Modeling and Optimization of Increasing Teacher Innovativeness Based on Local Wisdom and Technological Literacy

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Abstract: Improving teacher innovation is a strategic effort to enhance the quality of education in Indonesia. This study aims to examine the factors influencing teacher innovation through a combination of exploratory and quantitative approaches. Five key variables were identified: organizational climate, spirit of cooperation, work motivation, transformational leadership, and digital technology literacy. A total of 180 foundation permanent teachers (GTY) from 20 private high schools in Bekasi Regency participated by completing questionnaires. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) and the Scientific Identification Theory for Operational Research in Education Management (SITOREM) method. The PLS-SEM results indicate a strong model fit with an R^2 of 0.767, predictive relevance (Q^2) values above 0, Normed Fit Index (NFI) of 0.866, SRMR of 0.061, and better predictive accuracy than linear regression models. SITOREM analysis prioritized strategic improvements in teacher innovation, focusing on enhancing task responsibility, resource support, digital literacy, instructional media development, and scientific output. The findings contribute to targeted strategies for fostering teacher innovation and optimizing educational outcomes.

Keywords: Digital technology literacy; Local wisdom; Teacher innovation.

Introduction

National education today is undergoing major transformations driven by technological advancement, the industrial revolution 4.0, and the implementation of the Merdeka Curriculum (Herdianto et al., 2022; Maipita et al., 2020). This curriculum encourages teachers to be more adaptive and responsive to students' needs and local contexts by granting them the freedom to design innovative and relevant learning processes (Wulandari et al., 2024; Zikriati & Arani, 2024). In this regard, teacher innovativeness becomes a critical element, as teachers are expected not only to deliver content but also to act as agents of change in transforming educational practices. However, various field observations reveal that many teachers, particularly in private senior high schools,

have yet to reach optimal levels in developing innovative teaching approaches.

Data from surveys and the Ministry of Education's database (Dapodik) indicate that many teachers still lack the necessary academic and professional qualifications, with average competency test scores falling below the national standards (Santoso et al., 2020). These shortcomings affect their ability to design engaging learning media, effectively utilize digital technologies, and produce scientific works or creative projects with students. This gap highlights the need for a context-based strategy and model to enhance teacher innovativeness one that does not solely rely on general theoretical frameworks but explores variables that are locally rooted and derived from real field conditions (Coenders & Terlouw, 2015). Therefore, the chosen

approach must be contextual, adaptive, and capable of producing concrete, sustainable solutions (Abu-Rasheed et al., 2023; Antonini et al., 2021; Badarnah, 2025).

To address these challenges, this study aims to develop a model for improving teacher innovativeness in private senior high schools in Bekasi Regency using the POP-SDM (Modeling and Optimization of Management Resources) method. This comprehensive method enables the formulation of an empirically grounded model by identifying dominant and influential variables such as digital literacy and organizational support. The research also aims to define strategies and optimal solutions for enhancing teacher innovativeness by strengthening these key variables and prioritizing areas for improvement through indicator analysis using the SITOREM method (Sobirin et al., 2021).

Through this approach, the study is expected to provide both theoretical and practical contributions. Theoretically, it will enrich the existing literature on teacher innovativeness and its influencing factors, especially in the context of private secondary education in Indonesia. Practically, the resulting model and strategies will offer actionable insights for the Ministry of Education, school principals, educational foundations, and teachers in designing targeted interventions and professional development programs. Ultimately, this research supports the vision of an education system that is technologically adaptive while remaining rooted in local wisdom and cultural identity.

Method

This research employs a sequential exploratory mixed-methods design, grounded in the POP-SDM (Modeling and Optimization of Management Resources) approach. The research design consists of four main stages: preliminary study, qualitative exploration, quantitative testing, and data analysis with optimization. This structure ensures a comprehensive understanding of teacher innovativeness in private senior high schools in Bekasi Regency, beginning with contextual exploration and culminating in validated strategies and solutions.

The preliminary study was conducted to identify the actual condition of teacher innovativeness compared to the expected ideal. This involved initial observations and informal interviews with school principals to determine whether the variable had reached an optimal level or still required improvement. The findings from this stage established the foundation for the next phase of qualitative inquiry. The qualitative phase involved in-depth interviews with 13 informants from five selected private schools (five principals and eight teachers). The

aim was to explore key contextual variables—including digital literacy, organizational support, and local wisdom—that potentially influence teacher innovativeness. The qualitative data were coded and analyzed to identify dominant variables, which were then used to construct a conceptual constellation model and formulate hypotheses for further testing.

