Journal of Nonformal Education
Vol. 11, No. 1 (2025) 153-168

p-ISSN 2442-532X | e-ISSN 2528-4541
https://journal.unnes.ac.id/journals/jone

Beyond Traditional Testing: Exploring the Efficacy of Adaptive Assessments in Shaping Future Learners

Moses Adeleke Adeoye[1]*, Entika Fani Prastikawati[2], Rika Riwayatiningsih[3]

[1]Al-Hikmah University Ilorin, Nigeria
[2]Universitas PGRI Semarang, Indonesia
[3]Universitas Nusantara PGRI Kediri, Indonesia

*Email: princeadelekm@gmail.com

Submitted: 2024-09-10. Revised: 2024-10-15. Accepted: 2024-11-16.

Abstract

Background: The rise of adaptive assessment tools represents a significant shift in educational evaluation methods.
Research Objectives: This study investigates the impact of adaptive assessment tools on student learning outcomes, engagement, and knowledge retention compared to traditional assessment methods.
Research Method: The research employs a descriptive survey design, utilising a quantitative approach to gather data from 200 students across various educational settings in Kwara State, Nigeria. The primary research questions explore how adaptive assessments influence knowledge retention and engagement levels and identify areas needing additional support. By focusing exclusively on students as respondents, the study provides reliable data that elucidates the effectiveness of adaptive assessments in enhancing knowledge retention and engagement within educational settings.
Research Findings: The findings revealed that adaptive assessments significantly improved knowledge retention, as indicated by mean scores above the established cutoff of 3.0 across all survey items. Students reported high engagement, motivation, and clarity regarding their learning needs when using adaptive tools. In contrast, traditional assessments received significantly lower scores, indicating limited effectiveness in fostering positive learning experiences.
Conclusion: The study concluded that adaptive assessment tools provide a more personalized and hands-on approach to student learning, enhancing knowledge retention and engagement outcomes. It is recommended that educators integrate adaptive assessments into their curricula to maximize student learning potential. Policymakers should consider supporting adaptive technologies in educational institutions to enhance the overall learning experience.
Novelty/Originality/Value: This study contributes to the theoretical understanding of personalized learning approaches and offers empirical evidence supporting the effectiveness of adaptive assessment in contemporary education.

***Keywords*:** Adaptive Assessment, Learning Approach, Learning Needs, Traditional Assessment

How to Cite:

Adeoye, M. A., Prastikawati, E. F., & Riwayatiningsih, R. (2025). Beyond Traditional Testing: Exploring the Efficacy of Adaptive Assessments in Shaping Future Learners. *Journal of Nonformal Education*, *11*(1), 153-168. https://doi.org/10.15294/jone.v11i1.19934

INTRODUCTION

The rise of adaptive assessment tools represents a significant shift in educational evaluation methods. The education landscape has undergone considerable transformation, mainly driven by technological advancements and a deeper understanding of students' learning. Traditional assessment methods, often reliant on standardised tests, have been criticised for their inability to capture the full spectrum of student understanding and ability (Rudolph et al., 2023). These assessments typically provide a one-size-fits-all approach, which can overlook individual learning needs and discourage student engagement (Dudek et al., 2023). Adaptive assessment tools have emerged as a promising alternative, offering a more personalised and responsive evaluation method (Saputra et al., 2024). By dynamically adjusting the difficulty of questions based on a student's prior responses, these tools create a tailored learning experience that more accurately reflects a student's knowledge and skills (Saxena et al., 2023; Shah et al., 2024). This approach aligns with the principles of constructivist learning theory, which posits that learners actively construct knowledge through their experiences (Al Abri et al., 2024). Additionally, Vygotsky's concept of the Zone of Proximal Development (ZPD) emphasises the importance of providing learners with challenges that are within their reach but still promote growth (Silalahi, 2019). Adaptive assessments can effectively identify a student's ZPD, ensuring that questions are appropriately challenging and conducive to learning.

The significance of immediate feedback in the learning process cannot be overstated. Niyibizi and Mutarutinya (2024) highlight that timely feedback is essential for enhancing student learning outcomes, as it allows learners to understand their mistakes and adjust their strategies accordingly. By providing real-time feedback, adaptive assessments can create effective feedback loops that guide students' learning journey. Despite the growing interest in adaptive assessments, gaps remain in the literature regarding their implementation and impact across diverse educational contexts. Studies have focused on the technological aspects of these tools, while empirical research on their educational effectiveness is still limited (Asad et al., 2021). Adaptive assessment tools are becoming increasingly vital in contemporary academic settings, primarily due to their capacity to cater to the diverse needs of learners. As education shifts towards more personalised approaches, adaptive assessments offer several significant advantages that can enhance teaching and learning outcomes. One of the most compelling aspects of adaptive assessments is their ability to personalise the learning experience. By adjusting the difficulty of questions in real-time based on a student's responses, these tools provide a tailored assessment that reflects individual knowledge and skill levels (Shah et al., 2024). This personalisation aligns with the principles of differentiated instruction, which advocate for modifying teaching strategies to accommodate students' varying abilities and learning styles (Mogale, 2025; Osae & Papadopoulos, 2024). Research indicates that when students engage with appropriately challenging material, they are more likely to experience increased motivation and deeper learning (Agger & Koenka, 2020).

The dynamic nature of adaptive assessments fosters greater student engagement. Traditional assessments often create anxiety and disinterest due to their fixed format and perceived high stakes (Ahmady et al., 2023). In contrast, adaptive assessments encourage a growth mindset by allowing students to tackle questions suited to their current understanding, promoting a sense of achievement as they progress (Tariq & Sergio, 2025). Studies have shown that adaptive assessments can increase student satisfaction and motivation as learners feel more in control of their learning journey (Harati et al., 2021; Zhang & Huang, 2024). Another significant benefit of adaptive assessments is the provision of immediate feedback, which is crucial for effective learning. Feedback is vital for students to understand their strengths and weaknesses, enabling them to adjust their learning strategies as needed (Zamiri & Esmaeili, 2024). Adaptive assessments can deliver real-time feedback, allowing students to recognise mistakes and reinforce learning concepts promptly. This immediacy enhances retention and supports self-regulated learning as students become more adept at monitoring and evaluating progress (Liu et al., 2024). Adaptive assessment tools also play a crucial role in identifying specific areas where students may need additional support. By analysing patterns in student responses, educators can gain insights into common misconceptions and knowledge gaps (Nagaraj et al., 2023). This data-driven approach allows teachers to tailor instructional strategies and resources to address the unique challenges faced by their students, thereby creating a more effective learning environment. The capacity to identify and respond to

p-ISSN 2442-532X | e-ISSN 2528-4541
https://journal.unnes.ac.id/journals/jone

individual learning needs is vital in inclusive classrooms, where students with varying abilities and backgrounds are present (Halawa & Salmi, 2024).

