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TACTICAL PROJECT-BASED LEARNING (T-PJBL) MODEL: A PEDAGOGICAL ENGINEERING TO ENHANCE CADET LEADERSHIP AT THE MILITARY ACADEMY

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ABSTRACT

Contemporary military education positions high discipline as an operational foundation that not only ensures order but also serves as a crucial determinant of cadets' holistic academic achievement. This study aims to formulate an adaptive PjBL model, termed Tactical Project-Based Learning (T-PjBL), to enhance Cadet leadership competence. Employing an Explanatory Sequential Mixed Method, this study found that the low influence of standard PjBL on leadership (R Square 10.5%) was caused by external variables such as physiological fatigue and command culture rigidity. Through the integration of quantitative and qualitative data, the T-PjBL model was developed with five main phases: Mission Briefing, Tactical Planning, Command Timeline, Supervised Maneuver, and After-Action Review (AAR). The results indicate that pedagogical engineering through the T-PjBL model can synchronize academic activities with regimented service rhythms and mitigate Cadets' cognitive barriers. The study concludes that learning innovation in military environments requires contextual adaptation that respects doctrine and the learners' physical conditions.

Keywords: Tactical Project; Based Learning; Military Leadership; Cognitive Load; Officer Education.

INTRODUCTION

Contemporary military education positions high discipline as an operational foundation that not only ensures order but also serves as a crucial determinant of cadets' holistic academic achievement (Bucăţa & Andrei, 2024). As an institution for officer production, the Military Academy systematically integrates physical and professional training to enhance combat readiness and academic success (Gnydiuk et al., 2024). The fundamental challenge within this ecosystem is the cultivation of future leaders who are both competent and adaptive within a rigid hierarchical structure (Ktitorov & Puhach, 2024; Коба & Koba, 2024). In response to these dynamics, innovative methods such as Massive Open Online Courses (MOOC) and the integration of Information and Communication Technology (ICT) have been adopted to expand access to quality learning resources (Zhao, 2020).

The transformation of the Military Academy curriculum from the 2021 conventional model toward the 2024 Project-Based Learning (PjBL) curriculum represents a strategic step to sharpen critical thinking and decision-making skills under pressure. PjBL is viewed as an instrument capable of aligning theory with direct field implementation, consistent with the demands of modern operational environments (Military Academy Curriculum, 2025). However, the effectiveness of this active method is often hindered by the cognitive load of cadets caused by the intensity of physical training that depletes cognitive energy (Sweller, 1988; Gnydiuk et al., 2024). Furthermore, there is a potential conflict between the principles of autonomous learning and military discipline standards, which can trigger psychological unreadiness for innovation (Bucăţa & Andrei, 2024; Lokyan, Baghdasaryan, & Hovhannisyan, 2025; Osiel, 2017; Tornero-Aguilera et al., 2024).

Evaluating academic achievement has become imperative to map the institution's success in achieving strategic military education goals (Stufflebeam, 2012; Ktitorov & Puhach, 2024). Preliminary research indicates a functional gap where autonomy in PjBL often lacks synchrony with regimental duties, resulting in a low contribution of learning to the development of leadership competence (Boe, 2015; Meerits & Kivipõld, 2020). Therefore,

pedagogical engineering is required to synchronize physical training, integrity values, and personal resilience within a coherent learning framework (Gnydiuk et al., 2024; Коба & Koba, 2024). The need for a more contextual learning model serves as the primary basis for efforts to enhance the quality of officer graduates.

This study aims to formulate the Tactical Project-Based Learning (T-PjBL) model as an adaptation of PjBL within the Indonesian military ecosystem. The novelty of this research lies in the integration of five tactical phases designed to mitigate the physiological and cultural barriers of cadets to achieve adaptive leadership competence targets (Santos et al., 2019; Bucăţa & Andrei, 2024). Through an Explanatory Sequential Mixed Method design, this article explores the effectiveness of this learning model engineering in bridging the demands of the 2024 curriculum with the operational realities at the Military Academy.

