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Designing a Methodological Framework for Assessing Teacher Readiness in Adaptive Curriculum Implementation within Indonesian Context

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Purpose: This methodological paper aims to design and theorize a comprehensive framework for assessing teacher readiness for adaptive curriculum implementation. It demonstrates the systematic development of a mixed-methods instrument, including a Likert-scale questionnaire and a semi-structured interview protocol, tailored to the Indonesian context.

Methodology: The mixed-methods approach guided the design of the instrument. A quantitative questionnaire was developed to measure the prevalence of readiness across five theoretically derived constructs. At the same time, a qualitative interview protocol was designed to explore the depth and nuance behind the quantitative findings. The constructs were derived from a robust synthesis of Reigeluth & Merrill's (1979) classes of instructional variables and Martin et al.'s (2020) adaptive learning model, reinterpreted through a "human-in-the-loop" lens for the Indonesian context.

Findings: The study presents a theoretically and contextually validated mixed-methods instrument that moves beyond ad-hoc questionnaires. The complementary quantitative and qualitative components ensure that the instrument captures both broad patterns and deep contextual insights, providing a holistic diagnostic tool with strong content and ecological validity.

Conclusion: This research provides a replicable mixed-methods framework for developing context-sensitive assessment tools in education. The resulting instrument provides policymakers and researchers with a valid means to assess teacher readiness through an approach that integrates statistical measurement with a rich qualitative understanding.

Value: This ultimately informs targeted interventions for the successful implementation of adaptive curricula in Indonesia and similar contexts.

Keywords: *Adaptive Curriculum, Teacher Readiness, Mixed-Methods Research, Instrument Development, Indonesia's Education*

I. INTRODUCTION

The global imperative for adaptive education arises from the rapid and unpredictable changes of the 21st century, including technological revolutions, shifting labor markets, migration, climate change, and the global learning crisis, all of which demand that education systems become more flexible and responsive to diverse learner needs (Lautensach, 2021; Popa, 2024;

Strielkowski et al., 2025). International initiatives, such as UNESCO's Futures of Education, emphasize the need for a "new social contract for education" that prioritizes continuous learning, curriculum transformation, and the integration of adaptive pedagogies to prepare students for uncertain futures (Popa, 2024).

There is a significant global shift towards personalized and adaptive learning models, driven by advances in smart technologies and artificial intelligence. These models tailor educational content, pacing, and strategies to individual learners' needs, abilities, and preferences, resulting in improved academic performance, engagement, and satisfaction across various educational settings and age groups (Contrino et al., 2024; Mario, 2025; Peng et al., 2019; Plooy et al., 2024). Key components of these approaches include dynamic learner profiling, competency-based progression, flexible learning environments, and real-time adaptation of teaching strategies based on continuous monitoring of student progress (Adewale et al., 2024; Peng et al., 2019; Sarwar et al., 2019; Shemshack et al., 2021).

Kurikulum Merdeka is Indonesia's recent curriculum reform aimed at increasing autonomy and flexibility in education, allowing schools and teachers to adapt learning to students' needs and local contexts. The curriculum emphasizes student-centered, project-based learning, development of 21st-century skills, and a shift from rigid, standardized approaches to more flexible, competency-based education (Langoday et al., 2024; Wahyudi et al., 2024). Its goals include fostering critical thinking, creativity, digital literacy, and preparing students for the demands of Society 5.0 and the global workforce (Langoday et al., 2024).

However, implementation faces several documented challenges. Teacher readiness remains uneven, with many educators needing more training in curriculum structure, lesson planning, and the use of technology, especially in remote and disadvantaged areas (Hasriani et al., 2024; Nadrah, 2023; Nursaputri & Sabat, 2023; Priatmoko et al., 2024; Thana & Ramli, 2024; Tomasouw et al., 2024; Wahyudi et al., 2024). Standardization is difficult as teachers struggle to interpret and apply the flexible curriculum, and there is a lack of clear guidelines and supporting materials (Hasriani et al., 2024; Nadrah, 2023; Wahyudi et al., 2024). Infrastructure gaps, such as limited access to technology, inadequate facilities, and poor internet connectivity, further hinder effective adoption, particularly in rural and 3T (disadvantaged, remote, and outermost) regions (Hasriani et al., 2024; Tomasouw et al., 2024; Wahyudi et al., 2024). Addressing these challenges requires comprehensive teacher training, improved infrastructure, and ongoing support to ensure the curriculum's goals are met across diverse Indonesian contexts (Langoday et al., 2024; Tomasouw et al., 2024; Wahyudi et al., 2024).