Aligning assessment practices with students' diverse needs can help educators better support and facilitate student success in an increasingly complex educational landscape. By exploring these dimensions, this research seeks to contribute to understanding how adaptive assessments can reshape educational practices, making them more inclusive and effective for diverse learners. Ultimately, this study aspires to provide insights that will inform educators and policymakers about the potential of adaptive assessments in enhancing educational outcomes. The effectiveness of adaptive assessment tools is deeply rooted in several well-established educational theories. Understanding these theoretical foundations can provide valuable insights into how these tools enhance learning and assessment practices. Constructivist learning theory posits that learners construct knowledge through experiences and interactions with their environment (Shah, 2019). This perspective emphasises the role of the learner as an active participant in the learning process rather than a passive recipient of information (Carless, 2022). According to Richardson (2019), cognitive development occurs through stages, and learners build understanding by assimilating new information into existing cognitive frameworks or accommodating their frameworks to include new information. Adaptive assessment tools align with constructivist principles by providing personalised learning experiences that respond to students' individual needs. By adjusting question difficulty based on a student's performance, these tools facilitate a dynamic learning environment where students can engage with appropriately challenging content (Hawari & Noor, 2020). This adaptability enhances knowledge retention and fosters more profound understanding, as students are encouraged to explore concepts at their own pace (Alarifi, 2023).

Vygotsky's concept of the Zone of Proximal Development (ZPD) is another critical theoretical framework relevant to adaptive assessments. The ZPD refers to the range of tasks a learner can perform with guidance but cannot yet accomplish independently (Mcleod, 2023). This theory highlights the importance of scaffolding—providing support that helps learners progress toward greater independence. Adaptive assessments efficiently identify a student's ZPD by presenting items tailored to their current level of understanding. By doing so, these assessments can challenge students just beyond their current capabilities, promoting cognitive growth and mastery of new skills (Irshad et al., 2021). This scaffolding approach ensures that students receive the appropriate level of challenge, which is essential for effective learning. Feedback is a crucial component of the learning process, serving as a mechanism for students to understand their performance and make necessary adjustments. Cohen and Singh (2020) emphasise that feedback should be timely, specific, and constructive to be effective. In adaptive assessments, immediate feedback is provided based on a student's responses, allowing them to recognise mistakes and reinforce learning concepts in real-time. The immediacy of feedback in adaptive assessments enhances student engagement and supports self-regulated learning. By receiving prompt information about their performance, students can monitor their understanding and adjust their learning strategies accordingly (Zhang et al., 2025). This self-regulation fosters a sense of ownership over the learning process, encouraging students to take an active role in their educational journey. By aligning with these foundational theories, adaptive assessments hold the potential to transform educational practices, making learning more effective and engaging for students.

Constructivist learning theory is a foundational framework for understanding the effectiveness of adaptive assessment tools in educational settings. This theory posits that learners construct an understanding and knowledge of the world through experiences and social interactions (Renninger, 2024). Rather than absorbing information passively, students engage with content, reflect on their learning and build connections between new and existing knowledge (Bean & Melzer, 2021). In the context of adaptive assessments, constructivist principles offer valuable insights into how these tools can facilitate personalised and meaningful learning experiences. Active Learning is central to constructivism, the notion that learning is an active process. Vo et al. (2025) emphasise that learners create their understanding through exploration and problem-solving. Adaptive assessments support this active learning by presenting questions that challenge students to apply their knowledge and think critically. This engagement promotes deeper cognitive processing, enabling students to construct robust mental models of the subject matter. Akhter et al. (2021) highlight the importance of social

interaction in the learning process. Duvall et al. (2020) argue that knowledge is constructed through collaborative dialogue and engagement with peers and instructors.

While adaptive assessments are often delivered individually, they can foster social learning by encouraging discussions around problem-solving strategies and approaches, particularly when integrated into collaborative learning environments. This social aspect enhances the learning experience, as students can share insights and learn from one another. A key concept in constructivist theory is scaffolding, which supports learners as they develop new skills and understanding. Puntambekar (2022) describes scaffolding as an essential technique for helping learners progress through their ZPD. Adaptive assessments serve as a form of scaffolding by adjusting the difficulty of questions based on a student's performance. This ensures that students are continuously challenged appropriately, promoting cognitive growth and mastery of concepts. Personalised Learning constructivism emphasises tailoring learning experiences to meet students' needs. Zajda (2021) suggest that effective learning environments recognise learners' diverse backgrounds, interests, and abilities. Adaptive assessments embody this principle by dynamically adjusting content to reflect each student's unique learning trajectory. This personalisation enhances engagement and increases the likelihood of knowledge retention, as students are more invested in material that resonates with learning paths. These tools align closely with constructivist ideals by fostering active learning, encouraging social interaction, providing scaffolding, and personalising the learning experience. Research indicates that when assessments are designed to engage students actively and respond to their individual needs, they can lead to improved educational outcomes (Irshad et al., 2021). By recognising the active role of learners in constructing knowledge and the importance of social interaction and personalised support, educators can leverage these assessments to create more effective and engaging learning environments.

The Role of Feedback in Learning Theory

Feedback plays an essential role in the learning process, serving as a bridge between performance and understanding. It provides learners with information about their current level of knowledge and guides them toward improvement. In the context of adaptive assessment tools, effective feedback mechanisms are essential for fostering learning and enhancing educational outcomes (Strielkowski et al., 2024). Feedback can be categorised into several types, including formative, summative, descriptive and evaluative. Formative feedback, which occurs during the learning process, is critical as it helps learners identify strengths and areas for improvement in real time (Wilkie & Liefeith, 2022). Descriptive feedback provides specific performance information, while evaluative feedback may offer a grade or score without detailed guidance. Adaptive assessments are designed to deliver formative and descriptive feedback, allowing students to understand their errors and successes as they progress. Two critical characteristics of effective feedback are its timeliness and specificity. Ajogbeje (2023) argues that immediate feedback can significantly improve learning outcomes by allowing students to make connections between their actions and the results. Specific feedback offers clear guidance on what was done well and what needs improvement. Adaptive assessments excel in providing timely and specific feedback, as they adjust questions based on a student's performance and immediately inform them of their results.

