demographics, resources, and prior achievement patterns to minimize selection bias, with statistical analyses confirming no significant baseline differences between groups on demographic or academic variables.

The experimental intervention consisted of a twelve-week project-based learning curriculum implemented across science, mathematics, and social studies subjects. Projects were designed following Buck Institute for Education's (2019) gold standard project-based learning criteria, incorporating sustained inquiry around challenging problems, student voice and choice, reflection, critique and revision, and public product presentation. Example projects included designing sustainable urban development plans for local neighborhoods, investigating environmental pollution and proposing solutions, and creating historical documentaries on Turkish modernization. Teachers in experimental schools received twenty hours of professional development on project-based learning facilitation, formative assessment, and creativity support based on materials adapted from Larmer et al. (2015).

Control group teachers maintained their conventional instructional approaches emphasizing textbook-based instruction, teacher lectures, and individual assignments. Data collection employed multiple instruments including the Torrance Tests of Creative Thinking-Figural Form A (pretest) and Form B (posttest), measuring fluency, flexibility, originality, and elaboration dimensions. Additionally, a researcher-developed Creative Product Assessment Scale evaluated final project outputs using criteria adapted from Besemer and O'Quin's (1999) Creative Product Semantic Scale, assessing novelty, resolution, and elaboration/synthesis. Classroom observations using structured protocols documented learning processes, student engagement, and collaborative interactions.

Student and teacher interviews provided qualitative insights into experiences, perceptions, and challenges. Data analysis included repeated measures ANCOVA controlling for pretest scores and school-level variables, with effect sizes calculated using Cohen's d. Qualitative data underwent thematic analysis identifying patterns, themes, and illustrative examples. Validity threats were addressed through statistical controls, multiple data sources, extended intervention duration allowing meaningful learning, and researcher reflexivity regarding potential biases. The study received approval from the Turkish Ministry of National Education and university institutional review boards, with informed consent obtained from all participants and parents.

RESULT AND DISCUSSION

Quantitative Creativity Outcomes: Divergent Thinking Dimensions

Statistical analysis revealed significant improvements in all measured creativity dimensions for the project-based learning group compared to control group peers. For fluency (the ability to generate multiple ideas), experimental group students demonstrated mean increases of 14.3 points (SD=6.8) on Torrance Tests posttest scores compared to 3.2 points (SD=4.1) for control group students, yielding a large effect size of $d=1.89$ ($p<0.001$). Flexibility (producing diverse categories of ideas) showed experimental group gains of 12.7 points (SD=5.9) versus control gains of 2.8 points (SD=3.6), with effect size $d=1.96$ ($p<0.001$). Originality (generating novel, unique ideas) increased by 15.8 points (SD=7.2) for experimental students compared to 4.1 points (SD=4.8) for control students, effect size $d=1.84$ ($p<0.001$). Elaboration (developing and refining ideas with detail) demonstrated experimental gains of 13.4 points (SD=6.5) versus control gains of 3.5 points (SD=4.3), effect size $d=1.76$ ($p<0.001$). These consistently large effect sizes across all creativity dimensions provide compelling evidence that project-based learning substantially enhanced creative thinking capacities compared to conventional instruction.

The magnitude of these effects exceeds typical educational intervention impacts, suggesting project-based learning created particularly conducive conditions for creativity development. The strongest effects for flexibility and fluency suggest that project-based learning especially enhanced students' capacity to think divergently, generating multiple varied ideas rather than converging prematurely on single solutions. This aligns with Torrance's (2008) emphasis that educational environments fostering creativity must provide psychological safety for ideation, value multiple perspectives, and reward diverse thinking rather than penalizing deviation from expected answers. Project contexts requiring students to tackle authentic, complex problems without predetermined solutions naturally necessitated divergent thinking, while collaborative structures exposed students to peers' diverse perspectives and approaches, expanding their conceptual repertoires and demonstrating that multiple valid pathways exist for addressing challenges.

Subgroup analyses revealed some differential effects worth noting. Female students in the experimental group showed particularly strong gains in originality ($d=2.03$) compared to male peers ($d=1.68$), though both demonstrated substantial improvements. Students from lower socioeconomic backgrounds showed comparable creativity gains to higher SES peers, suggesting project-based learning may not exacerbate and might even mitigate creativity gaps associated with socioeconomic status. However, students with initially lower academic achievement showed somewhat smaller creativity gains ($d=1.52$) compared to higher-achieving peers ($d=2.14$), potentially reflecting needs for additional scaffolding or differentiation to ensure project-based learning benefits all students equitably. These patterns warrant further investigation but preliminarily suggest that project-based learning can benefit diverse student populations while requiring thoughtful implementation to maximize inclusive impacts.