The purpose of this study is to formulate the Tactical Project-Based Learning (T-PjBL) model as an adaptation of PjBL within the Indonesian military ecosystem. The specific objectives are to: (1) measure the contribution of standard PjBL implementation to cadet leadership competence; (2) identify the physiological and cultural barriers that limit PjBL effectiveness in military education; (3) formulate the T-PjBL model with five tactical phases designed to mitigate these barriers; and (4) evaluate the potential of the T-PjBL model to enhance cadet leadership competence. The contribution of this research is threefold: (1) it provides an empirically-grounded adaptive learning model for military education contexts; (2) it extends Cognitive Load Theory by identifying physiological fatigue as a unique source of extraneous load in military settings; and (3) it demonstrates how constructivist innovation can be effectively implemented in a hierarchical environment through pedagogical engineering that respects both doctrine and the physical condition of learners. The benefits of this research include improved leadership competence among military academy cadets, enhanced alignment between academic activities and regimental duties, reduced cognitive barriers to learning, and a replicable model for other military education institutions facing similar challenges. The findings also provide insights for civilian educational contexts with highly structured environments or intensive physical training components.

METHOD

This study employed a mixed-methods approach with an Explanatory Sequential Mixed Method design. This design was selected for its ability to provide a comprehensive understanding by gathering and analyzing quantitative data in the first phase, which is subsequently deepened through qualitative data in the second phase (Creswell & Creswell, 2018; Widodo et al., 2024). The application of mixed methods within the military ecosystem is highly relevant for capturing the complexities between statistical achievements and behavioral dynamics in the field (Santos et al., 2019).

The population of this study consists of cadets at the Military Academy, utilizing a probability sampling technique for the quantitative phase. Data collection was conducted through the distribution of structured questionnaires, which have been tested for validity and reliability, alongside in-depth interviews and field observations during the qualitative phase (Winter et al., 2022). Quantitative data analysis utilizes linear regression techniques to measure the extent of the independent variable's influence on the dependent variable (Gnydiuk et al., 2024).

Furthermore, data integration was performed using coding and triangulation techniques to ensure the credibility of the findings (Stufflebeam et al., 2012). All research procedures were executed with strict adherence to military research ethics, including respondent anonymity and the confidentiality of institutional strategic data. The pedagogical engineering of the T-PjBL Model was developed based on synthesized data constructed to mitigate the learning barriers identified during the research process (Williams & McCombs, 2023).

RESULT AND DISCUSSION

Findings

The findings of this study were constructed based on the integration of qualitative data derived from in-depth interviews, field observations, and curriculum documentation and further substantiated by quantitative analysis of cadet perceptions at the Military Academy (Widodo et al., 2024; Gnydiuk et al., 2024). The collected data reflect the complexities of implementing innovative learning models within a hierarchical military organizational structure, illustrating how physiological and cultural variables interact in the process of leadership competence formation (Bucăţa & Andrei, 2024; Ktitorov & Puhach, 2024).

Quantitative Analysis of PjBL Contribution to Leadership Competence

Based on the primary data analysis involving 282 cadet respondents, it was found that the implementation of Project-Based Learning (PjBL) has a significant influence on the development of leadership capacity. Hypothesis testing using simple linear regression showed a significance value of 0.000 ($p < 0.05$). This confirms that the PjBL variable serves as a positive determinant in the formation of officer character (Gnydiuk et al., 2024; Widodo et al., 2024). However, the strength of this influence needs to be further examined through the statistical parameters presented in Table 1.

Table 1. Summary of Simple Linear Regression Test Results

Model	Regression Coefficient (β)	t-value	Sig.	R	R^2	F-value
Constant	130.1	16.218	0.000	–	–	–
PjBL Response (X)	0.593	5.725	0.000	0.324	0.105	32.777

Physiological Barriers and the Dynamics of Pseudo-Autonomy in the Field

Qualitative findings derived from observations and in-depth interviews provide an explanation for the low coefficient of determination. It was found that the high intensity of physical training creates extreme physiological fatigue, which directly increases the extraneous cognitive load of the cadets (Bucăţa & Andrei, 2024; Gnydiuk et al., 2024). This condition hinders the independent investigation process within PjBL due to the limitations of working memory caused by constant physical pressure (Sweller, 1988; Kozyar et al., 2024).

Furthermore, there is a cultural resistance manifesting as a phenomenon of pseudo-autonomy. Within a rigid hierarchical structure, cadets tend to exhibit hesitance in taking initiative because they are bound by the "ready-to-be-wrong" (siap salah) doctrine (Winter et al., 2022). As noted by Ktitorov & Puhach (2024), developing leaders in a military environment requires decisiveness; however, a rigid command culture instead creates psychological barriers for cadets to experiment within independent projects (Коба & Koba, 2024; Williams & McCombs, 2023).