While numerous theoretical models and frameworks for adaptive learning exist, there is a clear research-practice gap regarding context-specific tools to assess teacher readiness—the primary agents of change in educational reform. Most studies highlight the importance of teacher perceptions, strategies, and willingness to adapt, but also note that teachers often lack concrete, practical guides or diagnostic instruments tailored to their specific contexts for implementing adaptive learning (Isaeva et al., 2025; Moltudal et al., 2022; Ramdani et al., 2021; Simon & Zeng, 2024). Teachers express a need for adaptive learning guides and ongoing professional development, yet available resources are often generic and not sufficiently localized or actionable for diverse educational environments (Isaeva et al., 2025; Ramdani et al., 2021; Simon & Zeng, 2024).

Barriers such as limited professional development, program complexity, and insufficient institutional support further hinder the translation of theory into practice (Christensen & Knezek, 2017; Isaeva et al., 2025; Simon & Zeng, 2024). While some research has begun to develop readiness surveys or frameworks, these are typically broad and not designed to diagnose the nuanced readiness levels of teachers in specific settings or subject areas

(Christensen & Knezek, 2017; Scherer et al., 2021). This gap underscores the necessity for context-sensitive diagnostic tools that can inform targeted interventions and support for teachers as they implement adaptive learning models (Isaeva et al., 2025; Ramdani et al., 2021; Simon & Zeng, 2024).

This methodological paper aims to articulate the design and theoretical underpinnings of a rigorously developed mixed-methods instrument—comprising a Likert-scale questionnaire and a semi-structured interview protocol—to assess teacher readiness for implementing an adaptive curriculum within Indonesia's *Kurikulum Merdeka* context. The primary objective is to demonstrate how global theoretical constructs, specifically Reigeluth & Merrill's (1979) classes of instructional variables and Martin et al's (2020) adaptive learning model, were systematically synthesized and contextually reinterpreted through a "human-in-the-loop" lens to generate the core constructs and specific items of the assessment tools. By explicitly mapping each questionnaire item and interview question back to its theoretical and contextual origin, this paper provides a replicable blueprint for developing contextually grounded research instruments that move beyond ad-hoc questions, thereby offering researchers and policymakers a valid framework to diagnose strengths, gaps, and actionable needs in teacher capacity for driving personalized and equitable education in diverse, resource-constrained environments.

II. THEORETICAL FRAMEWORK

Reigeluth & Merrill (1979) have been known for their success in developing a theory of classifying variables that are important in the instructional field. There are three classification in the field of instruction according to them. It can be seen on Figure 1.

