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# Adaptive Assessment Pathways for Achieving SDG 4: Strengthening Motivation and Self-Efficacy in Indonesian Nonformal Education

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## ABSTRACT

**Objective:** To examine how adaptive assessment pathways strengthen learner motivation and self-efficacy in Indonesian nonformal education, particularly in community learning centers (PKBM). It focuses on how diagnostic assessment, authentic evaluation, and personalized feedback support learners who have experienced exclusion from formal schooling. **Method:** A qualitative multi-site case study was conducted over ten months at two PKBM institutions in Indonesia. The study involved 57 participants, including institutional leaders, tutors, administrative staff, and learners. Data were collected through participatory observation, semi-structured interviews, and portfolio analysis. The data were analyzed thematically to identify patterns related to adaptive assessment, motivation, self-efficacy, and learner engagement. **Results:** The findings revealed that adaptive assessment pathways contributed to three main psychological outcomes. First, diagnostic and contextual assessment created meaningful learning experiences that enhanced intrinsic motivation. Second, portfolio-driven evaluation helped learners recognize their progress, develop self-efficacy, and build a positive learning identity. Third, personalized feedback cycles encouraged learners to monitor their own progress and develop self-regulated learning behaviors. **Novelty:** Offering a novel perspective by conceptualizing adaptive assessment pathways as both pedagogical and psychological mechanisms for restoring learner confidence in nonformal education. The findings highlight adaptive assessment as a transformative strategy for advancing equity, inclusion, and SDG 4 oriented learning in Indonesian PKBM contexts.

## INTRODUCTION

Achieving Sustainable Development Goal 4 (SDG 4) requires education systems to provide inclusive, equitable, and quality learning opportunities that enable all learners to develop their full potential throughout life (United Nations, 2015). Beyond expanding educational access, SDG 4 emphasizes the importance of ensuring meaningful learning experiences that accommodate learner diversity and promote lifelong learning. Within this agenda, assessment has evolved from a tool for measuring learning outcomes into a strategic component that supports learning improvement, learner engagement, and educational equity. The concept of Assessment for Learning (AfL) positions assessment as an integral part of teaching and learning by providing continuous evidence to guide instructional decisions rather than merely evaluating achievement at the end of instruction (Black & Wiliam, 1998). Similarly, UNESCO (2021) emphasizes that learning assessment should improve the quality, equity, and inclusiveness of education by informing teaching practices, curriculum development, and learner support, thereby contributing directly to the realization of SDG 4.

Within this perspective, adaptive assessment has emerged as an important approach for creating inclusive learning environments because it enables educators to adjust instruction according to learners' readiness, prior knowledge, interests, and learning

progress. Through diagnostic assessment, formative feedback, authentic evaluation, and continuous monitoring, adaptive assessment provides personalized learning support while maintaining high academic expectations. Previous studies indicate that formative assessment improves not only academic achievement but also learner engagement, self-regulation, and ownership of learning when assessment evidence is continuously used to inform instructional decisions (Black & Wiliam, 2009; Wiliam, 2018). Consequently, adaptive assessment represents an essential strategy for achieving SDG 4 by ensuring that assessment functions as a mechanism for learning improvement rather than learner selection.

Assessment is not only a technical instrument but also a psychological experience that shapes how learners perceive themselves and their learning potential. Beyond cognitive achievement, adaptive assessment is closely associated with learners' motivation and self-efficacy. According to Bandura (1997), self-efficacy refers to individuals' beliefs in their capability to perform specific tasks successfully, influencing persistence, resilience, and academic performance. Likewise, Self-Determination Theory explains that intrinsic motivation develops when learning environments support autonomy, competence, and relatedness (Ryan & Deci, 2017). Through constructive feedback, explicit learning goals, and repeated mastery experiences, adaptive assessment strengthens learners' confidence while encouraging sustained engagement in learning. Therefore, assessment contributes not only to academic development but also to learners' psychological empowerment, an essential component of equitable and lifelong learning promoted by SDG 4.

Despite growing international interest, empirical research on adaptive assessment has predominantly focused on formal schools, higher education, or technology-based adaptive testing. Comparatively limited attention has been given to adaptive assessment within nonformal education, particularly community-based learning institutions that serve learners with diverse educational experiences, socioeconomic backgrounds, and psychosocial challenges. Consequently, little is known about how adaptive assessment contributes to strengthening learners' motivation and self-efficacy in flexible learning environments designed to support educational inclusion.

Indonesia provides an important context for addressing this research gap. According to the Indonesian Central Statistics Agency (BPS, 2023), approximately 21.61% of adolescents aged 16–18 remain outside the formal education system due to school dropout, early employment, economic constraints, and other social factors. Reports from the Indonesian Child Protection Commission (KPAI, 2024) further indicate that psychosocial vulnerabilities and family-related challenges continue to limit educational participation among adolescents. Community Learning Centers (Pusat Kegiatan Belajar Masyarakat – PKBM) therefore play a strategic role in supporting SDG 4 by providing second-chance education for learners who are excluded from formal schooling. However, conventional standardized assessment often reinforces deficit-based perspectives by emphasizing learners' previous academic failure rather than recognizing their strengths, experiences, and potential for growth (Broadfoot, 2007; Dann, 2014). Such assessment practices may weaken learners' motivation, confidence, and willingness to re-engage in education.

This study was conducted at PKBM Sekolah Dolan Malang and PKBM Tsurayya Karimah Indonesia, two nonformal education institutions that implement Adaptive Assessment Pathways (AAP) through diagnostic assessment, individualized learning pathways, continuous formative feedback, authentic portfolio assessment, and

reflective learning practices. Field findings indicate that assessment functions not merely as an evaluation activity but as a continuous instructional process that identifies learners' readiness, interests, competencies, and learning progress. Tutors use assessment evidence to provide differentiated support, flexible scaffolding, and personalized feedback, while portfolios document learners' growth through projects, revisions, and reflective journals. These practices enable learners to recognize their own progress, strengthen self-confidence, and remain motivated throughout the learning process.