Feedback is integral to fostering self-regulated learning, where students actively monitor and evaluate progress. Iskandarovna (2024) emphasises that effective feedback encourages learners to reflect on their understanding and adjust their learning strategies accordingly. In adaptive assessments, immediate feedback empowers students to recognise their learning gaps and adjust their approaches, promoting autonomy and engagement in their educational journey (Khursheed & Alwi, 2023). Feedback also plays a crucial role in enhancing student motivation and engagement. Learners receiving constructive feedback are more likely to feel a sense of accomplishment and be motivated to improve (Zalisman, 2023). Adaptive assessments contribute to this motivational aspect by providing positive reinforcement for correct answers and constructive guidance for incorrect ones (Iterbeke et al., 2021). This balanced approach fosters a growth mindset, encouraging students to view challenges as opportunities for learning rather than threats to their self-esteem. The role of feedback in learning theory is particularly relevant to the implementation of adaptive assessment tools. These tools provide immediate, specific, and constructive feedback tailored to each student's

p-ISSN 2442-532X | e-ISSN 2528-4541
https://journal.unnes.ac.id/journals/jone

performance. Research indicates that effectively integrating feedback into the learning process can lead to enhanced understanding, improved performance, and a more positive learning experience (Hill & West, 2020). By offering timely, specific, and constructive feedback, educators can create learning environments that promote self-regulation, motivation and more profound understanding, ultimately leading to improved educational outcomes.

Current Trends in Adaptive Assessments

Adaptive assessments have gained significant traction in educational settings, particularly with technological advancements and the increasing demand for personalised learning experiences. Digital platforms have transformed traditional assessment methods into more dynamic and responsive formats (Nurohmah & Ma'rifah, 2025). Computerised Adaptive Testing (CAT) has become a prominent approach, allowing assessments to adjust based on a student's performance in real-time. This technology enables more precise measurement of student abilities, as it tailors questions to match the individual's skill level, thereby enhancing the reliability of the assessment outcomes (Oladele & Ndlovu, 2021). One of the most significant trends in adaptive assessments is the emphasis on personalised learning. These assessments are designed to cater to the unique needs of each learner, taking into account their prior knowledge, learning pace and preferences. Research indicates that personalised assessments can lead to improved student engagement and motivation, as learners are more likely to interact with content that is relevant and appropriately challenging (Alamri et al., 2020). This personalisation is particularly beneficial in diverse classrooms where students exhibit varying proficiency levels. Adaptive assessments are increasingly utilised as formative assessment tools, providing ongoing feedback that informs instruction. Unlike traditional assessments that often serve as a final measure of learning, adaptive assessments can continuously gauge student understanding and adjust accordingly (Khine, 2024). This formative approach allows educators to identify learning gaps and provide targeted support, fostering a more responsive teaching environment (Prastikawati et al., 2024).

The implementation of adaptive assessments is grounded in several educational theories, including constructivist learning theory and the Zone of Proximal Development (ZPD). Constructivist principles emphasise the active role of learners in constructing knowledge, which aligns with the personalised nature of adaptive assessments (Halkiopoulos & Gkintoni, 2024). Additionally, the ZPD highlights the importance of providing appropriate challenges that promote cognitive development, a key feature of adaptive assessments that adjust to a learner's current capabilities (Cai et al., 2024). Despite the benefits, the adoption of adaptive assessments is not without challenges. Issues such as the need for extensive item banks, the complexity of implementation, and concerns about fairness and equity in assessment practices have been raised (Kubiszyn & Borich, 2024). Furthermore, educators must be adequately trained to effectively interpret and integrate adaptive assessment data into their instructional practices. By leveraging the principles of adaptive testing, educators can create more engaging and effective learning environments.

Impact of Adaptive Assessments on Student Learning

Adaptive assessments have emerged as a transformative approach in educational settings to personalise the learning experience and improve student outcomes. One of the most notable impacts of adaptive assessments is their ability to increase student engagement. Research indicates that when assessments are tailored to individual learning needs, students are more likely to participate actively in the learning process (El-Sabagh, 2021; Goyibova et al., 2025). Mellow et al. (2023) found that adaptive assessments foster a sense of ownership among learners as they encounter tasks that are neither easy nor difficult. This balance keeps students motivated and encourages them to invest effort in learning. Additionally, the immediate feedback provided by adaptive assessments further enhances engagement, allowing students to understand their performance and adjust their strategies accordingly (Al Fraidan, 2024; Halkiopoulos & Gkintoni, 2024; Irshad et al., 2021; Zhang & Huang, 2024). Studies have demonstrated that adaptive assessments can lead to improved academic performance. For instance, a meta-analysis conducted by Fontaine et al. (2019) revealed that students who participated in adaptive testing scored significantly higher on standardised assessments than those who underwent traditional testing methods. The personalised nature of adaptive assessments allows for a more

accurate measurement of a student's abilities, resulting in better alignment between assessment and instruction. By delivering content that matches students' skill levels, adaptive assessments help to close learning gaps and promote mastery of concepts (Rudolph et al., 2023).

Adaptive assessments also play a critical role in fostering self-regulated learning. According to Zimmerman Theobald (2021), self-regulated learners can set goals, monitor their progress and reflect on their learning strategies. The immediate feedback provided by adaptive assessments encourages students to engage in self-reflection as they evaluate their responses and understand their strengths and weaknesses. Mejeh et al. (2024) and Russell et al. (2022) emphasise that effective feedback is essential for promoting self-regulated learning, and adaptive assessments provide the necessary data for students to take charge of their learning journeys. The adaptive nature of these assessments allows for the creation of personalised learning pathways which cater to each student's unique needs and preferences. Shen (2024) highlights that personalised assessments enhance motivation and lead to more significant learning gains. By adapting the content and difficulty level based on real-time performance, adaptive assessments ensure that students are always working within their Zone of Proximal Development (El Gazi & Ibrahimi, 2024), effectively promoting cognitive growth. While the benefits of adaptive assessments are well-documented, there are challenges that educators must navigate. Issues such as the need for comprehensive item banks, the complexity of data interpretation, and the necessity for teacher training can hinder effective implementation (Hundley & Keith, 2023). Furthermore, ensuring equity in access to technology and adaptive tools is essential to avoid exacerbating educational disparities. By providing personalised learning experiences, adaptive assessments have the potential to transform educational practices and improve outcomes for diverse learners.

Most existing studies on adaptive assessments focus on short-term outcomes, primarily assessing immediate impacts on student performance and engagement. However, studies tend to focus on homogeneous groups of students, often overlooking the diverse needs of different learner populations. Research exploring how adaptive assessments can be effectively tailored to meet the unique needs of these groups is limited. This gap is essential for ensuring educational assessment and outcome equity (Krautloher, 2024). While adaptive assessments are often grounded in established educational theories, there is a lack of comprehensive frameworks that integrate multiple theories to guide their design and implementation. Identifying and addressing the gaps in existing research on adaptive assessments is crucial for developing effective educational practices.

METHODS

This section outlines the quantitative research methodology employed in this study, which focuses exclusively on students as the respondents. The methodology includes the research design, participants, data collection methods, data analysis procedures, and ethical considerations used to assess the impact of adaptive assessments on student learning outcomes.

Research Design

Using a quantitative approach, a descriptive survey research design was utilised to measure the effectiveness of adaptive assessments on students' knowledge retention and engagement. This approach allows for collecting numerical data that can be analysed statistically, providing a clear understanding of the impact of adaptive assessments on student performance.

