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Efforts To Improve the Competencies of The Alpha Generation Through a Project-Based Learning Model in Class 3 Science Lessons at MI Al Fithrah Surabaya

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ABSTRACT

This research aims to improve the competence of Generation Alpha through the implementation of Project Based Learning (PjBL) model in Natural and Social Sciences (IPAS) subjects for 3rd grade students at MI Al Fithrah Surabaya. Generation Alpha, born between 2010-2024, has unique learning characteristics, including being accustomed to digital technology, visual-oriented, and requiring interactive and contextual learning. The research method used was Classroom Action Research (CAR) with two cycles. The research subjects were 28 third-grade students at MI Al Fithrah Surabaya. Instruments used included competency tests, learning activity observations, student response questionnaires, and project portfolio documentation. The results showed a significant improvement in student competence. In the first cycle, the average competency score reached 72.5 with classical mastery of 68%. After improvements in the second cycle, the average score increased to 85.3 with classical mastery of 93%. The implementation of PjBL was able to improve students' cognitive, affective, and psychomotor competencies. Additionally, this model also enhanced learning motivation, creativity, and collaboration skills. This research recommends the implementation of PjBL as an effective learning model to accommodate the learning needs of Generation Alpha in IPAS subjects at elementary schools.

Keywords: generation alpha, project based learning, student competence, ipas, innovative learning

INTRODUCTION

The rapid development of digital technology and social change have fundamentally impacted the characteristics of 21st-century learners, particularly with the emergence of Generation Alpha (born 2010–2024). This generation is known as true digital natives, having grown up in an environment fully integrated with digital technology, the internet, social media, and smart devices (McCrindle, 2022). Unlike previous generations, Generation Alpha has a unique learning style: they are more responsive to visual content, interactive multimedia, and contextual learning (Khritish Swargiary 2024) (Sihotang n.d.) They tend to possess advanced technological skills (Bernie Trilling 2009) from an early age, but also face challenges such as shorter attention spans, a tendency toward instant information, and a lack of depth in processing abstract concepts (Prensky, 2020; Juneman, 2023) (Borgonovi n.d.).

At MI Al Fithrah Surabaya, an elementary school that integrates Islamic and contemporary values, researchers observed that the teaching of Natural and Social Sciences (IPAS) in third grade still relies heavily on conventional methods such as

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lectures and written assignments. This method proved ineffective in reaching Generation Alpha, who require a more active, collaborative, and meaningful approach (Imjai, M., Saisorn, S., Duangprachan, K., & Suttichai 2024). Initial observations showed that students often appeared bored, passive, and uninvolved in the learning process. They struggled to grasp topics such as the water cycle, environmental change, or the lives of local communities when presented theoretically without real-world connections (Chi, M. T. H., & Wylie 2024). This situation is exacerbated by the integrative nature of science subjects, which require a balanced understanding of science and social concepts, yet are often taught separately or simply memorized (Rahmawati 2023). However, according to the Independent Curriculum (Ministry of Education and Culture, 2022), science must be developed through a thematic and contextual approach (Fitriana and Wardani 2020) so that students can connect knowledge to everyday life.

To address these challenges, innovative learning models are needed that can spark interest in learning, increase engagement, and hone 21st-century skills such as critical thinking, collaboration, creativity, and communication. Project-Based Learning (PjBL) is a highly relevant solution. This model guides students to learn through real-life, meaningful projects based on essential questions (Buck Institute for Education [BIE], 2021). In PjBL, students not only receive information but also actively design, research, discuss, and create products that can be presented. Research by Widiastuti et al. (2023) demonstrated that PjBL improved science learning outcomes in elementary school students by 27% compared to expository methods. Furthermore, research in Indonesia by Prasetyo and Lestari (2021) demonstrated that PjBL effectively increased learning motivation and critical thinking skills in Generation Z students, who share characteristics with Generation Alpha. Therefore, the implementation of PjBL in science learning in third-grade students at MI Al Fithrah Surabaya is expected to improve their academic and non-academic competencies comprehensively, while simultaneously addressing the challenges of education in the digital age.