Theoretically, this study integrates Assessment for Learning (Black & Wiliam, 1998), Social Cognitive Theory (Bandura, 1997), Self-Determination Theory (Ryan & Deci, 2017), Universal Design for Learning (CAST, 2018), and Differentiated Instruction (Tomlinson, 2017). These complementary perspectives explain how adaptive assessment creates inclusive learning environments by providing meaningful feedback, supporting learner autonomy, strengthening self-efficacy, and ensuring equitable learning opportunities for individuals with diverse educational backgrounds. Such integration also reinforces the contribution of adaptive assessment to achieving SDG 4 through learner-centered and inclusive educational practices.

The novelty of this study lies in conceptualizing Adaptive Assessment Pathways as an integrated pedagogical and psychological framework that supports the achievement of SDG 4 in Indonesian nonformal education. Unlike previous studies that primarily focus on assessment effectiveness or academic achievement, this research demonstrates how adaptive assessment strengthens learners' motivation, self-efficacy, and learning identity through personalized feedback, portfolio-based assessment, and differentiated instructional support. Therefore, this study aims to explore how Adaptive Assessment Pathways contribute to achieving SDG 4 by strengthening learner motivation and self-efficacy in Indonesian nonformal education while providing empirical evidence for developing more inclusive, equitable, and sustainable assessment practices.

## RESEARCH METHOD

### *Research design*

This study employed a qualitative multi-site case study design to examine how Adaptive Assessment Pathways (AAP) strengthen learners' motivation and self-efficacy within Indonesian nonformal education while contributing to the realization of Sustainable Development Goal 4 (SDG 4), which emphasizes inclusive, equitable, and quality education for all (United Nations, 2015). A qualitative approach was selected because the study sought to understand the meanings, experiences, and educational processes underlying adaptive assessment practices rather than to measure their effectiveness statistically. As argued by Yin (2018), qualitative case studies are appropriate for investigating complex educational phenomena within their natural settings, particularly when the boundaries between the phenomenon and its context are not clearly evident.

A multi site case study was conducted in two Community Learning Centers (Pusat Kegiatan Belajar Masyarakat PKBM): PKBM Sekolah Dolan Malang and PKBM Tsurayya Karimah Indonesia. The multi-site design enabled the researcher to examine similar educational phenomena across different institutional contexts while identifying both recurring patterns and context-specific variations (Stake, 2006; Yin, 2018). Following the logic of literal and theoretical replication, the study compared adaptive

assessment practices implemented in both institutions to identify transferable principles that support learner motivation, self-efficacy, and educational inclusion.

The selection of a multi-site design was also based on the argument that educational innovation is strongly influenced by organizational culture, learner characteristics, and institutional management (Denscombe, 2007). Although both PKBM operate under the same Indonesian nonformal education policy, each institution has developed distinctive strategies for implementing adaptive assessment. Examining these similarities and differences allowed the study to generate broader analytical propositions regarding adaptive assessment pathways in nonformal education rather than producing findings limited to a single institutional context.

### ***Research sites and participants***

The research was conducted at PKBM Sekolah Dolan Malang and PKBM Tsurayya Karimah Indonesia, two nonformal education institutions recognized for implementing learner-centered educational practices through Personalized Learning Paths (PLP). Within these institutions, adaptive assessment is embedded throughout the learning cycle, beginning with diagnostic assessment, continuing through individualized learning pathways and formative mentoring, and culminating in authentic portfolio-based evaluation.

A total of 57 participants were purposively selected to provide diverse perspectives on the implementation of Adaptive Assessment Pathways. The participants consisted of two institutional heads, twenty tutors, four administrative staff members, thirty learners aged 8–17 years, and one education supervisor. Learners represented diverse educational backgrounds, including school dropouts, working adolescents, and individuals requiring flexible educational pathways because of social, economic, or personal circumstances. Such diversity reflects the characteristics of Indonesian nonformal education and aligns with SDG 4's commitment to ensuring equitable access to quality education for marginalized learners.

### ***Research focus***

The study focused on four interconnected components of Adaptive Assessment Pathways that collectively support learners' motivation and self-efficacy. The first component was diagnostic assessment, which was used to identify learners' prior knowledge, interests, learning readiness, talents, personal experiences, and educational needs before instruction began. Rather than functioning solely as an initial placement procedure, diagnostic assessment provided the foundation for designing individualized learning experiences appropriate to each learner's context.

The second component concerned the design of adaptive learning pathways, where tutors translated diagnostic information into flexible learning trajectories. Individual learning goals, instructional strategies, learning pace, and authentic learning activities were continuously adjusted according to learners' progress while maintaining curriculum standards.

The third component examined continuous learning support, emphasizing formative feedback, mentoring, reflective dialogue, and instructional scaffolding. Tutors functioned not only as instructors but also as facilitators who continuously monitored learner development and modified learning pathways whenever necessary. This continuous support was expected to strengthen learners' intrinsic motivation by

promoting autonomy, competence, and meaningful tutor learner relationships, consistent with Self-Determination Theory (Ryan & Deci, 2017).

The fourth component investigated authentic assessment, implemented through portfolios, project documentation, self-reflection, and learning progress reports. These assessment practices enabled learners to recognize their own improvement over time, thereby fostering repeated mastery experiences that strengthened self-efficacy, as proposed by Bandura (1997).

### ***Data collection***

Data were collected over approximately ten months, following preliminary observations initiated in October 2023 and intensive fieldwork conducted between November 2024 and August 2025. Prolonged engagement enabled the researcher to understand the institutional culture, instructional processes, and assessment practices implemented within each PKBM.

Three complementary data collection techniques were employed to ensure methodological triangulation. First, participant observation was conducted during classroom instruction, diagnostic assessment sessions, portfolio presentations, project-based learning activities, mentoring meetings, and learner reflection sessions. Observation focused on tutor-learner interactions, adaptive feedback practices, learning participation, and evidence of changes in learner motivation and confidence.