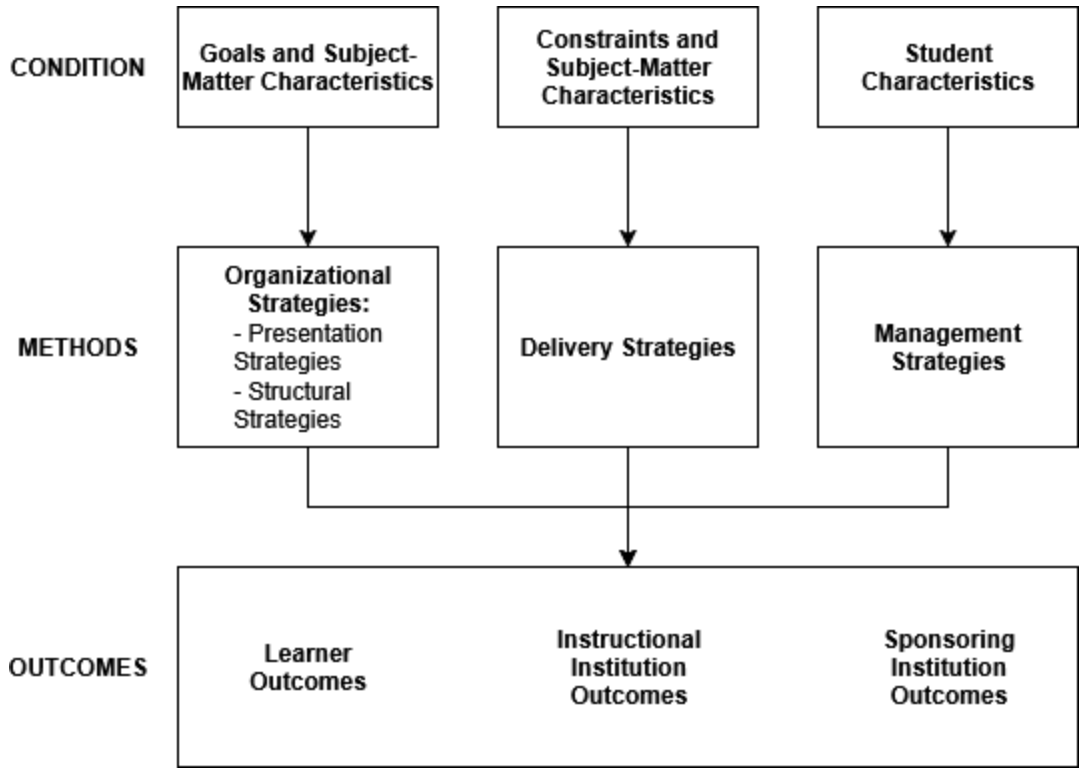

Figure 1 Classification of Instructional Variables *(Reigeluth, 1983)*

Figure 1 presents a conceptual framework that divides instructional design into three main components: CONDITION, METHODS, and OUTCOMES. The CONDITION component serves as the foundational input, consisting of Goals and Subject-Matter

Characteristics, Constraints and Subject-Matter Characteristics, and Student Characteristics. Based on these conditions, the METHODS component designs strategies to achieve the goals, divided into Organizational Strategies—including Presentation Strategies (how content is presented) and Structural Strategies (how content is sequenced and grouped)—as well as Delivery Strategies and Management Strategies for implementing instruction. Finally, the OUTCOMES component measures the results of this process, encompassing Learner Outcomes, Instructional Institution Outcomes, and Sponsoring Institution Outcomes.

Overall, this framework emphasizes a systematic and structured approach to instructional design. For teachers, this review focuses on how they can analyze conditions (such as student and subject matter characteristics) to then select and adapt the most effective organizational, delivery, and management methods to achieve the desired learning outcomes for their students.

Thus, adaptive learning emerged due to the need to support three main practices that teachers must consider during the instructional process, namely (1) personalization practices, (2) collaboration practices, and (3) adaptive media selection practices. According to Thaariq (2023), first, teachers' understanding of the importance of personalization in learning emphasizes that each student has different needs and learning styles. By understanding these differences, teachers can develop more effective learning strategies tailored to individual student needs. Second, the emphasis on students' collaborative role in learning indicates that interaction and active participation from students positively impact learning outcomes. By encouraging collaboration, teachers can create a classroom environment that supports the exchange of ideas and mutual understanding, enhancing student engagement in the learning process. Third, the selection of digital-based learning media that can be adapted to students' needs demonstrates an acknowledgment of the role of technology in modern education. By wisely choosing and using adaptable digital tools, teachers can enrich the learning experience, facilitate personalization, and address the needs of students in the digital era.

Adaptive learning has a mechanism in the implementation process of learning activities within it. This mechanism can be seen in Figure 2.

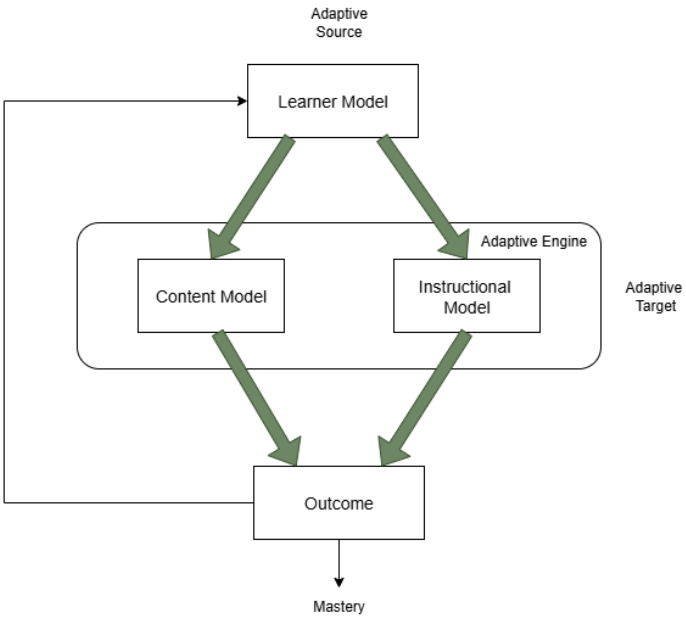

Figure 2 Adaptive Learning Mechanism *(Martin et al., 2020)*

The adaptive learning framework proposed by Martin et al. (2020) provides a comprehensive model for understanding the core components and operational logic of adaptive systems. This model synthesizes and advances prior work by Shute & Towle (2018) and Vandewaetere et al (2011) to address identified gaps, such as the unspecified source and target of adaptation. According to their synthesis, the mechanism functions through five interconnected components: (1) the Adaptive Source, which is the data on learner interactions (e.g., quiz scores, time on task) that triggers the adaptive process; (2) the Learner and Content Models, which are dynamic representations of the student's knowledge state and the structured domain knowledge, respectively; (3) the Adaptive Engine, which is the core intelligence (often an algorithm) that processes data from the Source and Models to make instructional decisions; (4) the Adaptive Target, which is the element of instruction that is adjusted (e.g., content sequencing, feedback, or difficulty level); and finally, (5) the Outcome, which is the measurable learning result, ideally leading to mastery (Martin et al., 2020). This model effectively frames adaptive learning as a closed-loop system where continuous assessment and personalization are central to optimizing the learning pathway for each individual.