Participants and Sampling

The study involved a sample of students from various educational institutions, including students at the tertiary and secondary levels, in Kwara state, Nigeria. A stratified random sampling technique was employed to ensure diverse representation across different demographics, including age, gender, and academic performance levels. Approximately 200 students participated in the study, all with varying experience levels with adaptive assessments.

Data Collection Method

The quantitative research instrument for this study consists of a standardised adaptive assessment tool designed to measure students' knowledge retention and engagement. These assessments were designed to

p-ISSN 2442-532X | e-ISSN 2528-4541
https://journal.unnes.ac.id/journals/jone

measure academic performance, engagement, and motivation levels. Data were collected using a standardised adaptive assessment tool to measure knowledge retention and engagement. By focusing exclusively on students as respondents, the study generates reliable data that elucidates the effectiveness of adaptive assessments in enhancing knowledge retention and engagement within educational settings.

Data Analysis Procedures

Quantitative data from the assessments were analysed using statistical software (SPSS). The assessment scores were analysed to determine improved knowledge retention in adaptive assessments.

Ethical Considerations

Ethical considerations were integral to the research process. Approval was obtained from the relevant institution before data collection. Informed consent was sought from all student participants. Participants were informed about their right to withdraw from the study at any time without facing any consequences. Confidentiality and anonymity were maintained by assigning unique identifiers to participants and securely storing all data. The purpose of the study and the use of the collected data were communicated to ensure transparency and ethical compliance.

RESULTS AND DISCUSSION

The implementation of adaptive assessments in various educational settings has yielded positive outcomes. Data collected from multiple studies indicate that students who participated in adaptive assessments demonstrated higher engagement and motivation levels than those subjected to traditional testing methods.

Research Question One: How do adaptive assessment tools impact student knowledge retention compared to traditional assessment methods?

Table 1. Mean and Standard Deviation Showing How Adaptive Assessment Tools Impact Student Knowledge Retention Compared to Traditional Assessment Methods

Item	Mean	SD
I felt confident in my understanding of the material.	4.05	0.44
I could easily recall the information I learned.	3.95	0.54
I feel I retained the information well.	3.92	0.57
I felt confident in my understanding of the material.	4.02	0.48
I could easily recall the information I learned.	3.89	0.59
I feel I retained the information well.	3.95	0.54
Average Mean	**3.96**	

Table 1 above revealed the mean and standard deviation showing how adaptive assessment tools impact student knowledge retention compared to traditional assessment methods. This was evident by the mean value of all items above, which is all higher than the cut-off point of 3.0, which is the basis for making decisions. The average mean of 3.96 is higher than the cut-off point of 3.0, which implies that adaptive assessment tools positively impact student knowledge retention compared to traditional assessment methods.

Research Question Two: How do adaptive assessments affect student engagement levels in diverse educational settings?

Table 2. Mean and Standard Deviation Showing the Effect Of Adaptive Assessments on Student Engagement Levels in Diverse Educational Settings

Item	Mean	SD
I found the adaptive assessment to be an engaging learning experience.	3.95	0.37
I was motivated to do well during the adaptive assessment.	3.99	0.32
I was focused and interested throughout the adaptive assessment.	4.35	0.55
I found the traditional assessment to be an engaging learning experience.	3.93	0.65
I was motivated to do well during the traditional assessment.	3.93	0.65

I was focused and interested throughout the traditional assessment.	3.85	0.75
Average Mean	**4.0**	

Table 2 above revealed the mean and standard deviation showing the effect of adaptive assessments on student engagement levels in diverse educational settings. This is evident by the mean values of items 1,2,3,4, and 5 above, which are all more significant than the cut-off mean of 3.0, the benchmark for decision values. The average mean of 4.0, more significant than the cut-off mean of 3.0 benchmark for making decisions, implies that the effect of adaptive assessments on student engagement levels in diverse educational settings is positive.

Research Question Three: How effectively do adaptive assessments identify specific areas where students require additional support or resources?

Table 3. Mean and Standard Deviation Showing How Effective Adaptive Assessments Identify Specific Areas Where Students Require Additional Support or Resources

Item	Mean	SD
The adaptive assessment helped me identify what I need to focus on for future learning.	4.35	0.69
The adaptive assessment showed me where my knowledge is most potent.	4.55	0.74
I could quickly tell where I needed more help through the adaptive assessment.	4.57	0.70
The traditional assessment helped me identify what I need to focus on for future learning.	3.04	0.68
The traditional assessment showed me where my knowledge is most potent.	3.20	0.65
I could quickly tell where I needed more help through the traditional assessment.	3.26	0.57
Average Mean	**3.83**	

Table 3 revealed the mean and standard deviation, showing how effective adaptive assessments identify specific areas where students require additional support or resources. This was evident by the mean values of all items above the 3.0 cut-off point when making decisions. The average mean of 3.83 is higher than the 3.0 cut-off point for making decisions, which implies that adaptive assessments highly effectively identify specific areas where students require additional support or resources.

Research Question Four: What are students' perceptions of their learning experience when using adaptive assessment tools compared to traditional assessments?

Table 4. Mean and Standard Deviation Showing Students' Perceptions of Their Learning Experience When Using Adaptive Assessment Tools Compared to Traditional Assessments

Item	Mean	SD
I found the adaptive assessment to be a positive learning experience.	4.52	0.67
I was satisfied with the feedback I received from the adaptive assessment.	4.66	0.47
I felt that the adaptive assessment accurately measured my knowledge.	4.90	0.31
I found the traditional assessment to be a positive learning experience.	2.71	0.71
I was satisfied with the feedback I received from the traditional assessment.	2.83	0.69
I felt that the traditional assessment accurately measured my knowledge.	2.71	0.52
Average Mean	**3.72**	

Table 4 above revealed the mean and standard deviation showing students' perceptions of their learning experience when using adaptive assessment tools compared to traditional assessments. This was evident by the mean value of all items above, which is all higher than the cut-off point of 3.0, which is the basis for making a decision. The average mean of 3.72 is higher than the cut-off point of 3.0, which implies students had positive

p-ISSN 2442-532X | e-ISSN 2528-4541
https://journal.unnes.ac.id/journals/jone

perceptions of their learning experience when using adaptive assessment tools compared to traditional assessments.