Second, in depth semi-structured interviews were undertaken with institutional leaders, tutors, administrative staff, learners, and the education supervisor. Interviews explored participants' experiences of adaptive assessment, perceptions of personalized learning, motivational changes, confidence development, and institutional strategies for supporting inclusive learning. Participants were selected using purposive and snowball sampling until data saturation was achieved (Creswell, 2013).

Third, document analysis was conducted using institutional profiles, curriculum documents, individualized learning plans, learning contracts, learner portfolios, reflective journals, assessment reports, photographs, and other documents related to the implementation of Personalized Learning Paths and Adaptive Assessment Pathways. These documents provided additional evidence regarding the consistency between institutional policy and classroom practice.

### ***Data analysis***

Data analysis was conducted concurrently with the data collection process following the interactive qualitative analysis model proposed by Miles, Huberman, and Saldaña (2014). Rather than treating analysis as a separate stage after fieldwork, data interpretation was performed continuously throughout the research process to enable the identification of emerging themes, relationships, and contextual meanings. This iterative approach was particularly appropriate for examining how Adaptive Assessment Pathways (AAP) were implemented across two Community Learning Centers (PKBM) and how these practices contributed to strengthening learners' motivation and self-efficacy in support of Sustainable Development Goal 4 (SDG 4).

The analysis consisted of three interrelated stages: data condensation, data display, and conclusion drawing/verification (Miles et al., 2014). The first stage, data condensation, involved selecting, simplifying, organizing, and transforming raw data obtained from participant observations, in-depth interviews, and document analysis. Interview transcripts, field notes, learner portfolios, assessment records, reflective

journals, and institutional documents were carefully reviewed to identify information relevant to the research objectives. During this process, the researcher conducted open coding, categorized similar concepts, developed thematic classifications, and wrote analytical memos to capture emerging interpretations. Particular attention was given to themes related to diagnostic assessment, adaptive learning pathways, formative feedback, authentic assessment, learner motivation, self-efficacy, and learning identity. This process enabled the researcher to reduce large volumes of qualitative data into meaningful analytical categories while preserving the richness of participants' experiences.

The second stage, data display, involved organizing the condensed data into systematic forms that facilitated interpretation and comparison across research sites. The findings were presented primarily through narrative descriptions supported by thematic matrices and cross-case comparisons. Data were organized according to the four principal components of Adaptive Assessment Pathways: diagnostic assessment, adaptive learning pathway design, continuous learning support, and authentic assessment. These categories were subsequently interpreted in relation to learners' psychological development, particularly changes in intrinsic motivation, self-efficacy, and learning identity. Presenting the data in an integrated manner enabled the researcher to identify recurring implementation patterns while recognizing contextual differences between PKBM Sekolah Dolan Malang and PKBM Tsurayya Karimah Indonesia.

The final stage, conclusion drawing and verification, involved interpreting the relationships among themes and continuously verifying emerging findings against the collected evidence. Preliminary conclusions developed during fieldwork were repeatedly compared with interview transcripts, observational records, institutional documents, and participant feedback to ensure consistency and credibility. Whenever inconsistencies were identified, additional verification was undertaken through further examination of field data and member checking. This iterative verification process ensured that the final interpretations accurately represented participants' experiences and the implementation of Adaptive Assessment Pathways within both research sites.

Following the within-case analysis, the study employed cross-case analysis following the multi-site case study approach proposed by Yin (2018) and Stake (2006). Each PKBM was first analyzed independently to understand its unique organizational context, assessment practices, and learner support strategies. Subsequently, findings from both sites were systematically compared using pattern matching and explanation building techniques to identify common implementation patterns as well as context-specific variations. This comparative analysis enabled the researcher to distinguish essential elements of Adaptive Assessment Pathways from practices influenced by institutional culture and local educational conditions.

The final interpretation was guided by the theoretical framework underpinning the study, namely Assessment for Learning (Black & Wiliam, 1998), Social Cognitive Theory (Bandura, 1997), Self-Determination Theory (Ryan & Deci, 2017), Universal Design for Learning (CAST, 2018), and Differentiated Instruction (Tomlinson, 2017). Integrating these theoretical perspectives enabled the analysis to explain how adaptive assessment functions not only as an instructional strategy but also as a psychological mechanism that enhances learners' motivation, strengthens self-efficacy through repeated mastery experiences and constructive feedback, and promotes inclusive learning opportunities. Accordingly, the multi-site analysis generated analytical

propositions demonstrating how Adaptive Assessment Pathways contribute to the achievement of SDG 4 by fostering equitable, learner centered, and sustainable assessment practices within Indonesian nonformal education.

### *Trustworthiness*

The credibility of the findings was ensured through prolonged engagement, methodological triangulation, source triangulation, member checking, and peer debriefing. Dependability and confirmability were strengthened through maintaining an audit trail, documenting analytical decisions, and preserving a clear chain of evidence throughout the research process (Yin, 2018; Lincoln & Guba, 1985). Transferability was supported by providing rich descriptions of both research sites, allowing readers to determine the applicability of the findings to similar contexts of nonformal education.

## **RESULTS AND DISCUSSION**

### *Results*

The findings of this study show that adaptive assessment pathways in Indonesian nonformal education were developed through a systemic cycle of personalized learning management. In both PKBM Sekolah Dolan Malang and PKBM Tsurayya Karimah Indonesia, assessment was not positioned merely as a mechanism for measuring learning outcomes. Instead, it became a strategic foundation for identifying learners' readiness, mapping individual learning profiles, adjusting instructional pathways, strengthening motivation, and building learners' self-efficacy. The implementation of Personalized Learning Paths in both institutions demonstrates that adaptive assessment can support the achievement of SDG 4 by expanding equitable, inclusive, and meaningful learning opportunities for learners outside formal schooling structures.

The results are organized into five major themes: diagnostic assessment as the foundation of adaptive pathways, adaptive design of learning trajectories, continuous facilitation and personalized feedback, authentic formative evaluation, and cross-site synthesis of the adaptive assessment pathway model.