The direct application of the technology-centric adaptive learning model (Martin et al., 2020) is often unfeasible in the Indonesian context due to significant infrastructural disparities and varying levels of digital literacy. To bridge this gap, a fundamental reconceptualization is proposed: repositioning the teacher as the central "Adaptive Engine" within a "human-in-the-loop" system (Thaariq, 2025). This reinterpretation maintains the core logical structure of the adaptive framework—Source (teacher observations and simple assessments), Model (the teacher's mental or documented profile of student progress), and Target (differentiated instruction)—but executes it through pedagogical expertise rather than algorithmic automation. The teacher, empowered by cultural competence and diagnostic skill, actively curates resources, interprets learner data, and makes strategic instructional decisions, thereby personalizing the learning experience without relying on sophisticated, always-online technology (Thaariq, 2025). This shift from a technocentric to a human-centric model of adaptivity reframes technology as a complementary tool to augment the teacher's capabilities, making the framework robust, low-cost, and culturally responsive for diverse Indonesian educational settings.

From this synthesized framework, which integrates global theory with local contextual imperatives, five core constructs for assessing teacher readiness were systematically derived. This derivation process was guided by the necessity to translate abstract theoretical components into measurable, practical dimensions of teacher competency and perception.

First, the conceptual understanding construct originates from the need for teachers to comprehend the foundational "Condition" and "Method" variables (Reigeluth & Merrill, 1979) that underpin adaptive education, as well as the principles of the *Kurikulum Merdeka*. Secondly, the technological and infrastructural readiness construct is a direct operationalization of the contextual "Conditions," probing the tangible realities of internet access, device availability, and digital proficiency that constrain or enable adaptive practices (Nurtanto et al., 2025). Thirdly, the pivotal construct of the teacher as the "Adaptive Engine" is derived from the core reinterpretation of Martin et al.'s (2020) model, aiming to measure a teacher's self-efficacy and practical skill in performing the roles of data gatherer ("Source"), diagnostician ("Model"), and instructional decision-maker ("Engine"). Fourth, the competence in cultural integration construct is extracted from the framework's expansion of "Condition" and "Method" variables to include local wisdom and cultural goals, assessing the teacher's ability to contextualize content. Lastly, the perception of barriers and support systems construct is essential for evaluating the external and internal "Conditions" that influence the feasibility of implementing

the adaptive "Methods," providing critical diagnostic data on the ecosystem surrounding the teacher (Thaariq, 2025).

Thus, these five constructs collectively provide a holistic and validated framework for diagnosing the human factors critical to implementing a contextually relevant adaptive curriculum.

III. METHOD

Research Design

This methodological paper outlines the design and development of a mixed-methods instrument to assess teacher readiness for implementing an adaptive curriculum within Indonesia's *Kurikulum Merdeka* framework. The instrument was designed to harness the complementary strengths of both quantitative and qualitative methodologies, thereby enabling future researchers to gain a complete and nuanced understanding of the research problem (Creswell & Clark, 2017). The development process followed established scale development procedures (Boateng et al., 2018; DeVellis, 2012), which involved a systematic approach to creating two complementary components: a quantitative questionnaire and a qualitative interview protocol.

The quantitative component consists of a Likert-scale questionnaire intended to measure the prevalence of specific attitudes, perceptions, and self-reported competencies across a large sample of teachers. The qualitative component consists of a semi-structured interview protocol designed to explore the depth and nuance behind the quantitative findings. The rationale for this mixed-methods instrument is to allow for triangulation—where findings from one method can validate, elaborate, or illuminate those from the other—ultimately leading to a more robust diagnosis (Fetters, 2020).

Phase 1: Quantitative Questionnaire (Likert Scale 1-4) Development

The quantitative phase of this study employed a structured questionnaire designed to measure teachers' readiness across five core constructs derived from the synthesized theoretical framework. A 4-point Likert scale was utilized to eliminate neutral responses, thereby compelling participants to indicate their degree of agreement or disagreement (Joshi et al., 2015). The scale was anchored as follows: 1 = *Sangat Tidak Setuju* (STS, Strongly Disagree), 2 = *Tidak Setuju* (TS, Disagree), 3 = *Setuju* (S, Agree), and 4 = *Sangat Setuju* (SS, Strongly Agree). The development of the items was a deductive process, where each question was explicitly formulated to operationalize a specific aspect of the theoretical constructs, ensuring content validity (DeVellis, 2012). The following table 1 outlines the five constructs, their theoretical foundations, and representative items.