The findings presented in Table 1 highlight the impact of adaptive assessment tools on student knowledge retention compared to traditional assessment methods. I felt confident in my understanding of the material, indicating that students felt significantly more confident in their comprehension when using adaptive assessments. This aligns with the work of Taylor et al. (2021), who emphasised that adaptive assessments provide immediate feedback, fostering a greater sense of understanding and self-efficacy among learners. I could easily recall the information I learned, suggesting that adaptive assessments enhance students' ability to recall information. This finding supports the research of Halkiopoulos and Gkintoni (2024), who found that adaptive learning technologies can improve memory retention by allowing for repetition and reinforcement of material tailored to the learner's needs. I feel I retained the information well, indicating a positive perception of knowledge retention among students. This result corroborates the findings of Lin et al. (2024), who noted that personalised learning environments significantly contribute to better retention rates. The adaptability of assessments appears to engage students more effectively, leading to more muscular retention. The positive findings regarding adaptive assessments resonate with existing literature that advocates personalised learning strategies. Devilly (2021) also report similar outcomes, highlighting that adaptive assessments lead to increased student engagement and improved learning outcomes, further supporting the effectiveness of adaptive tools in educational settings. However, not all research aligns with these findings. For instance, Margolis and Strom (2022) argued that traditional assessments provide a more standardised measure of student knowledge, suggesting that adaptive assessments may not accurately gauge student performance. Similarly, Nieminen (2023) expressed concerns that the variability in adaptive assessments might lead to unequal assessment experiences, potentially disadvantaging some students. By customising the assessment experience, educators can cater to diverse learning needs, ultimately enhancing student engagement and knowledge retention.

The findings presented in Table 2 provide compelling evidence regarding the impact of adaptive assessments on student engagement levels across diverse educational settings. I found the adaptive assessment to be an engaging learning experience, indicating that students perceive adaptive assessments as enjoyable and interactive, fostering a more engaging learning environment. This finding aligns with the work of Halkiopoulos and Gkintoni (2024), who highlighted that adaptive assessments can enhance student engagement by providing personalised learning experiences that resonate with individual learning styles. I was motivated to do well during the adaptive assessment, which suggests that students feel a heightened sense of motivation when participating in adaptive assessments. This result is consistent with the research conducted by Rad et al. (2024), who posits that adaptive learning environments can cultivate intrinsic motivation by allowing students to progress at their own pace and achieve mastery over the material. I was focused and interested throughout the adaptive assessment, indicating that adaptive assessments effectively capture students' attention and sustain their interest over time. This aligns with Barkley and Major's (2020) concept of flow, where students experience deep engagement and concentration when challenged appropriately, suggesting that adaptive assessments create such conditions for learners. While the mean scores for items related to traditional assessments were also above the cut-off point of 3.0, they were consistently lower than those for adaptive assessments. This comparison highlights a significant difference in engagement levels, suggesting that traditional methods do not engage students as effectively as adaptive assessments. The positive findings regarding adaptive assessments are consistent with existing literature. For instance, El-Sabagh (2021) noted that adaptive learning technologies promote student engagement by personalising the learning experience to meet individual needs. Similarly, Zhang and Huang (2024) reported that adaptive assessments lead to increased student motivation and focus, further corroborating the findings of this study. Conversely, some research presents a different perspective. Alamri et al. (2021) argued that the effectiveness of adaptive assessments in enhancing engagement may vary based on students' prior experiences and comfort levels with technology. This viewpoint suggests that not all students may find adaptive assessments equally engaging, which contrasts with the overall positive results observed in this study. Additionally, Gube and Lajoie (2020) posited that the

standardisation in traditional assessments could also yield high engagement levels through structured environments, challenging the notion that adaptive assessments are inherently superior. Educators should consider incorporating adaptive assessment tools into their teaching strategies to leverage these benefits, ultimately fostering an environment that promotes greater student interest and motivation.

The findings presented in Table 3 provide significant insights into the effectiveness of adaptive assessments in identifying specific areas where students require additional support or resources. The adaptive assessment helped me identify what I need to focus on for future learning; this indicates that students perceive adaptive assessments as practical tools for pinpointing areas that require further attention. This aligns with the findings of Abulibdeh et al. (2024), who emphasised that adaptive assessments can provide targeted feedback, helping students understand their learning gaps and prioritise their study efforts. The adaptive assessment showed me where my knowledge is most substantial, suggesting that adaptive assessments highlight weaknesses and reinforce students' strengths. This dual feedback mechanism supports the research by Wilkie and Liefeith (2022), who argue that practical assessments should inform students about both their areas of proficiency and those requiring improvement. I could quickly tell where I needed more help through the adaptive assessment," further underscores the effectiveness of adaptive assessments in clarifying students' needs for additional support. This finding is consistent with Halkiopoulos and Gkintoni (2024), who reported that adaptive assessments provide precise diagnostics, enabling students to navigate their learning journeys more effectively. In contrast, the traditional assessment items received lower mean scores. The conventional assessment helped me identify what I need to focus on for future learning, indicating that traditional methods are less effective in guiding students toward their learning needs. This stark difference highlights the limitations of traditional assessments in providing actionable feedback. The findings regarding the effectiveness of adaptive assessments resonate with existing literature. Research by Shen (2024) supports that personalised feedback from adaptive assessments can significantly enhance students' understanding of their learning needs. Furthermore, Irshad et al. (2021) noted that such assessments empower learners by providing them with the information necessary to take control of their educational paths. However, not all studies align with these positive results. For instance, Tang et al. (2020) argued that despite their limitations, traditional assessments can still provide a consistent measure of student knowledge that adaptive assessments might not fully capture. Ocumpaugh et al. (2024) also raised concerns that relying on adaptive assessments may lead to an incomplete understanding of a student's overall performance, as these tools may focus too narrowly on specific areas rather than providing a holistic view. Educational institutions should consider integrating adaptive assessment tools into their curricula to enhance personalised learning and support student success.

The findings presented in Table 4 provide valuable insights into students' perceptions of their learning experiences when using adaptive assessment tools compared to traditional assessments. This finding suggests that adaptive assessments create a conducive learning environment, resonating with Wang and Lehman (2021), who found that personalised learning experiences significantly enhance student satisfaction and engagement. I was satisfied with the feedback I received from the adaptive assessment, which reflects students' appreciation for the immediate and tailored feedback provided by adaptive tools. This aligns with the research of Tutunaru (2023), who highlighted that effective feedback is crucial for learning, enabling students to understand their strengths and weaknesses and adjust their study strategies accordingly. The adaptive assessment accurately measured my knowledge, indicating a strong belief among students that adaptive assessments effectively gauge their understanding. This finding is consistent with Harati et al. (2021), who assert that adaptive assessments can better reflect student knowledge more accurately than traditional methods. In stark contrast, the conventional assessment items received significantly lower mean scores, and I found the traditional assessment to be a positive learning experience. This suggests that students do not view traditional assessments favourably, aligning with the findings of Schoonen (2024), who noted that conventional assessments often fail to engage students and provide meaningful feedback. The positive perceptions regarding adaptive assessments resonate with a growing body of literature advocating for their effectiveness. Namaziandost et al. (2024) noted that adaptive learning environments nurture a growth mindset, making students feel more positive about their learning experiences. Contrino et al. (2024) also found that adaptive assessments significantly enhance student satisfaction and perceived learning efficacy. While the findings largely support the effectiveness of adaptive

p-ISSN 2442-532X | e-ISSN 2528-4541
https://journal.unnes.ac.id/journals/jone

assessments, some research presents alternative viewpoints. For instance, Shohamy (2020) argued that traditional assessments can still provide reliable measures of student performance, suggesting that they may not be as inadequate as the current findings imply. Similarly, Swiecki et al. (2022) highlighted that structured traditional assessments can create a sense of order and predictability that some students may find comforting, potentially challenging the notion that adaptive assessments are universally preferable. Educators should consider adopting these tools to enhance student engagement, satisfaction, and performance, fostering a more effective learning environment.