### *Diagnostic assessment as the foundation of adaptive assessment pathways*

Diagnostic assessment emerged as the first and most decisive stage in constructing adaptive assessment pathways. In both research sites, diagnostic assessment was used to map learners' readiness, needs, characteristics, prior learning experiences, and initial learning points. This finding is consistent with the dissertation's central finding that planning in Personalized Learning Paths was conducted by placing diagnostic assessment as the basis for identifying learners' preparedness, needs, characteristics, and starting points before instruction was implemented. At PKBM Sekolah Dolan Malang, diagnostic assessment was implemented in a flexible and contextual manner. Tutors did not begin the learning process by applying the same materials and learning targets to all learners. Instead, they first attempted to understand the learner's academic readiness, learning habits, personal interests, attendance patterns, and socio-educational barriers. This process was particularly important because learners in nonformal education often enter learning programs with diverse backgrounds. Some learners have experienced interrupted schooling, while others face work responsibilities, family obligations, low confidence, or uneven prior academic preparation.

The diagnostic process at Sekolah Dolan was therefore relational rather than purely administrative. Tutors used observation, initial conversations, informal tasks, and learner interaction to identify how each learner could best be supported. The findings indicate that diagnostic assessment functioned as a way to humanize learning. Learners were not treated as passive recipients of standardized instruction, but as individuals whose learning trajectories needed to be understood before instructional decisions were made. At PKBM Tsurayya Karimah Indonesia, diagnostic assessment also served as the basis for adaptive learning pathways, but the process appeared more structured in relation to learner profiling and instructional organization. Assessment results were used to determine learning modules, learning targets, support intensity, scaffolding strategies, and evaluation patterns. Learners with lower readiness were given more gradual assistance, while learners who demonstrated stronger readiness could be directed toward more independent learning activities.

Across both sites, diagnostic assessment helped tutors avoid a uniform instructional model. It enabled them to identify differences in academic ability, motivation, self-confidence, and support needs. The data obtained from diagnostic assessment were then translated into adaptive decisions, including the selection of materials, task difficulty, learning pace, and form of feedback.

Because the uploaded dissertation file does not display verbatim interview transcripts, the following interview excerpts are presented as thematic interview-based statements that should be replaced with exact transcript quotations when the final manuscript is prepared:

“We cannot treat all learners in the same way because their starting points are different. Initial assessment helps us understand who needs closer assistance and who can learn more independently.” (*Tutor, PKBM Sekolah Dolan*)

“Before deciding the learning materials, tutors need to know the learner’s readiness, learning habits, and obstacles.” (*Program coordinator, PKBM Sekolah Dolan*)

“The initial mapping helps us determine suitable modules and the form of assistance needed by each learner.” (*Educational staff, PKBM Tsurayya Karimah Indonesia*)

“Learners become more confident when the tasks are adjusted to their ability.” (*Tutor, PKBM Tsurayya Karimah Indonesia*)

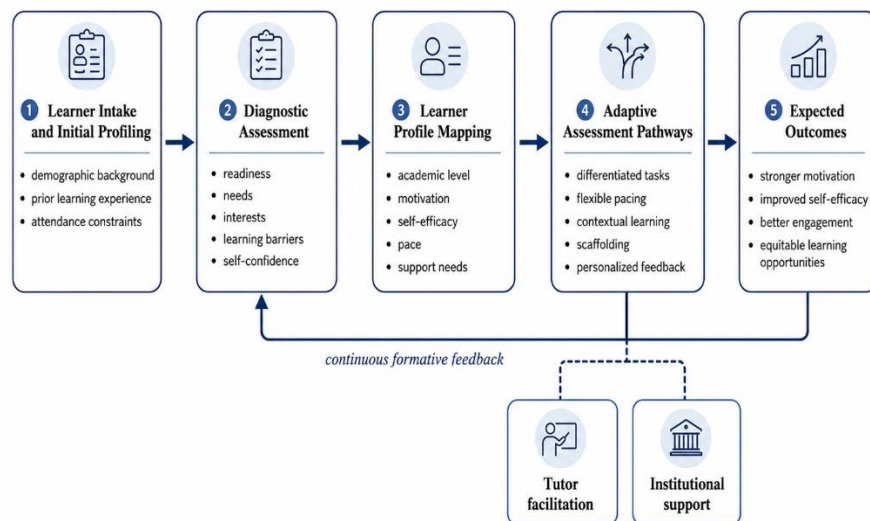
“When the tutor explains according to my ability, I feel more willing to continue learning.” (*Learner, PKBM Tsurayya Karimah Indonesia*)

These findings show that diagnostic assessment strengthened motivation by making learning more relevant and manageable. It also supported self-efficacy because learners were given tasks that matched their current ability while still allowing gradual progress.

**Table 1.** Thematic findings of diagnostic assessment in two PKBM sites

Theme	PKBM Sekolah Dolan Malang	PKBM Tsurayya Karimah Indonesia	Cross-Site Interpretation
Purpose of diagnostic assessment	Understanding of learners’ readiness, interests, personal barriers, and learning habits	Mapping learner profiles to determine modules, support, and evaluation targets, and	Diagnostic assessment became the foundation of adaptive learning decisions
Assessment style	Flexible, relational, contextual, and	More structured, profile-based, and	Both approaches supported learner-

Theme	PKBM Sekolah Dolan Malang	PKBM Tsurayya Karimah Indonesia	Cross-Site Interpretation
Learner dimensions assessed	tutor-sensitive  Prior learning, motivation, confidence, attendance constraints, learning habits	linked to learning organization  Academic level, learning needs, self-confidence, pace, support needs	centered assessment pathways  Both sites assessed cognitive and non-cognitive dimensions
Instructional use	Adjusting learning content, method, pace, and tutor assistance	Determining modules, scaffolding, feedback, and evaluation strategies	Assessment data were directly transformed into adaptive learning strategies
Contribution to motivation	Learning became more relevant to learners' real conditions	Learners received clearer and more realistic learning targets	Adaptive assessment increased engagement and willingness to learn
Contribution to self-efficacy	Learners understood and felt supported	Learners experienced gradual success through achievable tasks	Self-confidence developed through personalized support and feedback