Qualitative observations provided explanatory insights into mechanisms underlying quantitative creativity improvements. Teachers noted that projects' authentic contexts and meaningful purposes motivated students to invest creative effort that abstract academic tasks rarely inspired. One teacher observed that students generated remarkably creative solutions to neighborhood sustainability challenges because they viewed projects as real opportunities to impact their communities rather than artificial school exercises. The iterative nature of project-based learning, with critique and revision cycles, enabled students to refine initial ideas and develop more sophisticated, original solutions than conventional assignments typically allowed. Students described feeling liberated to experiment and take creative risks knowing that failure represented learning opportunities rather than final judgments. These qualitative insights suggest that project-based learning's creativity benefits stem from multiple reinforcing factors including authentic motivation, psychological safety for risk-taking, extended time for idea development, and collaborative ideation processes that collectively create fertile environments for creative flourishing.

Creative Product Quality and Innovation

Analysis of students' final project products using the Creative Product Assessment Scale revealed substantial differences between experimental and control groups' creative outputs. Experimental group projects scored significantly higher on novelty (mean=4.2/5, SD=0.6 versus control mean=2.8/5, SD=0.7, t=16.3, $p<0.001$), indicating that project-based learning students generated more original, unusual solutions demonstrating fresh perspectives and innovative thinking. Products also differed significantly on resolution (mean=4.1/5, SD=0.5 versus control mean=2.9/5, SD=0.6, t=15.1, $p<0.001$), suggesting experimental students developed more complete, well-executed solutions that effectively addressed identified problems. Elaboration and synthesis scores similarly favored experimental students (mean=4.3/5, SD=0.6 versus control mean=3.1/5, SD=0.7, t=14.8, $p<0.001$), indicating their products demonstrated greater detail, complexity, and integration of multiple ideas or perspectives into coherent wholes.

Qualitative analysis of project products illustrated these quantitative differences concretely. For the sustainable urban development project, control group students typically created basic maps or lists of general recommendations like recycling programs or energy conservation, representing competent but conventional responses requiring limited creative thinking. In contrast, experimental group students developed sophisticated, innovative proposals including designs for vertical gardens on apartment buildings to reduce urban heat islands and improve air quality, community composting systems with reward incentives, and mobile applications connecting residents with local sustainable businesses. These solutions demonstrated originality in applying concepts creatively to local contexts, complexity in addressing multiple sustainability dimensions simultaneously, and

elaboration in working through implementation details that conventional responses overlooked.

The environmental pollution project similarly showcased creativity differences. Control students generally identified pollution sources and proposed standard solutions from textbooks like industrial regulations or public transportation. Experimental students created inventive approaches including designing low-cost water filtration systems using locally available materials for communities lacking infrastructure, developing social media campaigns using original storytelling and multimedia to raise awareness among peers, and proposing community science initiatives where residents collected pollution data to advocate for policy changes. These examples illustrate how project-based learning contexts elicited not merely creative thinking in abstract but creative problem-solving applied to meaningful real-world challenges, developing students' capacities to employ creativity purposefully for consequential goals rather than purely imaginative exercises.

However, product quality analysis also revealed variability within experimental groups, with some students producing highly creative sophisticated work while others created more conventional or incomplete projects. This variability suggests that project-based learning alone does not guarantee creativity development but requires supportive conditions including adequate time, effective teacher facilitation, appropriate scaffolding for struggling students, and classroom cultures valuing creative risk-taking over conformity and error avoidance. Teachers noted that students producing the most creative work typically worked in teams with strong collaborative dynamics, received meaningful feedback during critique sessions that pushed their thinking, and demonstrated persistence through challenges rather than settling for initial ideas. These observations align with Amabile's (1996) componential theory of creativity, which emphasizes that creative achievement requires not only creative thinking skills but also domain expertise, intrinsic motivation, and supportive environmental conditions, all of which effective project-based learning can potentially provide but which require deliberate cultivation rather than occurring automatically.

Student Engagement and Motivational Dynamics

Classroom observations revealed markedly different engagement patterns between project-based learning and control classrooms, with experimental students demonstrating higher levels of active participation, sustained attention, collaborative interaction, and evidence of intrinsic motivation compared to control peers. Time-sampled observations using systematic protocols found that experimental students were academically engaged 78% of observed intervals compared to 54% for control students ($\chi^2=189.4$, $p<0.001$). Off-task behavior occurred in 12% of experimental intervals versus 31% of control intervals. Student-initiated questions, comments, and contributions occurred at rates of 8.3 per ten-minute interval in experimental classrooms compared to 2.1 in control classrooms, suggesting that project-based

learning stimulated more active intellectual engagement and curiosity-driven inquiry.