Table 1 Overview of Questionnaire Constructs and Sample Items

Construct	Definition	Theoretical Basis	Example Questionnaire Item (Translated)
Conceptual Understanding	Measures teachers' grasp of the principles of adaptive learning and the philosophy of *Kurikulum Merdeka*	Reigeluth & Merrill's (1979) "Condition" and "Method" variables; Policy documents on *Kurikulum Merdeka.*	"I understand that the Independent Curriculum is designed to give students greater freedom to explore their interests."
Technological & Infrastructural Readiness	Assesses access to digital tools, competency in using them, and ability to	Contextual "Constraints" within "Condition Variables" (Reigeluth & Merrill,	"My school has stable and adequate internet access to support digital learning."

	adapt to infrastructural limitations.	1979); Nurtanto et al. (2025).	
Role as "Adaptive Engine"	Evaluates teachers' self-efficacy and practiced skill in diagnosing needs and personalizing instruction.	The reconceptualized "Adaptive Engine" (Martin et al., 2020; Thaariq, 2025).	"I routinely conduct initial assessments to understand the varying comprehension levels of my students."
Cultural Integration	Gauges competence in integrating local wisdom and cultural contexts into learning materials and methods.	Expanded "Condition" and "Method" variables emphasizing cultural goals (Reigeluth & Merrill, 1979).	"I often use local folklore or traditions in my teaching materials."
Perception of Barriers & Support	Identifies external and internal factors that hinder or facilitate the implementation of adaptive practices.	"Condition Variables" affecting the implementation environment (Reigeluth & Merrill, 1979).	"I receive adequate support from school leadership in implementing adaptive learning strategies."

The first construct relates to conceptual understanding. This construct is founded on the necessity for teachers to comprehend the "why" behind the curriculum shift. It translates abstract theoretical principles into measurable perceptions. The items probe understanding of key concepts like student autonomy, the teacher's role as a facilitator, and the overall goals of Kurikulum Merdeka, which are essential "Conditions" for effective design (Reigeluth & Merrill, 1979).

The second construct relates to technological & infrastructural readiness. This construct operationalizes the practical "Constraints" within the instructional environment. The items move beyond simply asking about technology use to probe the reality of the Indonesian context, assessing the quality of internet access, device availability, and the ability to implement low-tech workarounds (Nurtanto et al., 2025).

The third construct relates to role as “Adaptive Engine”. This is the pivotal construct of the study, directly measuring the practical application of the "human-in-the-loop" model. The items break down the teacher's role as the adaptive engine into actionable behaviors: gathering data (the "Source"), interpreting it (managing the "Model"), and making instructional decisions (the "Engine") to differentiate content (the "Target") (Martin et al., 2020; Thaariq, 2025).

The fourth construct relates to cultural integration. This construct assesses the translation of cultural theory into practice. The items evaluate whether teachers actively leverage local culture not as an add-on but as a fundamental "Method" and "Condition" for creating relevant and inclusive learning experiences, which is a core aspect of the proposed contextualized framework.

The fifth construct relates to perception of barriers and support. This construct serves a diagnostic purpose, identifying the ecosystem in which the teacher operates. The items provide crucial data on the "Condition Variables" that must be addressed by policymakers and school administrators to enable teachers to succeed in their adaptive roles, such as the need for better training, resources, or administrative support.

Phase 2: Qualitative Interview Protocol Development

The qualitative phase was designed to complement the quantitative survey by providing depth, context, and rich narrative understanding to the statistical patterns identified. While the questionnaire measured the prevalence of attitudes and perceptions, the semi-structured interview protocol was developed to explore the lived experiences, underlying reasoning, and nuanced challenges faced by teachers in implementing adaptive curriculum principles

(Brinkmann & Kvale, 2015). The protocol was constructed to ensure alignment with the five core theoretical constructs, allowing for triangulation of data and a more comprehensive analysis. Each section of the interview guide was meticulously crafted to probe the "how" and "why" behind the teachers' practices and beliefs, moving beyond the "what" captured by the Likert-scale responses (Creswell & Poth, 2016).

The following table outlines the structure of the interview protocol, demonstrating its direct linkage to the quantitative constructs and the overall theoretical framework.