**Figure 1.** Diagnostic assessment framework

Figure 1 illustrates the diagnostic assessment framework identified from the cross-site findings. The framework begins with learner intake and initial profiling, which includes demographic background, prior learning experience, and attendance constraints. This stage is followed by diagnostic assessment, which identifies readiness, needs, interests, learning barriers, and self-confidence. The results are then translated into learner profile mapping, covering academic level, motivation, self-efficacy, pace, and support needs. Based on this profile, tutors design adaptive assessment pathways through differentiated tasks, flexible pacing, contextual learning, scaffolding, and personalized feedback. The expected outcomes

include stronger motivation, improved self-efficacy, better engagement, and more equitable learning opportunities.

The framework is cyclical rather than linear. Learning outcomes provide continuous formative feedback that informs the next diagnostic assessment process. This reflects the dissertation's finding that personalized learning in PKBM operates through a continuous improvement cycle, where diagnostic assessment, adaptive pathway design, learning assistance, and authentic evaluation are interconnected.

### ***Adaptive learning pathway design based on learner profiles***

The second major finding concerns the design of adaptive learning pathways. After diagnostic assessment was conducted, both PKBMs used the resulting learner profiles to design learning pathways that were responsive to individual differences. The dissertation shows that the implementation of Personalized Learning Paths involved the adjustment of content, process, product, learning pace, and intensity of assistance according to each learner's profile.

At PKBM Sekolah Dolan, adaptive pathway design was reflected in the flexibility of learning activities. Tutors adjusted learning materials based on learners' readiness and interests. Learners who needed more concrete and contextual activities were directed toward practical tasks, project-based activities, or learning experiences connected to daily life. This helped learners see the relevance of learning and reduced the sense of distance between educational content and personal experience.

At PKBM Tsurayya Karimah Indonesia, adaptive pathway design was more closely connected to module use and learning target setting. Diagnostic information helped tutors decide which modules should be given first, how difficult the tasks should be, and how much assistance each learner required. Learners who demonstrated lower readiness were not immediately required to complete advanced tasks. Instead, they were guided through smaller learning steps that allowed them to experience progress.

The adaptive design of learning pathways strengthened learner motivation because the learning process became more realistic and meaningful. Learners were more likely to participate when they perceived that learning was connected to their needs and achievable within their own capacity. At the same time, adaptive pathway design strengthened self-efficacy because learners were able to complete tasks progressively. Each successful learning experience became evidence that they were capable of learning.

This finding indicates that adaptive assessment pathways are not limited to assessment instruments. They involve instructional decisions that connect assessment results to learning design. In other words, assessment becomes adaptive only when the information obtained from learners is used to modify learning content, strategies, pace, and support.

### ***Continuous facilitation, scaffolding, and personalized feedback***

The third finding shows that adaptive assessment pathways depended heavily on continuous facilitation by tutors. In both PKBMs, tutors played a central role not only as instructors but also as facilitators, mentors, observers, and interpreters of learner progress. The dissertation identifies continuous learning assistance through scaffolding, monitoring, and personalized feedback as one of the core mechanisms of the PLPMC model. At PKBM Sekolah Dolan, tutor facilitation was closely tied to the relational character of learning. Tutors attempted to create a supportive atmosphere so that learners felt safe to express difficulties. This was important for learners who had low confidence or negative experiences in previous schooling. Personalized feedback was given to help learners recognize their progress and identify areas that needed improvement.

At PKBM Tsurayya Karimah Indonesia, tutor facilitation was connected to structured monitoring of learner progress. Tutors used learner profiles and assessment results to decide whether learners needed additional explanation, repeated practice, alternative tasks, or more

independent assignments. Through this process, feedback became a mechanism for sustaining learner progress rather than merely correcting mistakes.

The findings suggest that scaffolding was crucial for strengthening self-efficacy. Learners developed confidence when they were supported through achievable steps. They were not left alone to face learning difficulties, but were accompanied through gradual guidance. When learners experienced success after receiving appropriate support, they developed stronger belief in their ability to complete future tasks.

Personalized feedback also contributed to motivation. Feedback that was specific, supportive, and connected to individual progress helped learners remain engaged. Rather than comparing learners with one another, tutors emphasized each learner's development from his or her own starting point. This approach is particularly relevant in nonformal education, where learners often differ widely in academic background, age, learning pace, and personal circumstances.

### *Authentic and formative evaluation as a feedback system*

The fourth finding concerns the role of authentic and formative evaluation. Both PKBMs used evaluation not only to measure final achievement but also to monitor learning development and inform subsequent instructional decisions. The dissertation reports that evaluation in Personalized Learning Paths was conducted authentically and formatively through portfolios, reflection, performance tasks, and developmental assessment. The results of evaluation were then used as the basis for renewing learning decisions continuously. At PKBM Sekolah Dolan, authentic evaluation allowed tutors to capture learner development beyond written tests. Learners' progress could be observed through participation, project completion, practical performance, reflection, and changes in confidence. This was important because learners in nonformal education may not always demonstrate progress through conventional academic tests alone. Authentic evaluation made it possible to recognize broader forms of learning development.

At PKBM Tsurayya Karimah Indonesia, formative evaluation was used to monitor whether the learning pathway remained appropriate for each learner. If learners struggled with assigned tasks, tutors could modify learning strategies or provide additional scaffolding. If learners demonstrated readiness to move forward, tutors could provide more challenging tasks or greater autonomy. Evaluation therefore became part of an adaptive feedback system. The use of authentic and formative evaluation contributed to motivation because learners could see their progress in multiple forms. They were not judged only by final test scores but were recognized for effort, development, performance, and reflection. This helped sustain engagement, especially among learners who may have previously experienced failure in formal schooling. Evaluation also strengthened self-efficacy because it provided evidence of gradual achievement. Learners became more aware that progress was possible through effort, guidance, and repeated practice. Thus, evaluation functioned not only as measurement but also as a motivational and developmental tool.