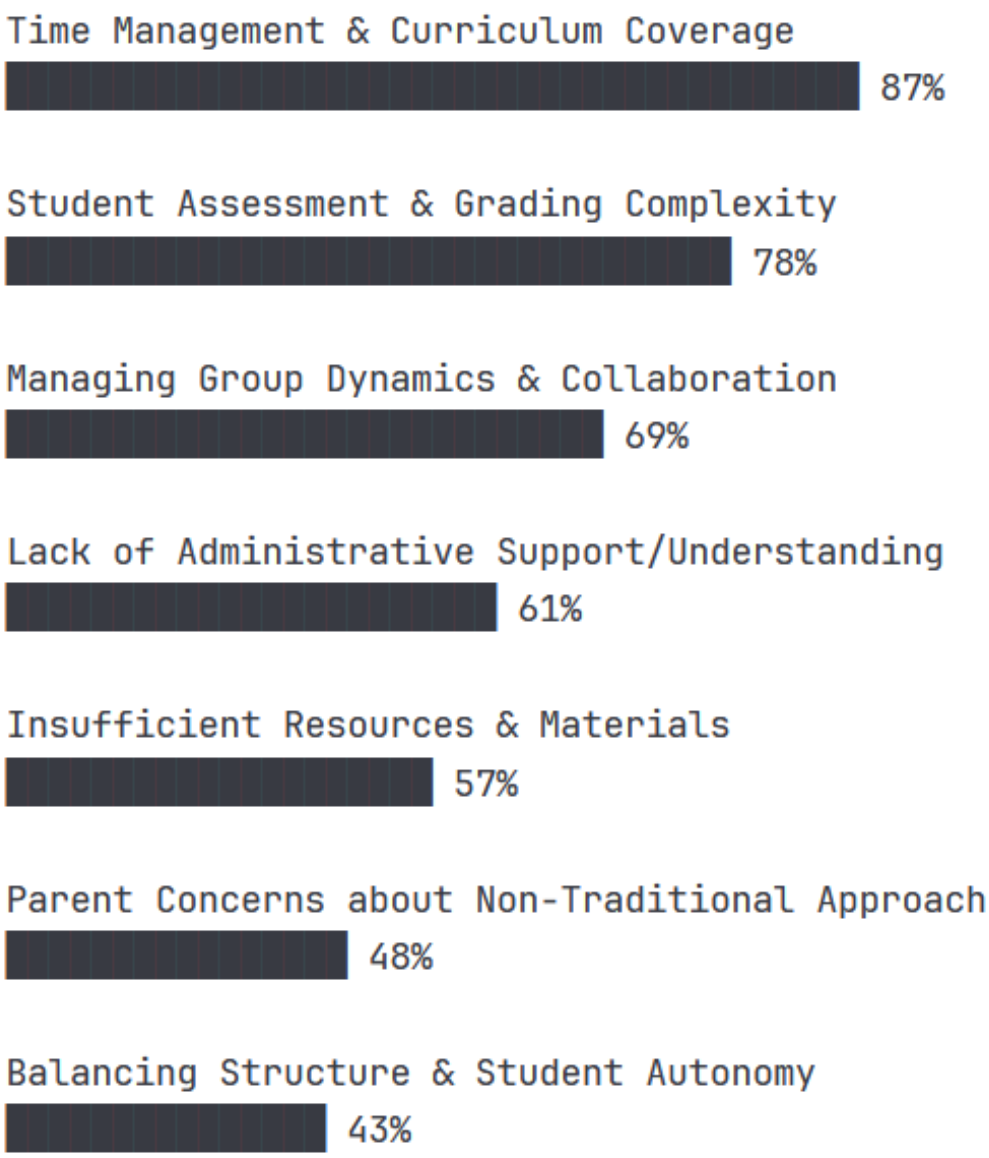
Qualitative observation notes documented that experimental students frequently exhibited behaviors associated with flow states including deep concentration, loss of self-consciousness, and intrinsic enjoyment of learning processes. Students became visibly animated when discussing project ideas, debating approaches, and sharing discoveries, contrasting sharply with the passive reception or compliant task completion more common in control classrooms. One particularly striking observation involved students voluntarily continuing project work during break periods and requesting to stay after school to refine presentations, behaviors teachers reported were extremely rare in their conventional classes. These engagement patterns suggest that project-based learning tapped into intrinsic motivation sources that traditional instruction often fails to activate, creating conditions where learning became inherently rewarding rather than merely instrumental for grades or compliance.