In the quantitative phase, a survey instrument based on the qualitative findings was distributed to a larger sample. The data collected were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 software to test the strength of relationships between variables and validate the model. The final stage of the research applied the SITOREM (Scientific Identification Theory to Conduct Operation Research in Education Management) method to identify indicators that should be improved or maintained (Desianti, 2022; Laihad & Hardhienata, 2024). These indicators were prioritized using four criteria: Cost, Benefit, Urgency, and Importance. The results of this process were used to develop optimized recommendations and an actionable plan to strengthen teacher innovativeness in line with the goals of educational transformation.

Result and Discussion

This study was designed to develop and optimize a model of teacher innovativeness by integrating elements of local wisdom and digital technology literacy. It was conducted in the context of private high schools in Bekasi Regency, West Java, Indonesia—a region marked by diverse socio-cultural dynamics and growing expectations for educational reform in the digital era. The research employed a mixed-methods approach using POP-SDM (Modeling and Optimization of Human Resource Strengthening). It began with qualitative exploration to identify dominant influencing variables, followed by quantitative validation through Partial Least Squares Structural Equation Modeling (PLS-SEM). The final stage involved SITOREM analysis to rank and prioritize improvement strategies based on empirical field data.

The PLS-SEM analysis confirmed that the constructed model has high predictive accuracy and structural coherence, with several statistical indicators exceeding commonly accepted thresholds: Coefficient of Determination (R^2): 0.767 — indicating that 76.7% of the variance in teacher innovativeness can be explained by the model's independent variables; Predictive Relevance (Q^2): Q^2 = 0.518 for teacher innovativeness, 0.411 for work motivation, and 0.022 for digital literacy, all of which are above zero and therefore confirm predictive relevance; Normed Fit Index (NFI): 0.866 — approaching

the ideal value of 1.0; Standardized Root Mean Square Residual (SRMR): 0.061 — below the cut-off of 0.08, indicating a well-fitting model; and PLS Predict Validation: The Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) values of most indicators in the PLS model were lower than those in the benchmark linear regression model, suggesting superior predictive power.

Table 1. Data analysis of teacher innovation

Variable	R-Square (R²)	Q-Square (Q²)	Influence on Teacher Innovativeness
Work Motivation	0.767	0.518	Very dominant in driving teacher innovativeness
Mutual Cooperation	-	0.411	Significant as a mediator for work motivation
Organizational Climate	-	-	Significant as a mediator for work motivation
Transformational Leadership	-	-	Direct influence, but weak as a mediating factor
Digital Technology Literacy	-	0.022	Direct influence, relatively low contribution

From the data, it is clear that work motivation emerged as the most influential predictor of teacher innovativeness. Teachers with higher intrinsic and extrinsic motivation are more likely to engage in innovative teaching practices, use diverse instructional strategies, and generate creative learning environments (Aseery, 2024; Xiong, 2025). Mutual cooperation and organizational climate further enhanced innovativeness through their role in supporting teamwork, professional culture, and resource accessibility. This supports theories of social capital and educational leadership that emphasize collaboration as a foundation for innovation.

Interestingly, transformational leadership, though expected to play a pivotal role, showed weaker effects when mediated through digital literacy (Ben Ghrbeia & Alzubi, 2024). This suggests that digital competency is best supported through direct training and infrastructure provision rather than solely through leadership influence. In the preliminary field survey conducted among 38 teachers across 10 private high schools, several weaknesses in teacher innovativeness were revealed: 53% of respondents needed improvement in developing instructional media; 49% struggled to create innovative learning models; 42% required guidance in writing and publishing scientific educational papers; and 32% lacked confidence in designing creative learning modules or using technology effectively.

These findings were validated in the larger quantitative sample, confirming the need for capacity building in several key domains of teacher creativity and innovation (Haryani et al., 2021). To convert the findings into actionable strategies, the SITOREM method was used to identify and rank specific indicators for improvement. Indicators were selected based on their contribution to the dependent variable (teacher innovativeness), their current performance levels, and their strategic importance. The results emphasize that teacher innovativeness is a multidimensional construct influenced by internal motivation, social context, institutional support, and digital competency (Wu et al., 2022). The empirical findings also support the hypothesis that innovation in education does not emerge from isolated efforts but is the result of systemic support and cultural transformation within schools. In the context of Indonesian education, particularly the Merdeka Curriculum policy, this study affirms that empowering teachers through structured models such as POP-SDM can directly enhance learning outcomes, curriculum implementation, and education equity (Martiarini et al., 2023).

The findings of this study confirm that enhancing teacher innovativeness is a complex, multifaceted process shaped by both individual and systemic variables. The combination of POP-SDM modelling (Hidayat et al., 2024), PLS-SEM statistical validation, and SITOREM-based prioritization provided a comprehensive framework to understand and improve the innovativeness of teachers in private high schools in Bekasi Regency.