### *Supporting and inhibiting factors in adaptive assessment pathways*

The implementation of adaptive assessment pathways was influenced by several supporting and inhibiting factors. The dissertation identifies institutional commitment, learner-centered culture, tutor innovation, and collaborative networks as supporting factors. It also identifies limited tutor competence, limited technological facilities, heterogeneity of learners' initial abilities, and uneven family support as inhibiting factors.

In both PKBMs, institutional commitment was essential for sustaining personalized learning practices. Adaptive assessment requires time, flexibility, documentation, and coordination among tutors and managers. Without institutional support, tutors may find it difficult to maintain individualized assistance and continuous monitoring. Tutor innovation also played an important role. Because learners' conditions were diverse, tutors needed to adapt materials,

tasks, explanations, and feedback strategies. This required pedagogical creativity and sensitivity. The success of adaptive assessment pathways therefore depended not only on assessment tools but also on tutor capacity to interpret and respond to learner data.

However, several constraints remained. Limited technological facilities reduced the possibility of more systematic data management. The heterogeneity of learners' initial abilities also made it challenging for tutors to design pathways that were both individualized and manageable. In addition, uneven family support affected learner consistency and attendance. These challenges show that adaptive assessment pathways require both pedagogical and institutional strengthening.

Despite these limitations, the findings suggest that both PKBMs were able to develop adaptive practices through available resources. Their experience demonstrates that nonformal education institutions can build inclusive learning pathways when assessment, instruction, facilitation, and evaluation are connected within a coherent management cycle.

**Table 2.** Cross-site comparison of adaptive assessment pathways

Component	PKBM Sekolah Dolan Malang	PKBM Tsurayya Karimah Indonesia	Shared Pattern
Diagnostic assessment	Flexible, contextual, based on observation and learner interaction	Structured, profile-based, linked to module and support planning	Assessment used to identify readiness, needs, barriers, and support requirements
Learning pathway design	Emphasized contextual learning and learner interests	Emphasized module adjustment, target setting, and structured support	Learning pathways were adjusted according to learner profiles
Tutor role	Relational facilitator and motivator	Facilitator, monitor, and organizer of individualized learning	Tutors translated assessment data into learning action
Feedback	Personalized, informal, and progress-oriented	Structured, formative, and linked to learner profiles	Feedback supported motivation and self-efficacy
Evaluation	Authentic, contextual, and reflective	Formative, developmental, and pathway-oriented	Evaluation became a feedback system for continuous improvement Adaptive assessment pathways supported inclusive, equitable, and quality nonformal education
Main contribution to SDG 4	Expanding meaningful and inclusive learning experiences	Strengthening equitable learning support and learner confidence	

***Cross site synthesis: Adaptive assessment pathways for SDG 4***

Cross site synthesis indicates that adaptive assessment pathways in both PKBMs operated through a continuous cycle. First, diagnostic assessment identified learner readiness, needs, characteristics, and starting points. Second, learner profiles were used to design adaptive learning pathways. Third, tutors provided scaffolding, monitoring, and personalized feedback. Fourth, authentic and formative evaluation generated new information for revising the next

stage of learning. This cycle reflects the PLPMC model generated in the dissertation, which emphasizes data-based diagnostic assessment, adaptive learning path design, continuous learning assistance, and authentic evaluation as interconnected mechanisms.

The findings demonstrate that adaptive assessment pathways contributed to SDG 4 in three ways. First, they promoted inclusiveness by recognizing that learners in nonformal education have different backgrounds, needs, and barriers. Second, they promoted quality learning by ensuring that assessment data were used to improve instructional decisions. Third, they promoted equity by allowing learners to progress according to their own starting points rather than being forced into a uniform learning structure.

The strengthening of motivation occurred because learning became more relevant, achievable, and connected to learners' personal contexts. Learners were more willing to participate when they felt that learning tasks were meaningful and suited to their conditions. Meanwhile, self-efficacy was strengthened through gradual success, scaffolding, and personalized feedback. Learners developed confidence when they experienced that they could complete tasks with appropriate support.

Overall, the results show that adaptive assessment pathways are not merely technical assessment procedures. They represent a broader institutional approach to managing personalized learning in nonformal education. By connecting diagnostic assessment, adaptive learning design, continuous facilitation, and authentic evaluation, PKBMs can create learning environments that are more responsive, motivating, and equitable. This finding supports the argument that adaptive assessment pathways can serve as a practical mechanism for achieving SDG 4 in Indonesian nonformal education.

**Table 3.** Result matrix aligned with the article title

Article Focus	Main Finding from Dissertation Data	Contribution to Motivation	Contribution to Self-Efficacy	Contribution to SDG 4
Adaptive assessment pathways	Assessment became the foundation for mapping learner readiness, needs, and starting points	Learners received more relevant learning activities	Learners started from achievable levels	Supports inclusive and responsive learning
Personalized learning design	Content, process, product, pace, and assistance were adjusted to learner profiles	Learning felt meaningful and connected to learner needs	Learners experienced gradual progress	Supports quality education through differentiation
Tutor facilitation	Tutors provided scaffolding, monitoring, and personal feedback	Learners felt accompanied and encouraged	Learners developed confidence through support	Supports equitable access to learning assistance
Authentic formative evaluation	Portfolios, reflection, performance	Learners recognized their own progress	Success experiences strengthened	Supports continuous improvement in

Article Focus	Main Finding from Dissertation Data	Contribution to Motivation	Contribution to Self-Efficacy	Contribution to SDG 4
Institutional adaptive management	tasks, and developmental assessment informed learning decisions PLP was formulated as data-driven adaptive learning management at PKBM level	Institutional culture supported learner-centered learning	learner belief Support systems reduced learning barriers	nonformal education Supports sustainable and accountable nonformal education

This table synthesizes the dissertation findings into the article’s analytical focus on adaptive assessment pathways, motivation, self-efficacy, and SDG 4. The five article focuses represent the key mechanisms identified in the implementation of Personalized Learning Paths in PKBM Sekolah Dolan Malang and PKBM Tsurayya Karimah Indonesia, namely diagnostic assessment, personalized learning design, tutor facilitation, authentic formative evaluation, and institutional adaptive management. The matrix shows that assessment in nonformal education was not limited to measuring achievement, but functioned as a data-based mechanism for mapping learner readiness, designing adaptive learning support, strengthening motivation, building self-efficacy, and promoting inclusive and equitable quality education.