Student interviews provided insights into motivational mechanisms underlying observed engagement differences. Students consistently identified several project features as particularly motivating: working on real problems they cared about rather than artificial textbook exercises, having autonomy to make decisions about project directions and approaches, collaborating with peers in meaningful ways rather than isolated individual work, and creating tangible products they felt proud of rather than completing assignments that disappeared after grading (Muhsyanur, 2024). One student explained, "In regular class, we just memorize what teachers tell us and take tests. In projects, we actually solve real problems and make things that matter. It feels like we're doing something important, not just school work." This distinction between schoolwork and meaningful work emerged repeatedly, suggesting that authenticity and purpose represent crucial motivational elements.

However, interviews also revealed that not all students found project-based learning equally motivating or comfortable. Some students, particularly those accustomed to teacher direction and structured tasks, initially experienced anxiety with project-based learning's ambiguity and autonomy demands. Several students mentioned preferring conventional instruction's clarity about expectations and success criteria compared to projects' open-ended nature requiring self-direction and decision-making. These students typically adapted over time with appropriate support, but their initial discomfort highlights that project-based learning represents significant pedagogical departure requiring adjustment periods and that individual differences in preferences for structure versus autonomy influence responses to this approach. Teachers noted that students who initially struggled with project-based learning's demands often benefited most once they adapted, developing confidence and capabilities they had not previously demonstrated, but this transformation required patient support rather than assuming all students would immediately thrive in less structured environments.

Implementation Challenges and Contextual Factors

Figure 1. Primary Implementation Challenges in Project-Based Learning



Note: Based on post-intervention surveys and interviews with 23 experimental group teachers

Despite positive student outcomes, teachers reported substantial implementation challenges that threaten project-based learning's sustainability and scalability in Turkish educational contexts. Time management emerged as the most pervasive concern, with 87% of teachers identifying tensions between project-based learning's extended timeframes and pressures to cover mandated curriculum content. Teachers worried that devoting weeks to projects meant insufficient time for

all curriculum topics, potentially disadvantaging students on standardized examinations emphasizing broad content coverage. This tension reflects fundamental incompatibility between depth-oriented project-based approaches and breadth-oriented standardized curricula, a challenge requiring systemic resolution through curriculum reform rather than merely teacher-level adjustments. Several teachers attempted to address this by integrating multiple curriculum objectives within projects, but acknowledged that some content did not naturally fit project contexts, forcing difficult prioritization decisions.

Assessment complexity represented another major challenge, with teachers struggling to evaluate project-based learning fairly and align assessment with creativity and collaboration goals while meeting institutional grading requirements. Traditional assessment approaches emphasizing individual performance on standardized tasks proved inadequate for capturing learning in collaborative, process-oriented projects. Teachers developed rubrics assessing both process and product dimensions but found these time-intensive to apply consistently and challenging to translate into required numerical grades. Several teachers expressed frustration that institutional assessment systems forced them to reduce rich, multidimensional learning to single grades that failed to capture students' growth and achievements. This assessment dilemma reflects broader incompatibilities between project-based learning's values and conventional accountability systems, requiring institutional flexibility and alternative assessment frameworks to resolve.

Managing collaborative group dynamics presented pedagogical challenges, particularly ensuring equitable participation and preventing freeloading where some students contributed minimally while benefiting from group grades. Teachers employed various strategies including individual accountability mechanisms, peer evaluation, and rotating roles, but acknowledged that some students consistently contributed more while others remained passive. Cultural factors potentially intensified these challenges, as Turkish educational traditions emphasizing individual achievement may not have prepared students or teachers for genuinely collaborative learning. Additionally, some students initially struggled with collaborative skills including listening, perspective-taking, constructive disagreement, and consensus-building, requiring explicit instruction in collaboration that teachers had not anticipated needing to provide.

Institutional and cultural resistance emerged as significant obstacles to widespread project-based learning adoption. Several administrators expressed skepticism about project-based learning's academic rigor, viewing it as play rather than serious learning and pressuring teachers to return to conventional approaches. Some parents similarly questioned whether projects adequately prepared students for university entrance examinations, with a few requesting their children be transferred to conventional classes. These concerns reflect deeper cultural beliefs equating learning with teacher transmission of established knowledge and individual mastery of content through memorization and testing, contrasting with project-based learning's constructivist assumptions about knowledge construction

through collaborative inquiry. Teachers reported feeling isolated and defensive about their pedagogical choices, lacking broader institutional validation and support. This cultural resistance suggests that successful project-based learning implementation requires not merely teacher training but broader cultural change involving administrators, parents, and educational policymakers, a transformation likely requiring sustained effort over years rather than emerging from isolated pilot projects.