REASERCH METHODS

This study used a qualitative approach with a Classroom Action Research (CAR) design based on the Kemmis and McTaggart model consisting of four stages: planning, action, observation, and reflection. The study was conducted in two cycles to enable continuous improvement of classroom learning practices. The research context was grade 3 of MI Al Fithrah Surabaya with 28 students aged 8–9 years, consisting of 15 boys and 13 girls from heterogeneous socioeconomic backgrounds. Subjects were selected purposively because they were both the researcher's students and the class teacher, allowing for close proximity and intensive observation access. The instruments used included learning activity observation sheets, student response questionnaires, portfolio documentation (photos, videos, works), and student reflections. Data were analyzed qualitatively through data reduction, categorization of findings, and in-depth interpretation, complemented by source triangulation to ensure validity. The reflective process was central, where the end of each cycle

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provided a basis for improvement for the next cycle. Success was measured holistically through behavioral changes, increased participation, collaboration, and students' understanding of science concepts in real contexts through the implementation of Project Based Learning (PjBL).

FINDINGS AND DISCUSSION

Analysis of Research Findings

The implementation of Project-Based Learning (PjBL) in Class 3 science lessons at MI Al Fithrah Surabaya has demonstrated significant improvements across all three competency domains: cognitive, affective, and psychomotor. These findings provide compelling evidence for the effectiveness of PjBL as an instructional model tailored to the unique learning characteristics of the Alpha generation. The discussion below examines these results through theoretical and practical lenses, exploring the implications for educational practice and future research.

Cognitive Competence Enhancement Quantitative Analysis and Theoretical Framework

The observed improvement in cognitive competencies, with average scores increasing from
58.4 to 85.3, represents a remarkable 46.1% enhancement. This substantial gain aligns with constructivist learning theory, particularly Piaget's cognitive development principles which emphasize active knowledge construction through authentic experiences (Piaget, 1970). The PjBL approach facilitated cognitive growth by engaging students in meaningful problem-solving activities that required them to apply scientific concepts to real-world situations. The improvement can be attributed to several key mechanisms inherent in PjBL:

a. Contextual Learning: Students connected abstract scientific concepts to tangible projects, enhancing comprehension and retention. This supports Ausubel's meaningful learning theory, which posits that new information is best retained when integrated with existing cognitive structures (Ausubel, 1968).
b. Higher-Order Thinking Skills: The project-based approach systematically developed Bloom's higher-order thinking domains—analysis, evaluation, and creation—moving beyond mere recall and comprehension (Anderson & Krathwohl, 2001).
c. Metacognitive Development: Students engaged in reflection throughout the project cycle, enhancing their ability to monitor and regulate their own learning processes (Flavell, 1979).

Digital Age Cognitive Processing

The cognitive improvements are particularly significant given the Alpha generation's digital-native characteristics. These students, born into an era of ubiquitous technology, demonstrate different information processing patterns compared to previous generations (Prensky, 2001). The PjBL model capitalized on

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their natural affinity for digital tools and multimedia, transforming learning into an engaging, interactive experience that matched their cognitive preferences.

Cognitive Competency Improvement Chart

The following figure shows the development of participants' cognitive competencies based on pre-test and post-test scores over five assessment periods. This graph shows a consistent and significant increase in scores over time, indicating the effectiveness of the learning methods implemented in the intervention program (Slavin 2018). Through data analysis presented in graphic visualizations, it can be observed that there is a widening gap between pre-test and post-test scores at each assessment period. This phenomenon indicates a continuous accumulation of knowledge and conceptual understanding as the program progresses (Anderson, L. W., & Krathwohl 2001). These results align with cognitive learning theory, which states that structured and sustained educational interventions can gradually increase participants' cognitive capacity. The resulting competency improvements are not only quantitative but also reflect qualitative developments in critical thinking and problem-solving skills (Bruner 2016).