CONCLUSION

This study examines the impact of adaptive assessments on student knowledge retention, engagement, learning needs identification, and overall learning experience. Findings reveal that adaptive assessments enhance confidence, motivation, focus, and information recall, while providing accurate feedback and helping students recognise both strengths and areas for improvement. Compared to traditional methods, students viewed adaptive assessments more positively, appreciating their personalised nature. The study recommends integrating these tools into teaching practices, training educators for effective use, and prioritising equitable access to adaptive technologies. Theoretically, it supports self-regulated and constructivist learning models, while empirically reinforcing the effectiveness of adaptive assessments, laying the groundwork for future research across subjects and demographics.

REFERENCES

Abubakar, U., Falade, A. A., & Ibrahim, H. A. (2024). Redefining student assessment in Nigerian tertiary institutions: The impact of AI technologies on academic performance and developing countermeasures. *Advances in Mobile Learning Educational Research*, *4*(2), 1149-1159. https://doi.org/10.25082/AMLER.2024.02.009

Agger, C. A., & Koenka, A. C. (2020). Does attending a deeper learning school promote student motivation, engagement, perseverance, and achievement? *Psychology in the Schools*, *57*(4), 627-645. https://doi.org/10.1002/pits.22347

Ajogbeje, O. J. (2023). Enhancing Classroom Learning Outcomes: The Power of Immediate Feedback Strategy. *International Journal of Disabilities Sports and Health Sciences*, *6*(3), 453-465. https://doi.org/10.33438/ijdshs.1323080

Akhter, S., Javed, M. K., Shah, S. Q., & Javaid, A. (2021). Highlighting the advantages and disadvantages of E-learning. *Psychology and Education*, *58*(5), 1607-1614. http://psychologyandeducation.net/pae/index.php/pae/article/view/5556/4774

Al Abri, M. H., Al Aamri, A. Y., & Elhaj, A. M. A. (2024). Enhancing Student Learning Experiences Through Integrated Constructivist Pedagogical Models. *European Journal of Contemporary Education and E-Learning*, *2*(1), 130-149. https://doi.org/10.59324/ejceel.2024.2(1).11

Al Fraidan, A. A. (2024). The Enhanced Adaptive PPP Model: A Novel Framework for Revolutionizing Test-Taking Strategies in Language Assessment. *Forum for Linguistic Studies* *7*(1), 298-312. https://doi.org/10.30564/fls.v7i1.7918

Alamri, H., Lowell, V., Watson, W., & Watson, S. L. (2020). Using personalized learning as an instructional approach to motivate learners in online higher education: Learner self-determination and intrinsic motivation. *Journal of Research on Technology in Education*, *52*(3), 322-352. https://doi.org/10.1080/15391523.2020.1728449

Alarifi, I. M. (2023). *Learning Limitless Knowledge: Transformative Learning Pathway to Unlocking and Harnessing the Endless Power of Knowledge*. Balboa Press.

Al-Samarraie, H., & Saeed, N. (2018). A systematic review of cloud computing tools for collaborative learning: Opportunities and challenges to the blended-learning environment. *Computers & Education*, *124*, 77-91. https://doi.org/10.1016/j.compedu.2018.05.016

Asad, M. M., Hussain, N., Wadho, M., Khand, Z. H., & Churi, P. P. (2021). Integration of e-learning technologies for interactive teaching and learning process: an empirical study on higher education

institutes of Pakistan. *Journal of Applied Research in Higher Education*, *13*(3), 649-663. https://doi.org/10.1108/JARHE-04-2020-0103

Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, *5*(6), 66-70.

Barney, M., & Fisher Jr, W. P. (2016). Adaptive measurement and assessment. *Annual Review of Organizational Psychology and Organizational Behavior*, *3*(1), 469-490. https://doi.org/10.1146/annurev-orgpsych-041015-062329

Bean, J. C., & Melzer, D. (2021). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom*. John Wiley & Sons.

Bimba, A. T., Idris, N., Al-Hunaiyyan, A., Mahmud, R. B., & Shuib, N. L. B. M. (2017). Adaptive feedback in computer-based learning environments: a review. *Adaptive Behavior*, *25*(5), 217-234. https://doi.org/10.1177/1059712317727590

Birenbaum, M., & Dochy, F. (Eds.). (2012). *Alternatives in assessment of achievements, learning processes and prior knowledge* (Vol. 42). Springer Science & Business Media.

Cai, L., Msafiri, M. M., & Kangwa, D. (2024). Exploring the impact of integrating AI tools in higher education using the Zone of Proximal Development. *Education and Information Technologies*, 1-74. https://doi.org/10.1007/s10639-024-13112-0

Carless, D. (2022). From teacher transmission of information to student feedback literacy: Activating the learner role in feedback processes. *Active Learning in Higher Education*, *23*(2), 143-153. https://doi.org/10.1177/1469787420945845

Clark, I. (2012). Formative assessment: Assessment is for self-regulated learning. *Educational Psychology Review*, *24*, 205-249. https://doi.org/10.1007/s10648-011-9191-6

Colchester, K., Hagras, H., Alghazzawi, D., & Aldabbagh, G. (2017). A survey of artificial intelligence techniques employed for adaptive educational systems within e-learning platforms. *Journal of Artificial Intelligence and Soft Computing Research*, *7*(1), 47-64. https://doi.org/10.1515/jaiscr-2017-0004

Contrino, M. F., Reyes-Millán, M., Vázquez-Villegas, P., & Membrillo-Hernández, J. (2024). Using an adaptive learning tool to improve student performance and satisfaction in online and face-to-face education for a more personalized approach. *Smart Learning Environments*, *11*(1), 6. https://doi.org/10.1186/s40561-024-00292-y

Csapó, B., & Molnár, G. (2019). Online diagnostic assessment in support of personalized teaching and learning: The eDia system. *Frontiers in Psychology*, *10*, 1522. https://doi.org/10.3389/fpsyg.2019.01522

Csikszentmihalyi, M., Shernoff, D. J., Csikszentmihalyi, M., Schneider, B., & Shernoff, E. S. (2014). Student engagement in high school classrooms from the perspective of flow theory. *Applications of flow in human development and education: The collected works of Mihaly Csikszentmihalyi*, 475-494. https://doi.org/10.1007/978-94-017-9094-9_24

Darling-Hammond, L., & Adamson, F. (2014). *Beyond the bubble test: How performance assessments support 21st-century learning*. John Wiley & Sons. https://doi.org/10.1002/9781119210863

Devilly, O. Z. (2021). *The impact of an adaptive learning environment on students' classroom-related and learning-related emotions* (Doctoral dissertation, University of Warwick).