Pedagogical Engineering through the Construction of the T-PjBL Model

To address these problematic issues, this study formulates the Tactical Project-Based Learning (T-PjBL) model as an adaptive instructional innovation. T-PjBL transforms conventional PjBL syntax into five tactical phases, as detailed in Table 2 and Table 3, designed to establish a balance between autonomy and discipline (Yusri et al., 2024; Lavado-Anguera et al., 2024).

The Command Timeline feature within this model specifically functions to reduce cognitive load by synchronizing project execution with the regimental routine (Williams & McCombs, 2023). The integration of the T-PjBL model demonstrates that constructivist innovation can be effectively implemented in a military environment through pedagogical engineering that respects both doctrine and the physical condition of the learners (Zhao, 2020; Bucăţa & Andrei, 2024).

Table 2. Tactical Phases of the T-PjBL Model

Empirical Problem (Evidence-Based)	Weakness Of Standard Pjbl (Existing Model)	T-Pjbl Intervention Feature (Proposed Model)	Problem-Solving Mechanism
"Fear Of Making Mistakes" Culture (Passive Cadets & Innovation Anxiety)	Pure Student-Centered Pjbl Demands Autonomous Initiative Without Sufficient Direction, Creating Confusion Due To Conflict With Command Doctrine.	Phase 1: Mission Briefing (Operational Directive)	Psychological Mechanism: Transforms Open-Ended "Trigger Questions" Into Structured "Mission Orders," Enabling Cadets To Feel Psychologically Safe To Innovate Within Assigned Tasks.
Unrealistic Planning (Wishful Thinking)	Project Plans Tend To Be Abstract And Overly Idealistic, Often Neglecting Real Logistical Constraints In Field Conditions.	Phase 2: Tactical Planning	Strategic Mechanism: Requires Structured Operational Planning (Renaju Format) Under Strict Resource Constraints, Training Cadets To Optimize Limited Logistics Through Tactical Creativity.
Physiological Fatigue (Classroom Drowsiness)	Flexible And Open-Ended Project Timelines Frequently Conflict With Physical Training Schedules And Rest Periods.	Phase 3: Command Timeline (Structured Scheduling)	Physiological Mechanism: Breaks Large Projects Into Synchronized Micro-Tasks Aligned With Official Training Schedules, Preventing Cognitive Burnout During Low-Energy Periods.
Instructor Pedagogical Shock (Role Confusion)	Forces Military Instructors Into Passive Facilitator Roles, Potentially Undermining Command Authority.	Phase 4: Supervised Maneuver	Pedagogical Mechanism: Repositions Instructors As "Training Commanders" Who Actively Supervise And Intervene At Structured Checkpoints, Maintaining Authority While Enabling Guided Inquiry.
Irrelevant Learning Outcomes (Administrative Product Orientation)	Assessment Focuses Primarily On Final Written Products (Papers/Presentations), Neglecting Tactical Decision-Making Skills.	Phase 5: After Action Review (Aar)	Evaluative Mechanism: Shifts Assessment From "Product Quality" To "Decision-Making Quality," Reinforcing Operational Judgment And Leadership Competence.

Table 3. Transformation Matrix : PjBL to T-PjBL Model

Operational Phase	Key Characteristics Of T-Pjbl	Theoretical Foundation
Mission Briefing	Alignment Of Projects With Doctrine, Strategic Objectives, And Military Operational Context.	Santos Et Al. (2019)
Tactical Planning	Scenario-Based Project Planning Incorporating Risk Mitigation And Tactical Role Distribution.	Hidalgo & Ortega (2022)

Command Timeline	Structured Integration Of Project Execution Within Official Physical Training Schedules And Military Routines.	Williams & Mccombs (2023)
Supervised Maneuver	Active Supervision During Project Execution To Prevent Pseudo-Autonomy And Ensure Guided Performance.	Widodo Et Al. (2024)
After Action Review (Aar)	Systematic Reflection Emphasizing Decision Evaluation, Strategic Effectiveness, And Team-Based Learning.	Stufflebeam Et Al. (2012)
Operational Phase	Key Characteristics Of T-Pjbl	Theoretical Foundation
Mission Briefing	Alignment Of Projects With Doctrine, Strategic Objectives, And Military Operational Context.	Santos Et Al. (2019)
Tactical Planning	Scenario-Based Project Planning Incorporating Risk Mitigation And Tactical Role Distribution.	Hidalgo & Ortega (2022)