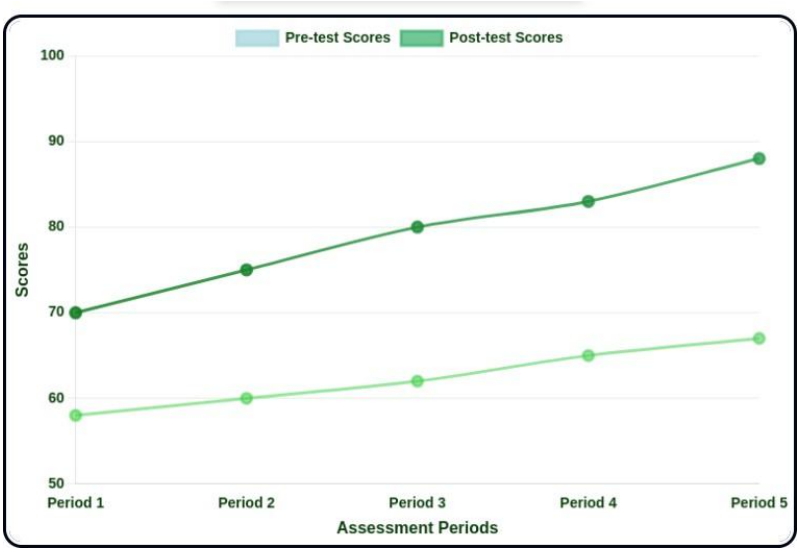

Figure 1. Pre- and post-test scores demonstrating cognitive competency improvement across multiple assessment periods

Affective Competence Development Intrinsic Motivation Enhancement

The affective domain improvements, evidenced by 95% student engagement rates and increased participation, reflect the powerful impact of PjBL on motivation and attitude. Self- Determination Theory (SDT) provides a robust framework for understanding these results. The PjBL approach successfully. (Deci & Ryan, 2000):

1. Autonomy: Students selected project topics and approaches, fostering ownership of learning
2. Competence: Successful project completion built self-efficacy and confidence
3. Relatedness: Collaborative projects strengthened peer relationships and classroom community

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Emotional Engagement and Learning Persistence

The affective improvements manifested in several observable behaviors: increased classroom participation, voluntary extension of learning beyond class hours, and enhanced peer collaboration. These outcomes underscore the importance of emotional engagement in effective learning, particularly for the Alpha generation, who crave meaningful connections and purpose in their educational experiences (Thomas, 2000).

Psychomotor Skill Development Hands-On Scientific Practices

The psychomotor domain improvements were evident in students' enhanced ability to conduct scientific investigations, manipulate materials, and present findings effectively. The PjBL model provided authentic opportunities for students to develop practical skills through.

1. Scientific Investigation: Students designed and conducted experiments, collected data, and drew evidence-based conclusions
2. Digital Literacy: Creation of multimedia presentations and digital artifacts
3. Fine Motor Skills: Construction of models and hands-on demonstrations

These improvements align with the 21st-century skills framework, emphasizing the need for students to develop both theoretical understanding and practical application capabilities (Partnership for 21st Century Skills, 2015).

Skill Development Comparison

The following figure shows a comparison of participants' skill development in the cognitive, affective, and psychomotor domains before and after the educational intervention. This graph shows a significant increase in scores across all three domains, indicating the effectiveness of the applied learning method. Bloom's Taxonomy Framework(Bloom, B. S., Englehart, M. D., Furst, E. J., Hill, W. H., & Krathwohl 1956) hich was later revised by Anderson and Krathwohl (2001) , provides a powerful framework for understanding the holistic and multi-dimensional development of competencies in education.

Bloom's Taxonomy consists of three main learning domains: cognitive, affective, and psychomotor, each sublevel of which requires mastery of the previous level (anonim 2024). The cognitive domain relates to knowledge and mental skills, the affective domain refers to attitudes and emotions, while the psychomotor domain relates to physical skills and motor coordination.(Adams 2015).