Table 2 Structure of the Semi-Structured Interview Protocol

Interview Section	Corresponding Construct(s)	Theoretical Anchor	Primary Objective	Example Guiding Questions
Conceptual Understanding & Beliefs	Conceptual Understanding	Reigeluth & Merrill (1979); Kurikulum Merdeka Policy	To explore teachers' mental models of adaptive learning and curriculum flexibility.	1. "In your own words, what does a 'responsive' or 'adaptive' classroom mean to you?" 2. "How do you interpret the 'Merdeka' (Freedom) in *Kurikulum Merdeka* in your daily teaching?"
Practical Strategies & Implementation	Role as "Adaptive Engine"; Cultural Integration	Martin et al. (2020); Reigeluth & Merrill (1979)	To elicit concrete examples of diagnostic, differentiation, and cultural contextualizatio n strategies.	3. "Can you walk me through a specific time you adapted a lesson based on students' varying levels of understanding?" 4. "How do you incorporate local culture or wisdom into your subjects? Could you give an example?"
Technology & Infrastructure in Practice	Technological & Infrastructural Readiness	Nurtanto et al. (2025)	To understand the real-world interplay between technology access, digital literacy, and adaptive teaching.	5. "What role does technology play in your efforts to personalize learning? What tools do you use most and why?" 6. "Describe any challenges you face due to internet or device limitations and how you work around them."
Challenges & Enabling Factors	Perception of Barriers & Support	Reigeluth & Merrill's "Condition Variables"	To identify perceived systemic barriers and critical sources of support.	7. "What is the most significant challenge you face in trying to implement this adaptive approach?" 8. "What kind of support from the school or government would be most helpful to you?"
Vision & Suggestions	All Constructs	Synthesized Framework	To gather teachers' aspirations and actionable recommendatio ns for improvement.	9. "If you had full autonomy and resources, what would your ideal adaptive classroom look like?" 10. "Based on your experience, what advice would you give to a teacher just starting with *Kurikulum Merdeka*?"

The interview protocol was designed as a semi-structured guide, utilizing open-ended, guiding questions rather than a rigid script. This format ensures that all core theoretical constructs are systematically explored while granting the interviewer the flexibility to probe emergent themes and pursue nuanced participant responses in greater depth, thereby capturing the rich, contextual reality of the teachers' experiences (Rubin & Rubin, 2012). Prior to deployment, the protocol was piloted to refine question clarity, flow, and appropriateness. Ethical implementation was paramount, beginning with a comprehensive introduction that explained the study's purpose, ensured confidentiality, obtained recorded verbal consent, and explicitly stated the participants' right to withdraw at any time. Interviews were conducted in the participants' preferred language to foster comfort and authenticity, were audio-recorded, and subsequently transcribed verbatim to ensure accuracy for detailed thematic analysis.

The inclusion of this qualitative phase is theoretically justified by its critical role within the mixed-methods design, moving beyond the *what* of the quantitative data to explain the *how* and *why* behind the statistical patterns. The protocol is not merely an adjunct but an essential tool for grounding the study's findings in the lived expertise of practitioners. It is specifically designed to contextualize quantitative results—for instance, exploring whether a low score in technological readiness stems from inadequate access, insufficient training, or high perceived complexity—and to give voice to the complex, situated decision-making processes that define the teacher's role as the "adaptive engine" (Creswell & Poth, 2016). Furthermore, the open-ended nature of the questions allows for the identification of unforeseen barriers or enabling factors not anticipated by the initial theoretical framework, ensuring the research remains responsive to the on-the-ground realities of the Indonesian educational context. Ultimately, this phase provides the necessary depth and narrative understanding to translate data into actionable, empirically grounded recommendations for policy and teacher professional development.

IV. DISCUSSION

Beyond Ad-Hoc Questionnaires

The development of this research instrument moves decisively beyond the common practice of creating ad-hoc questionnaires, which often lack a rigorous foundational framework. Such ad-hoc instruments are frequently critiqued for being based on researcher intuition or a superficial review of literature, resulting in items that may suffer from construct underrepresentation or contamination, thereby compromising content validity (DeVellis & Thorpe, 2021; Haynes et al., 1995). In contrast, the present instrument's superiority stems from its systematic derivation from a robust synthesis of established instructional design theory and deep contextual analysis. Each of the five core constructs—Conceptual Understanding, Technological Readiness, Role as "Adaptive Engine," Cultural Integration, and Perception of Barriers—was explicitly mapped from Reigeluth and Merrill's (1979) classes of instructional variables and Martin et al.'s (2020) adaptive learning model, ensuring that the instrument comprehensively captures the key theoretical domains of an adaptive curriculum. This theoretical anchoring provides a strong foundation for content validity, as the items are direct operationalizations of well-defined constructs rather than arbitrary questions (Boateng et al., 2018).