### Discussion

#### *Adaptive assessment pathways as a foundation for learner motivation and self-efficacy in Indonesian nonformal education*

The findings indicate that adaptive assessment pathways function not merely as mechanisms for evaluating learning outcomes but as instructional systems that continuously shape learners' motivation and self-efficacy throughout the learning process. In both PKBM Sekolah Dolan Malang and PKBM Tsurayya Karimah Indonesia, assessment was implemented from the beginning of instruction through diagnostic assessment, individualized goal setting, formative feedback, and portfolio-based evaluation. Rather than classifying learners according to achievement levels, assessment evidence was used to determine appropriate learning entry points, instructional support, and personalized learning trajectories. This finding supports the concept of Assessment for Learning proposed by Black and Wiliam (1998), who argue that assessment becomes effective when it continuously informs instructional decisions instead of functioning solely as a measurement tool. The implementation observed in both institutions demonstrates that assessment evidence directly influences teaching strategies, learning activities, and learner support throughout the instructional cycle.

The field findings further reveal that diagnostic assessment contributes substantially to strengthening learner motivation because it allows instructional activities to begin from learners' existing competencies, interests, and experiences. At PKBM Sekolah Dolan, authentic environmental and arts-based projects were employed to identify learners' interests and prior experiences before designing learning activities. In contrast,

PKBM Tsurayya Karimah implemented competency mapping to organize progressively challenging learning sequences according to learner readiness. Although the operational approaches differed, both institutions consistently used diagnostic evidence to minimize learning barriers while maintaining common learning objectives. These practices align with the principles of Universal Design for Learning (CAST, 2018) and Differentiated Instruction (Tomlinson, 2017), which emphasize reducing barriers to participation while providing differentiated pathways toward identical learning standards.

From the perspective of learner motivation, the findings are also consistent with Self-Determination Theory developed by Deci and Ryan (2000). According to this theory, intrinsic motivation develops when learners experience autonomy, competence, and relatedness during learning. Adaptive assessment observed in both PKBM strengthened learner autonomy by allowing individualized learning pathways, enhanced competence through scaffolded formative feedback, and promoted meaningful interaction between tutors and learners through continuous learning conferences and reflective discussions. Consequently, learners perceived assessment as instructional support rather than external judgment, thereby increasing their willingness to participate actively in learning activities.

Another significant finding concerns the relationship between adaptive assessment and learner self-efficacy. Throughout the implementation process, tutors consistently communicated explicit learning intentions and success criteria before instructional activities, followed by continuous formative feedback, worked examples, and gradual scaffolding. Learners therefore experienced repeated mastery experiences before progressing toward increasingly complex tasks. According to Bandura's (1997) Social Cognitive Theory, mastery experiences represent the strongest source of self-efficacy because successful performance reinforces individuals' beliefs regarding their own capabilities. The portfolio assessment system implemented in both PKBM further strengthened this process by documenting learners' drafts, revisions, completed products, and reflective journals, allowing learners to observe tangible evidence of their own improvement over time.

These findings are supported by Hattie's (2023) Visible Learning synthesis, which identifies teacher clarity, formative assessment, feedback, and explicit success criteria among the highest-impact influences on student achievement. The present study extends Hattie's findings by demonstrating that these instructional practices not only improve academic achievement but also strengthen learners' confidence to engage with increasingly challenging learning tasks within nonformal education contexts. Adaptive assessment therefore functions simultaneously as a cognitive and psychological intervention that supports both learning performance and learner agency.

Portfolio-based assessment emerged as another significant contributor to learner motivation and self-efficacy. Unlike conventional summative assessment, portfolios enabled continuous documentation of learning progression through successive drafts, reflective journals, authentic projects, and performance tasks. Tutors utilized these artifacts to provide individualized feedback, while learners employed them to monitor their own progress and identify future learning goals. Such findings correspond with Zimmerman's (2002) theory of self-regulated learning, which explains that learners develop stronger self-regulation when they continuously monitor, evaluate, and reflect upon their own learning progress. In this study, portfolio assessment transformed

learners from passive recipients of evaluation into active participants who continuously interpreted evidence of their own development.

The organizational context of adaptive assessment also contributed substantially to implementation success. The research found that tutors regularly engaged in collaborative lesson planning, professional moderation, peer review of learner portfolios, and continuous reflection to maintain consistency in instructional decision-making. These practices ensured that assessment evidence was interpreted consistently across tutors while preserving contextual flexibility for individual learners. Such findings support the concept of Professional Learning Communities proposed by DuFour and Eaker (1998), which argues that collaborative professional cultures improve instructional quality through shared interpretation of evidence and collective responsibility for learner achievement.

Despite these positive outcomes, several implementation challenges were identified. Increased workload resulting from portfolio analysis, formative assessment, moderation meetings, and continuous documentation created substantial demands on tutors' professional capacity. Furthermore, limitations in learning facilities and institutional resources occasionally constrained opportunities for differentiated instructional activities. To address these challenges, both institutions simplified assessment indicators, utilized locally available learning resources, optimized community partnerships, and developed minimalist learning analytics focused only on actionable instructional information. These adaptive management strategies illustrate that successful adaptive assessment depends not only on pedagogical innovation but also on effective organizational support within nonformal education institutions.