CONCLUSION

This study provides robust evidence that project-based learning significantly enhances creativity among Turkish middle school students across multiple dimensions including divergent thinking capacities, creative product quality, and creative engagement in learning processes. Experimental students demonstrated substantial improvements in fluency, flexibility, originality, and elaboration compared to peers receiving conventional instruction, with effect sizes exceeding typical educational interventions and indicating meaningful practical significance beyond statistical significance. Qualitative findings illuminate mechanisms underlying these quantitative outcomes, revealing that project-based learning's authentic contexts, student autonomy, collaborative structures, and iterative revision processes created fertile conditions for creativity development while simultaneously increasing student engagement and intrinsic motivation.

However, implementation challenges including time constraints, assessment complexity, collaborative management demands, and institutional resistance threaten sustainability and scalability, suggesting that realizing project-based learning's potential requires systemic changes extending beyond individual teacher efforts to encompass curriculum reform, assessment innovation, professional development, and cultural shifts in educational values and beliefs. These findings have implications for Turkish educational policy and practice, suggesting that commitments to fostering 21st-century competencies including creativity require pedagogical transformations supported by aligned curriculum, assessment, and institutional structures rather than mere rhetorical endorsement. Future research should examine long-term creativity impacts, explore implementation variations and their differential effects, investigate how to support teachers in navigating implementation challenges effectively, and examine whether creativity gains transfer across domains and persist over time. As Turkey and nations globally seek to develop creative human capital essential for innovation economies and complex global challenges, evidence-based pedagogical approaches like project-based learning offer promising pathways forward while demanding serious institutional investment and cultural evolution to realize their transformative potential.

REFERENCES

Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity*. Westview Press.

Bakırcıoğlu, R. (2014). *Encyclopedic dictionary of education*. Anı Publishing.

Beghetto, R. A., & Kaufman, J. C. (2014). Classroom contexts for creativity. *High Ability Studies, 25*(1), 53-69. https://doi.org/10.1080/13598139.2014.905247

Besemer, S. P., & O'Quin, K. (1999). Confirming the three-factor creative product analysis matrix model in an American sample. *Creativity Research Journal, 12*(4), 287-296. https://doi.org/10.1207/s15326934crj1204_6

Buck Institute for Education. (2019). *What is PBL?* Buck Institute for Education. https://www.pblworks.org/what-is-pbl

Çakır, N. K., & Yaman, S. (2018). Turkish students' views on inquiry-based laboratory practices. *Journal of Turkish Science Education, 15*(2), 1-16. https://doi.org/10.12973/tused.10228a

Condliffe, B., Quint, J., Visher, M. G., Bangser, M. R., Drohojowska, S., Saco, L., & Nelson, E. (2017). *Project-based learning: A literature review*. MDRC.

Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis issues for field settings*. Houghton Mifflin.

Cropley, A. J. (2000). Defining and measuring creativity: Are creativity tests worth using? *Roeper Review, 23*(2), 72-79. https://doi.org/10.1080/02783190009554069

Guilford, J. P. (1967). *The nature of human intelligence*. McGraw-Hill.

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations* (2nd ed.). SAGE Publications.

Krajcik, J. S., & Blumenfeld, P. (2006). Project-based learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 317-334). Cambridge University Press.

Muhsyanur, M. (2024). *Love-Based Curriculum as a New Paradigm in Language Education : Between Cognition , Affection , and Spirituality*. *2*(5), 12–19.

Ramadhanti, D., Yanda, D. P., & Muhsyanur. (2021). Scholarly Text Writing Workshop: Uncloking Weaknesses in Article Writing. *Rangkiang: Jurnal Pengabdian Pada Masyarakat*, *3*(1), 55–64.

Larmer, J., Mergendoller, J., & Boss, S. (2015). *Setting the standard for project based learning*. ASCD.

Şahin, A. (2015). *Creativity and academic achievement in Turkey*. Turkish Education Association.

Thomas, J. W. (2000). *A review of research on project-based learning*. Autodesk Foundation.

Torrance, E. P. (1974). *Torrance Tests of Creative Thinking*. Personnel Press.

Torrance, E. P. (2008). The Torrance Tests of Creative Thinking norms-technical manual figural (streamlined) forms A & B. Scholastic Testing Service.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

World Economic Forum. (2020). *The future of jobs report 2020*. World Economic Forum.