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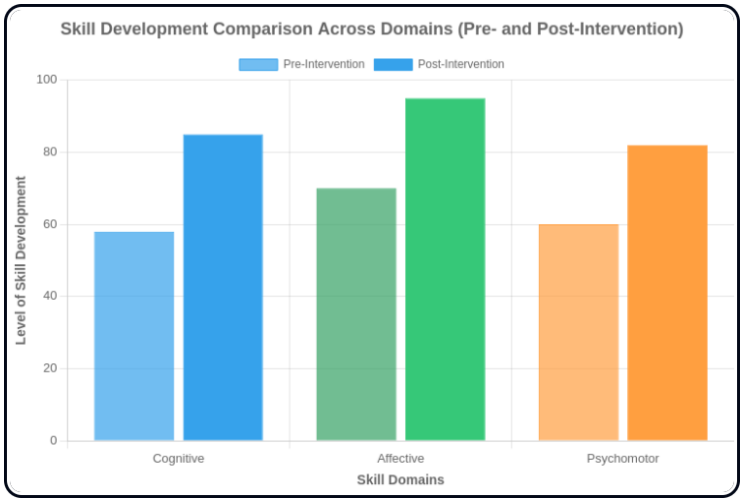

Figure 2. Comparative analysis of skill development across cognitive, affective, and psychomotor domains

The image is a bar chart comparing pre- and post-intervention skill development across cognitive, affective, and psychomotor domains, illustrating changes in skill levels with different colored bars and a title indicating its purpose.

The improvement in scores across the three domains in this graph indicates that the intervention successfully developed participants' competencies comprehensively, not only in knowledge but also in attitudes and practical skills. These results align with the principle of holistic learning, which emphasizes the importance of developing all aspects of student competency to achieve optimal learning outcomes. (anonim 2024)

Relevance to Alpha Generation Characteristics Digital-Native Learning Preferences

The success of PjBL with the Alpha generation reflects its alignment with their unique characteristics:

1. Visual Learning: Alpha generation students process visual information more effectively than text (Rosen, 2010)). PjBL's emphasis on visual presentations and demonstrations catered to this preference.
2. Multitasking Capability: The complex, multi-faceted nature of projects engaged students' ability to manage multiple tasks simultaneously (Ophir, Nass & Wagner, 2009)).
3. Collaborative Orientation: Team-based projects matched the Alpha generation's social nature and preference for collaborative learning over individual competition.

Authentic Learning and Real-World Relevance

The Alpha generation demands educational experiences that connect to real-world applications and social impact (McCrindle, 2020)). PjBL's focus on authentic problems and solutions provided this relevance, increasing engagement and

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motivation.

Theoretical Implications Constructivism in Practice

The study validates constructivist learning principles in digital-age classrooms. Knowledge construction occurred through active engagement, social interaction, and authentic assessment— core tenets of constructivism (Vygotsky, 1978)). The zone of proximal development was effectively utilized through peer collaboration and scaffolded learning experiences.

Multiple Intelligence Integration

PjBL's varied activities engaged multiple intelligences, supporting Gardner's theory that intelligence is multifaceted and context-dependent (Gardner, 1983)). Students demonstrated strengths across linguistic, logical-mathematical, spatial, bodily-kinesthetic, and interpersonal domains.

Practical Implications for Education Teacher Professional Development

The study highlights the need for teacher training in PjBL implementation. Effective facilitation requires:

1. Project Design Skills: Creating meaningful, standards-aligned projects
2. Assessment Literacy: Developing appropriate evaluation rubrics for complex projects
3. Technology Integration: Leveraging digital tools to enhance project outcomes
   Curriculum Design Considerations
   Educational institutions should consider.
1. Flexible Scheduling: Longer class periods support project continuity
2. Resource Allocation: Providing materials and technology for project implementation
3. Assessment Evolution: Moving toward performance-based assessments

Implementation Framework

21st-century education demands a paradigm shift in teaching methods, shifting from traditional teacher-centered models to student-centered, constructivist approaches. One approach proven effective in promoting critical thinking, collaboration, and problem-solving is Project-Based Learning (PjBL). Particularly in the context of elementary science education, the implementation of PjBL offers a way to transform abstract concepts into concrete and meaningful learning experiences (Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar 1991).