Furthermore, the instrument's relevance and applicability are significantly enhanced by its deliberate contextualization within Indonesia's unique educational landscape. The theoretical models were not applied statically but were reinterpreted through a "human-in-the-loop" lens (Thaariq, 2025) to address specific local realities, such as infrastructural constraints and the central role of cultural diversity. This process of contextualization, informed by empirical

studies on Indonesian education (e.g., Nurtanto et al., 2025; Ulfa et al., 2024), ensures that the items are not only theoretically sound but also meaningful and accessible to the target population of Indonesian teachers. For instance, questions about technology probe the reality of tiered internet access and low-tech workarounds, moving beyond generic assumptions about digital tool availability. This alignment between theory and context is critical for establishing ecological validity, ensuring that the instrument measures constructs as they manifest in the actual environment being studied (Brewer, 2000).

The mixed-methods approach employed in the instrument's development further bolsters its validity. The initial qualitative phase, involving interviews with practitioners, served as a crucial mechanism for item generation and refinement, grounding the theoretical constructs in the lived experiences and language of Indonesian teachers (Creswell & Clark, 2017). This iterative process helps to ensure that the items possess strong face validity and are interpreted by respondents as intended. Consequently, the resulting instrument is not merely a translation of Western theories but a culturally situated tool that offers a more accurate and meaningful diagnosis of teacher readiness. By bridging the gap between abstract theory and concrete practice, this methodology provides researchers and policymakers with a validated, context-sensitive tool capable of generating reliable and actionable insights for advancing educational reform in Indonesia and similar contexts.

Informing Policy and Teacher Professional Development

The primary value of this theoretically-grounded assessment instrument lies in its capacity to transform diagnostic data into precise, actionable insights for both systemic policy interventions and targeted teacher professional development. Unlike generic assessments, the results generated by this tool provide a granular understanding of specific strengths and gaps across the five core constructs, enabling stakeholders to move beyond one-size-fits-all solutions and instead implement tailored strategies that address the root causes of implementation challenges. The data can be visualized as a diagnostic pathway that translates findings into concrete actions, as illustrated below and explained thereafter.

Granular Diagnosis for Targeted Professional Development

The instrument's constructs allow for a precise diagnosis of teacher readiness. For instance, low scores in "Conceptual Understanding" indicate that teachers may be implementing *Kurikulum Merdeka* procedurally without grasping its philosophical underpinnings. This calls for professional development focused on the "why"—through workshops on the theory of adaptive learning and the principles of student autonomy—rather than just the "how.".

In addition, low scores in "Role as 'Adaptive Engine'" reveal a gap in practical pedagogical skills. This necessitates professional development on differentiated instruction techniques, formative assessment strategies, and classroom management for personalized learning environments (Supianto et al., 2024). Teachers need hands-on training in diagnosing student needs and adjusting instruction in real-time.

Lastly, low scores in "Cultural Integration" suggest teachers lack the resources or knowledge to localize content. professional development should then focus on culturally responsive pedagogy, providing teachers with frameworks and exemplars for integrating local wisdom into their subject matter, akin to the REGARD model (Mahadewi et al., 2025).

Evidence-Based Policy Formulation and Resource Allocation

The aggregated data provides compelling evidence for policymakers to make informed equitable decisions. Persistently low scores in "Technological & Infrastructural Readiness" across a region would justify targeted infrastructure investments (e.g., improving internet

connectivity, providing devices) and policies promoting "offline-first" or low-tech adaptive strategies, rather than investing in complex online platforms that remain inaccessible (Nurtanto et al., 2025).

Besides, strong identification of specific "Barriers" (e.g., excessive administrative burden, lack of collaborative planning time) provides direct evidence for policy adjustments at the school or district level, such as revising teacher workload policies or creating professional learning communities (Wijayanti et al., 2024).

At the last, the data can guide equitable resource allocation by identifying disparities between urban and rural schools or between different school types, ensuring that support reaches the most underserved areas first (Thaariq & Wedi, 2020).

Fostering a Culture of Continuous Improvement

The instrument is not a one-off assessment but a tool for fostering a cyclical process of improvement. By administering it periodically, schools and districts can (1) monitor the impact of PD programs and policy changes by tracking changes in scores over time, and (2) empower teachers and school leaders with data about their own contexts, facilitating evidence-based school improvement plans and fostering a culture of reflective practice. In essence, this instrument shifts the focus from a deficit-oriented evaluation of teachers to a systemic, diagnostic approach. It provides a clear roadmap for building teacher capacity and designing supportive policies that are directly responsive to the realities of the Indonesian classroom, thereby closing the critical gap between curriculum policy and effective practice.