The Central Role of Work Motivation

The results consistently show that work motivation is the strongest and most significant predictor of teacher innovativeness. This aligns with existing theories in organizational psychology, particularly Herzberg's two-factor theory and expectancy theory, which suggest that motivation both intrinsic (e.g., personal growth, sense of achievement) and extrinsic (e.g., recognition, career progression) is essential in fostering innovation behavior (Nurhayati, 2024). Teachers who are highly motivated tend to demonstrate a greater willingness to experiment with new teaching strategies, develop creative learning materials, and engage in professional development (Zhang et al., 2021). In the context of Indonesian private schools, where job security and institutional support may vary significantly, motivation becomes a critical internal driver for innovation.

Social and Organizational Context: Mutual Cooperation and Climate

The variables mutual cooperation and organizational climate emerged as significant mediators that strengthen the impact of work motivation on innovativeness. These findings support the notion that innovation is not merely an individual act but is embedded in a social and organizational context. A school culture that promotes collaboration, open communication, shared goals, and psychological safety enables teachers to take creative risks and learn from one another (Darmawan et al., 2024; Fobert, 2024).

The role of organizational climate further reinforces the importance of leadership and policy in shaping teacher behavior. When teachers perceive their institutions as supportive, transparent, and participatory, they are more likely to pursue innovative teaching practices (Blömeke et al., 2021).

Transformational Leadership: A Conditional Influence

Contrary to expectations, transformational leadership did not significantly mediate the relationship between digital literacy and teacher innovativeness. This finding highlights an important distinction: while leadership may inspire and motivate, it may not be sufficient to address technical gaps such as digital competence. Transformational leadership should therefore be complemented by concrete resources, hands-on training, and ongoing technical support to ensure that teachers can effectively integrate digital tools into their pedagogy (Fobert, 2024) .

This result does not downplay the importance of leadership; instead, it points to the need for distributed leadership that empowers technology-savvy peers and instructional coaches to play a more direct role in capacity building.

Digital Technology Literacy: A Necessary but Not Sufficient Condition

Although digital literacy was positively associated with innovativeness, its predictive power was relatively low compared to other variables (Kabakus et al., 2023). This suggests that while digital tools are enablers of innovation, they do not automatically lead to creative teaching practices. Teachers must be equipped not only with the skills to operate technology but also with pedagogical frameworks that guide meaningful technology integration.

Moreover, the modest effect of digital literacy might reflect disparities in access to infrastructure or a lack of contextualized training (Raihan et al., 2024). As such, digital transformation in education must be accompanied by context-specific support, especially in private schools that may have fewer resources than their public counterparts.

Insights from SITOREM: Strategic Priorities for Policy and Practice

The use of the SITOREM method yielded a set of prioritized indicators that require immediate attention (Hermawan, 2024). These range from basic professional responsibilities (e.g., accountability in task execution) to advanced competencies (e.g., scientific publication). The analysis highlights that interventions should be both comprehensive and sequential, addressing foundational issues before moving toward more complex innovations.

For example, without clear accountability and resource support, efforts to introduce digital innovation or research-based teaching practices are unlikely to succeed. Therefore, training programs, incentive systems, and institutional policies must be aligned with the priority indicators identified in the study.

Theoretical and Practical Implications

Theoretically, this study contributes to the development of an integrated model of teacher innovativeness by combining socio-cultural, motivational, and technological dimensions (Mansour, 2013). It also demonstrates the value of combining qualitative exploration, quantitative modeling, and optimization analysis in education research.

Practically, the findings offer a roadmap for stakeholders in the Indonesian education system—particularly school leaders, policymakers, and professional development providers—to design targeted interventions. The POP-SDM model can be replicated or adapted to other regions and educational levels to guide data-driven policy-making.

Relevance to the Merdeka Curriculum

The results are particularly relevant in light of Indonesia's Merdeka Curriculum, which encourages flexible, student-centered learning guided by teacher autonomy. The success of this curriculum hinges on the readiness and innovativeness of teachers. By mapping out the conditions that support innovation—including motivation, collaboration, leadership, and digital literacy—this study provides practical guidance for ensuring the curriculum's effective implementation.

Conclusion

Teacher innovativeness is a key factor in achieving success across various aspects of education, including improving the quality and effectiveness of learning in schools. Therefore, innovation in teaching must be taught and continuously practiced. Innovative teachers are highly needed to shape students who are highly creative, resilient, intelligent, independent, and capable

of finding solutions. In addition, such students are more likely to enjoy new challenges and remain open to complexity in the learning process.

Author Contributions

Conceptualization, P.P.; methodology, P.P.; software, P.P.; validation, P.P.; formal analysis, P.P.; investigation, P.P.; resources, P.P.; data curation, P.P.; writing—original draft preparation, P.P.; writing—review and editing, P.P.; visualization, P.P.; supervision, P.P.; project administration, P.P.; funding acquisition, P.P. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The author declares no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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