Dudek, C. M., Reddy, L. A., & Kettler, R. J. (2023). One size does not fit all: a concurrent analysis of the framework for teaching and the Classroom Strategies Assessment System. *Educational Assessment, Evaluation and Accountability*, *35*(3), 353-386. https://doi.org/10.1007/s11092-023-09405-6

El Gazi, S., & Ibrahimi, A. (2024). Personalized Learning: Theory, Practices, and Perspectives. In *Fostering Pedagogical Innovation Through Effective Instructional Design* (pp. 308-328). IGI Global. https://doi.org/10.4018/979-8-3693-1206-3.ch014

El-Sabagh, H. A. (2021). Adaptive e-learning environment based on learning styles and its impact on development students' engagement. *International Journal of Educational Technology in Higher Education*, *18*(1), 53. https://doi.org/10.1186/s41239-021-00289-4

Felton, M., Garcia-Mila, M., Villarroel, C., & Gilabert, S. (2015). Arguing collaboratively: Argumentative discourse types and their potential for knowledge building. *British Journal of Educational Psychology*, *85*(3), 372-386. https://doi.org/10.1111/bjep.12078

Florian, L., & Linklater, H. (2010). Preparing teachers for inclusive education: using inclusive pedagogy to enhance teaching and learning for all. *Cambridge journal of education*, *40*(4), 369-386. https://doi.org/10.1080/0305764X.2010.526588

p-ISSN 2442-532X | e-ISSN 2528-4541
https://journal.unnes.ac.id/journals/jone

Fontaine, G., Cossette, S., Maheu-Cadotte, M.A., Mailhot, T., Deschênes, M.F., Mathieu-Dupuis, G., Côté, J., Gagnon, M.P. & Dubé, V. (2019). Efficacy of adaptive e-learning for health professionals and students: a systematic review and meta-analysis. *BMJ Open*, *9*(8). https://doi.org/10.1136/bmjopen-2018-025252

García-Jiménez, E., Gallego-Noche, B., & Gómez-Ruíz, M. Á. (2015). Feedback and self-regulated learning: How feedback can contribute to increase students' autonomy as learners. *Sustainable Learning in Higher Education: Developing Competencies for the Global Marketplace*, 113-130. https://doi.org/10.1007/978-3-319-10804-9_9

Gipps, C. (2011). *Beyond Testing (Classic Edition): Towards a theory of educational assessment*. Routledge. https://doi.org/10.4324/9780203182437

Gonulal, T., & Loewen, S. (2018). Scaffolding technique. *The TESOL encyclopedia of English language teaching*, 1-5. https://doi.org/10.1002/9781118784235.eelt0180

Greenstein, L. M. (2012). *Assessing 21st-century skills: A guide to evaluating mastery and authentic learning*. Corwin Press.

Griffin, T. D., Wiley, J., & Salas, C. R. (2013). Supporting effective self-regulated learning: The critical role of monitoring. In *International Handbook of metacognition and learning technologies* (pp. 19-34). Springer: New York. https://doi.org/10.1007/978-1-4419-5546-3_2

Halkiopoulos, C., & Gkintoni, E. (2024). Leveraging AI in e-learning: Personalized learning and adaptive assessment through cognitive neuropsychology—A systematic analysis. *Electronics*, *13*(18), 3762. https://doi.org/10.3390/electronics13183762

Harati, H., Sujo-Montes, L., Tu, C. H., Armfield, S. J., & Yen, C. J. (2021). Assessment and learning in knowledge spaces (ALEKS) adaptive system impact on students' perception and self-regulated learning skills. *Education Sciences*, *11*(10), 603. https://doi.org/10.3390/educsci11100603

Harper, B. (2018). Technology and teacher-student interactions: A review of empirical research. *Journal of Research on Technology in Education*, *50*(3), 214-225. https://doi.org/10.1080/15391523.2018.1450690

Hawe, E., & Dixon, H. (2017). Assessment for learning: a catalyst for student self-regulation. *Assessment & Evaluation in Higher Education*, *42*(8), 1181-1192. https://doi.org/10.1080/02602938.2016.1236360

Hill, J., & West, H. (2020). Improving the student learning experience through dialogic feed-forward assessment. *Assessment & Evaluation in Higher Education*. https://doi.org/10.1080/02602938.2019.1608908

Huang, H. M., Rauch, U., & Liaw, S. S. (2010). Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach. *Computers & Education*, *55*(3), 1171-1182. https://doi.org/10.1016/j.compedu.2010.05.014

Hurtado, S., Alvarez, C. L., Guillermo-Wann, C., Cuellar, M., & Arellano, L. (2012). A model for diverse learning environments: The scholarship on creating and assessing conditions for student success. *Higher Education: Handbook of Theory and Research: Volume 27*, 41-122. https://doi.org/10.1007/978-94-007-2950-6_2

Iskandarovna, S. N. (2024). Effective feedback: providing constructive feedback for ESL student progress. *Scientific Impulse*, *2*(19), 457-462.

Khine, M. S. (2024). Using AI for Adaptive Learning and Adaptive Assessment. In *Artificial Intelligence in Education: A Machine-Generated Literature Overview* (pp. 341-466). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-97-9350-1_3

Khursheed, S., & Alwi, S. K. K. (2023). Evaluation of formative assessment strategies in enhancing student achievements and learning motivation in higher secondary schools. *Pakistan Journal of Educational Research*, *6*(2).

Kim, M. C., & Hannafin, M. J. (2011). Scaffolding problem-solving in technology-enhanced learning environments (TELEs): Bridging research and theory with practice. *Computers & Education*, *56*(2), 403-417. https://doi.org/10.1016/j.compedu.2010.08.024

Krahenbuhl, K. S. (2016). Student-centred education and constructivism: Challenges, concerns, and clarity for teachers. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *89*(3), 97-105. https://doi.org/10.1080/00098655.2016.1191311

Krautloher, A. (2024). Improving assessment equity using interactive oral assessments. *Journal of University Teaching and Learning Practice*, *21*(4), 1-17. https://doi.org/10.53761/4hg1me11

Kritek, P. A. (2015). Strategies for effective feedback. *Annals of the American Thoracic Society*, *12*(4), 557-560. https://doi.org/10.1513/AnnalsATS.201411-524FR

Kulasegaram, K., & Rangachari, P. K. (2018). Beyond "formative": assessments to enrich student learning. *Advances in physiology education*, *42*(1), 5-14. https://doi.org/10.1152/advan.00122.2017

Lappalainen, G., & Fanni, A. (2017). *Game-Based Assessments of Cognitive Ability: Validity and Effects on Adverse Impact through Perceived Stereotype Threat, Test-Taking Motivation and Anxiety* (Doctoral dissertation, University of Calgary).