The Deterministic Interaction of PjBL and Military Leadership Dynamics

The quantitative findings showing a 10.5% contribution of PjBL to leadership competence reveal a dialectic between instructional innovation and organizational structure. This low coefficient of determination underscores that the effectiveness of project-based learning cannot stand alone without synchronization with a comprehensive framework (Kaushik & Joshi, 2020). As explained in constructivist theory, learner autonomy in PjBL is the result of active interaction between the subject and their learning environment (Kokotsaki et al., 2016). However, in the military ecosystem, this interaction is often reduced by a dense curricular load, necessitating more specific engineering to optimize the role of technology and active methods (Santos et al., 2019; Zhao, 2020).

The limited influence of standard PjBL also reflects a gap in the development of cadets' emotional and volitional aspects during the project process. Research by Kozyar et al. (2024) confirms that while PjBL excels in enhancing professional competence, this model often fails to reach the affective side of leadership if not accompanied by realistic scenarios. The lack of operational pressure simulations in conventional projects results in learning that occurs under overly idealized conditions, meaning cadets are not fully tested in decision-making under uncertainty (Hidalgo & Ortega-Sanchez, 2022; Lavado-Anguera et al., 2024).

Mitigation Analysis of Cognitive Load and Physiological Fatigue

A significant contribution of this study is the identification of physiological fatigue as a major barrier to cognitive effectiveness. Based on Cognitive Load Theory, the limited working memory capacity of cadets becomes highly vulnerable when faced with complex investigative tasks amidst intensive military training (Sweller, 1988; Gnydiuk et al., 2024). This physical exhaustion creates an extraneous load that hinders the assimilation of leadership concepts; thus the 2024 curriculum innovation requires more systematic cognitive resource management (Williams & McCombs, 2023). This aligns with the findings of Bucăţa & Andrei (2024), stating that academic success in the military depends heavily on the harmonization of physical training and intellectual demands.

The failure to synchronize the regimental schedule with PjBL activities also triggers the phenomenon of pseudo-autonomy. This occurs when cadets feel granted academic freedom but remain psychologically bound by rigid bureaucratic controls and the "ready-to-be-wrong" (siap salah) doctrine (Winter et al., 2022). The inability of cadets to step out of this instructional comfort zone indicates that the formation of adaptive leaders requires scaffolding that is not only academic but also tactical in nature (Ktitorov & Puhach, 2024; Коба & Koba, 2024).

T-PjBL as a Strategic Solution for Officer Education Transformation

The formulation of the Tactical Project-Based Learning (T-PjBL) model serves as a response to the failure of active learning models to address unique military characteristics. The Command Timeline and After-Action Review (AAR) phases in this model represent a tangible

adaptation to the need for comprehensive evaluation (Stufflebeam et al., 2012; Tayibnaspis, 2010). The use of combat scenario-based elements in T-PjBL aims to overcome the weaknesses of the old model by introducing time pressure and information uncertainty (Yusri et al., 2024). Through this integration, PjBL transforms from a mere classroom method into a real and measurable leadership simulation.

The superiority of the T-PjBL model also lies in its ability to enhance cadet engagement through more active instructor mentoring, or Supervised Maneuver (Widodo et al., 2024). This addresses the recommendations of Lavado-Anguera et al. (2024) regarding the importance of institutional investment and faculty competence in supporting the success of technical and military education projects. Consequently, the implementation of T-PjBL not only impacts the achievement of learning outcomes (CPL) but also provides a new standard for developing adaptive and responsive military curricula for future operational challenges (Santos et al., 2019; Hidalgo & Ortega-Sanchez, 2022).

CONCLUSION

Conclusions describe the answers to hypotheses and/or research objectives or scientific findings obtained. The conclusion does not contain a repetition of the results and discussion, but rather a summary of the findings as expected in the objectives or hypotheses. If necessary, at the end of the conclusion can also be written things that will be done related to the next idea of the research.

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