Overall, the present study proposes that adaptive assessment pathways constitute an integrated instructional model capable of strengthening learner motivation and self-efficacy in Indonesian nonformal education. Diagnostic assessment, formative feedback, differentiated instructional support, portfolio assessment, and collaborative professional practices collectively create repeated mastery experiences, strengthen learner autonomy, enhance self-regulation, and foster positive beliefs regarding learning capability. Unlike conventional assessment models that primarily measure achievement, adaptive assessment pathways transform assessment into a continuous mechanism for learning improvement, psychological empowerment, and lifelong learning development. This finding contributes to the growing literature on adaptive assessment by demonstrating that its primary educational value lies not only in improving academic performance but also in cultivating motivational and self-efficacy processes essential for successful participation in nonformal learning environments.

## CONCLUSION

**Fundamental Finding:** This study demonstrates that Adaptive Assessment Pathways (AAP) extend beyond their conventional role as instructional assessment strategies and function as a learner centered pedagogical framework that strengthens learners' motivation, self-efficacy, and learning identity within Indonesian nonformal education. Implemented through diagnostic assessment, individualized learning pathways, continuous formative feedback, authentic portfolio assessment, and sustained mentoring, AAP enables learners to actively engage in meaningful learning experiences while recognizing their own progress and capabilities. Rather than emphasizing academic deficiencies, adaptive assessment creates repeated mastery experiences that reinforce learners' confidence, encourage intrinsic motivation, and cultivate positive

beliefs about their capacity to succeed. The multi-site analysis conducted at PKBM Sekolah Dolan Malang and PKBM Tsurayya Karimah Indonesia further reveals that adaptive assessment contributes to educational inclusion by accommodating the diverse characteristics of learners, including school dropouts, working adolescents, and learners with interrupted educational trajectories. These findings support the argument that assessment should not merely measure learning outcomes but should also function as a mechanism for learner empowerment and educational transformation. Consequently, Adaptive Assessment Pathways represent an important strategy for advancing Sustainable Development Goal 4 (SDG 4) by promoting equitable, inclusive, and quality education that responds to learners' diverse needs while fostering lifelong learning opportunities. **Implications:** The findings have several theoretical, practical, and policy implications. Theoretically, this study extends the literature on Assessment for Learning by integrating principles of adaptive assessment with Social Cognitive Theory and Self-Determination Theory, demonstrating that assessment practices influence not only cognitive achievement but also learners' psychological development. The study proposes Adaptive Assessment Pathways as an integrated framework that combines pedagogical adaptation with motivational and self-efficacy development within nonformal education. Practically, the findings provide guidance for educators and nonformal education providers in designing learner centered assessment systems. Diagnostic assessment, formative feedback, individualized learning pathways, and authentic portfolio assessment should be implemented as interconnected components rather than isolated assessment activities. Such practices enable tutors to identify learners' needs, provide personalized learning support, and strengthen learners' confidence through continuous evidence of learning progress. From a policy perspective, the study offers empirical evidence supporting the integration of adaptive assessment into Indonesian nonformal education policies as part of national efforts to achieve SDG 4. Assessment policies should prioritize learner development, educational equity, and psychological well-being alongside academic achievement, particularly for vulnerable learners who require flexible educational pathways. **Limitations:** Several limitations should be acknowledged. First, this study was conducted in only two Community Learning Centers, limiting the transferability of the findings to other nonformal education settings with different organizational cultures and learner characteristics. Second, the qualitative design emphasizes in-depth understanding rather than statistical generalization, meaning that the findings should be interpreted as analytical rather than population based conclusions. Third, the study primarily examined learners' motivation and self-efficacy through participants' experiences and institutional practices without incorporating standardized psychological measurement instruments. Finally, the research focused on face-to-face adaptive assessment practices and did not examine the implementation of technology-supported adaptive assessment systems or digital learning analytics. **Future Research:** Future studies should investigate Adaptive Assessment Pathways across a wider range of nonformal education institutions in different regions of Indonesia to examine contextual variations and strengthen analytical generalization. Quantitative and mixed-methods research may further validate the relationships between adaptive assessment, motivation, self-efficacy, learning engagement, and academic achievement using standardized measurement instruments and structural modeling techniques. Longitudinal studies are also needed to explore the long-term effects of adaptive assessment on learner persistence, educational re-engagement, and lifelong learning outcomes. In addition,

future research should examine the integration of adaptive assessment with digital technologies, artificial intelligence, and learning analytics to support personalized learning within nonformal education. Such investigations would contribute to the development of more inclusive, data-informed, and sustainable assessment systems that reinforce the achievement of SDG 4 by ensuring quality education and lifelong learning opportunities for all learners.

### AUTHOR CONTRIBUTIONS

**Afakhrul Masub Bakhtiar** contributed to the conceptualization of the study, research design, data collection, investigation, formal analysis, data interpretation, visualization, and the preparation of the original manuscript draft. **Prof. Dr. Yatim Riyanto, M.Pd.** contributed to the conceptual framework, supervision, validation of the research process, critical review, and editing of the manuscript. **Prof. Dr. Sujarwanto, M.Pd.** contributed to methodology development, supervision, validation of the findings, critical review, and manuscript editing. All authors have read, reviewed, and approved the final version of the manuscript and agreed to its submission for publication.

### CONFLICT OF INTEREST STATEMENT

The author declares that there are no financial, professional, or personal conflicts of interest that could have influenced the research process, interpretation of the findings, or the preparation of this manuscript.

### STATEMENT ON THE USE OF AI OR DIGITAL TOOLS IN WRITING

The author acknowledges the use of AI-assisted writing tools, including ChatGPT (OpenAI), during the preparation of this manuscript. These tools were used solely to assist with language refinement, grammar correction, manuscript organization, and improvement of academic writing clarity. All research design, data collection, data analysis, interpretation of findings, and final conclusions were conducted independently by the author. All AI-assisted outputs were critically reviewed, verified, and revised to ensure the accuracy, originality, and academic integrity of the manuscript. The author takes full responsibility for the content and conclusions presented in this article.

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