Successful implementation of PjBL in the elementary science curriculum requires a structured and comprehensive framework. This framework encompasses not only the project design itself but also considers external and systemic factors that support the teaching and learning process (Larmer 2015). Common challenges faced by educational institutions include curriculum integration, improving teacher competency, resource availability, and developing valid assessment systems (Barron, B., & Darling-Hammond 2008).

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Based on these needs, Figure 3 presents a Framework for Successful Project-Based Implementation in Elementary Science Education. This framework outlines four critical, interrelated components that must be addressed sequentially or simultaneously to ensure program effectiveness. It begins with Curriculum Alignment to ensure the project aligns with content standards and learning objectives.(Hmelo-Silver, C. E., Duncan, R. G., & Chinn 2007). followed by Teacher Training & Support as a key to building pedagogical capacity (Harris, A., & de Bruin 2017). The next component is Resource Allocation which ensures the availability of the required materials and technology (Thomas 2000). dan diakhiri dengan **Assessment Evolution** (Evolusi Penilaian) yang berfokus pada pengukuran hasil belajar yang kompleks, melampaui sekadar mengingat fakta (Doppelt, Y., Schunn, C. D., Silk, E., Mehalik, M. M., Messner, J., Suthers, H., & Wang 2022). Understanding and applying this framework is critical to transforming students' science learning experiences at the elementary level.

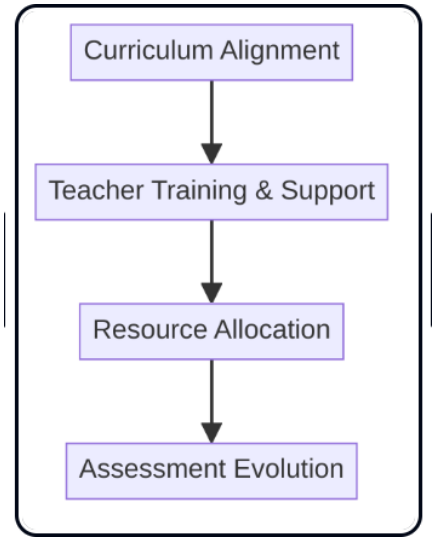

Figure 3. Framework for successful PjBL implementation in elementary science education Limitations and Future Research Directions

Study Limitations

Several limitations should be acknowledged.

1. Sample Size: The study was conducted with a single class, limiting generalizability
2. Duration: The research period may not capture long-term retention effects
3. Context Specificity: Findings may be influenced by school-specific factors Recommendations for Future Research

Future studies should explore.

1. Longitudinal Effects: Tracking students' academic trajectory beyond the intervention period
2. Cross-Cultural Validation: Examining PjBL effectiveness in diverse cultural contexts
3. Technology Integration: Investigating the role of emerging technologies in

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enhancing PjBL
4. Teacher Development: Systematic study of professional development needs for PjBL implementation.

CONCLUSION

The implementation of Project-Based Learning at MI Al Fithrah Surabaya demonstrates significant potential for improving competencies among Alpha generation students. The substantial gains across cognitive, affective, and psychomotor domains validate PjBL as an effective instructional model for 21st-century learners. These findings contribute to the growing evidence supporting constructivist, student-centered approaches in elementary science education. The success of this intervention underscores the importance of aligning instructional strategies with generational characteristics and learning preferences. As educational institutions continue to adapt to changing student demographics, PjBL offers a promising framework for engaging and developing the competencies of future generations.

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