A Replicable Model for Other Contexts

The methodological framework presented in this study offers a replicable model for educational researchers and policymakers in other countries across the Global South facing similar challenges of curricular reform, infrastructural constraints, and rich cultural diversity. The core innovation of this approach—the systematic synthesis of globally-established instructional design theories with deep local contextual analysis to create culturally and practically relevant assessment tools—is not limited to the Indonesian context. Instead, it provides a blueprint for developing valid and reliable instruments that can diagnose implementation gaps and inform interventions in varied educational settings (Vavrus & Bartlett, 2013). The persistent tension between globally circulated "best practices" and local realities often leads to the uncritical adoption of models that are misaligned with on-the-ground resources and cultural values, a phenomenon well-documented in international educational development (Altinyelken, 2010; Tabulawa, 2013). This methodology directly addresses this issue by prioritizing contextualization as a fundamental step in the research design process.

Researchers in countries such as Vietnam, Nigeria, or Peru, for instance, could adapt this model by first identifying their own specific "conditions"—such as prevalent use of mobile phones over computers, multilingual classrooms, or specific national curriculum goals—and then reinterpreting the core components of adaptive learning models (Martin et al., 2020) or other relevant theories through that local lens. The process of replacing the technological "adaptive engine" with the teacher, as demonstrated here, is a powerful example of a context-driven modification that is highly applicable to other resource-constrained environments (Selwyn & Facer, 2013). The mixed-methods approach ensures that the resulting instruments are not merely translated but are genuinely grounded in the terminology, experiences, and challenges of local educators, thereby enhancing the validity and utility of the findings (Creswell & Clark, 2017).

By providing a structured yet flexible methodology, this model encourages a shift away from deficit-oriented comparisons with Western systems and instead fosters the creation of endogenous, evidence-based solutions. It empowers local stakeholders to define and measure readiness based on their own priorities and constraints, ultimately contributing to more sustainable and equitable educational improvement efforts across the Global South (Samoff, 1999). The replicability of this model lies in its foundational principle: that effective educational tools are born from the dialogue between universal theoretical principles and particular contextual realities.

V. CONCLUSION

This study has successfully designed and theorized a comprehensive methodological framework for assessing teacher readiness in implementing an adaptive curriculum within the unique context of Indonesia's Kurikulum Merdeka. By systematically synthesizing Reigeluth & Merrill's (1979) instructional variables and Martin et al.'s (2020) adaptive learning model, and reinterpreting them through a "human-in-the-loop" lens, this research has produced a mixed-methods instrument that is both theoretically robust and contextually grounded. The five core constructs—Conceptual Understanding, Technological & Infrastructural Readiness, Role as "Adaptive Engine," Cultural Integration, and Perception of Barriers & Support—provide a holistic diagnostic tool capable of capturing the multifaceted dimensions of teacher readiness. Unlike ad-hoc questionnaires, this instrument ensures content validity, ecological relevance, and practical utility by directly linking each item to established theoretical foundations and localized educational realities.

This study makes a significant theoretical contribution by demonstrating a replicable methodology for contextualizing global educational theories within specific socio-cultural and infrastructural settings. It advances the field of instructional design by illustrating how abstract models can be operationalized into measurable constructs that reflect local priorities and constraints. The repositioning of the teacher as the central "adaptive engine" offers a critical alternative to technocentric paradigms, emphasizing the role of pedagogical expertise and cultural responsiveness in resource-constrained environments. This approach encourages future researchers to prioritize contextual synthesis in instrument development, particularly in non-Western educational systems, thereby promoting more inclusive and equitable theoretical advancements.

The instrument developed in this study offers immediate practical value for Indonesian policymakers, teacher educators, and school administrators. It enables a granular diagnosis of teacher readiness, informing targeted professional development programs that address specific gaps—whether in conceptual understanding, pedagogical skills, or cultural integration. For policymakers, the data generated can guide evidence-based decisions regarding infrastructure investment, resource allocation, and policy support, particularly for underserved regions. Moreover, the instrument serves as a tool for continuous improvement, allowing schools to monitor progress and foster a culture of reflective practice. By bridging the gap between curriculum policy and classroom practice, this framework supports the sustainable implementation of Kurikulum Merdeka and contributes to the broader goal of personalized, equitable education across Indonesia.

Future studies should focus on the empirical validation of this instrument through large-scale quantitative surveys and in-depth qualitative inquiries across diverse Indonesian regions. Further research could also explore its adaptation and application in other Global South contexts facing similar challenges, examining the transferability of the framework and its constructs. Longitudinal studies tracking changes in teacher readiness following targeted

interventions would provide valuable insights into the long-term impact of such diagnostic tools on curriculum implementation and student outcomes.

VI. DECLARATION OF INTEREST STATEMENT

During the preparation of this work the authors used DeepSeek and Concensuss in order to improve writing qualities. After using this tool/service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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