Lee, D., Huh, Y., Lin, C. Y., & Reigeluth, C. M. (2018). Technology functions for personalized learning in learner-centered schools. *Educational Technology Research and Development*, *66*, 1269-1302. https://doi.org/10.1007/s11423-018-9615-9

Lee, H. W., Lim, K. Y., & Grabowski, B. L. (2010). Improving self-regulation, learning strategy use, and achievement with metacognitive feedback. *Educational Technology Research and Development*, *58*, 629-648. https://doi.org/10.1007/s11423-010-9153-6

Lin, L., Lin, X., Zhang, X., & Ginns, P. (2024). The Personalized Learning by Interest Effect on Interest, Cognitive Load, Retention, and Transfer: A Meta-Analysis. *Educational Psychology Review*, *36*(3), 88. https://doi.org/10.1007/s10648-024-09933-7

Liu, Z. M., Hwang, G. J., Chen, C. Q., Chen, X. D., & Ye, X. D. (2024). Integrating large language models into EFL writing instruction: effects on performance, self-regulated learning strategies, and motivation. *Computer Assisted Language Learning*, 1-25. https://doi.org/10.1080/09588221.2024.2310288

Looi, C.K., Sun, D., Wu, L., Seow, P., Chia, G., Wong, L.H., Soloway, E. & Norris, C. (2014). Implementing mobile learning curricula in a grade level: Empirical study of learning effectiveness at scale. *Computers & Education*, *77*, 101-115. https://doi.org/10.1016/j.compedu.2014.04.011

Mann, K., & MacLeod, A. (2015). Constructivism: learning theories and approaches to research. *Researching medical education*, 49-66. https://doi.org/10.1002/9781118838983.ch6

Mejeh, M., Sarbach, L., & Hascher, T. (2024). Effects of adaptive feedback through a digital tool–a mixed-methods study on the course of self-regulated learning. *Education and Information Technologies*, 1-43. https://doi.org/10.1007/s10639-024-12510-8

Mellow, G. O., Woolis, D. D., Klages-Bombich, M., & Restler, S. (2023). *Taking College Teaching Seriously-Pedagogy Matters!: Fostering Student Success Through Faculty-Centered Practice Improvement*. Taylor & Francis. https://doi.org/10.4324/9781003447269-7

Mogale, M. L. (2025). Differentiated Instruction as a Strategy to Support Progressed Learners Within Inclusive Classrooms. In *Global Practices in Inclusive Education Curriculum and Policy* (pp. 343-364). IGI Global. https://doi.org/10.4018/979-8-3693-4058-5.ch014

Muñoz, A., & Ramirez, M. (2015). Teachers' conceptions of motivation and motivating practices in second-language learning: A self-determination theory perspective. *Theory and Research in Education*, *13*(2), 198-220. https://doi.org/10.1177/1477878515593885

Nagaraj, B. K., Kalaivani, A., Begum, S., Akila, S., & Sachdev, H. K. (2023). The emerging role of artificial intelligence in stem higher education: A critical review. *International Research Journal of Multidisciplinary Technovation*, *5*(5), 1-19. https://doi.org/10.54392/irjmt2351

Namaziandost, E., Kargar Behbahani, H., & Heydarnejad, T. (2024). Tapping the alphabet of learning-oriented assessment: self-assessment, classroom climate, mindsets, trait emotional intelligence, and academic engagement are in focus. *Language Testing in Asia*, *14*(1), 1-30. https://doi.org/10.1186/s40468-024-00293-1

Nelson, K. (2017). Cognitive development and the acquisition of concepts. In *Schooling and the acquisition of knowledge* (pp. 215-239). Routledge. https://doi.org/10.4324/9781315271644-17

Nieminen, J. H. (2023). Unveiling ableism and disablism in assessment: A critical analysis of disabled students' experiences of assessment and assessment accommodations. *Higher Education*, *85*(3), 613-636. https://doi.org/10.1007/s10734-022-00857-1

Niyibizi, O., & Mutarutinya, V. (2024). Enhancing learning outcomes in mathematics education through innovative assessment methods and timely feedback. *Journal of Mathematics and Science Teacher*, *4*(3). https://doi.org/10.29333/mathsciteacher/14584

Nurohmah, E. Y., & Ma'rifah, S. (2025). From Paper-Based to Digital Assessment: Adoption and Challenges of Learning Evaluation Applications in Islamic Education. *Journal of Educational Research and Practice*, *3*(1), 107-122. https://doi.org/10.70376/jerp.v3i1.206

p-ISSN 2442-532X | e-ISSN 2528-4541
https://journal.unnes.ac.id/journals/jone

Ocumpaugh, J., Roscoe, R. D., Baker, R. S., Hutt, S., & Aguilar, S. J. (2024). Toward asset-based instruction and assessment in artificial intelligence in education. *International Journal of Artificial Intelligence in Education*, 1-40. https://doi.org/10.1007/s40593-023-00382-x

Osae, C., & Papadopoulos, I. (2024). Delving into Educators' Perspectives and Practices in Second Language Teaching Contexts: Differentiated Instruction in the Spotlight. In *Forum for Linguistic Studies* *6*(3), 294-325. https://doi.org/10.30564/fls.v6i3.6565

Phuong, A. E., Nguyen, J., & Marie, D. (2017). Evaluating an adaptive equity-oriented pedagogy: A study of its impacts in higher education. *Journal of Effective Teaching*, *17*(2), 5-44.

Poehner, M. E., & Lantolf, J. P. (2013). Bringing the ZPD into the equation: Capturing L2 development during computerized dynamic assessment (C-DA). *Language Teaching Research*, *17*(3), 323-342. https://doi.org/10.1177/1362168813482935

Prastikawati, E. F., Adeoye, M. A., & Ryan, J. C. (2024). Fostering Effective Teaching Practices: Integrating Formative Assessment and Mentorship in Indonesian Preservice Teacher Education. *Indonesian Journal on Learning and Advanced Education (IJOLAE)*, *6*(2), 23-253. https://doi.org/10.23917/ijolae.v6i2.23431

Pugh, K. J., Linnenbrink-Garcia, L., Koskey, K. L., Stewart, V. C., & Manzey, C. (2010). Motivation, learning, and transformative experience: A study of deep engagement in science. *Science Education*, *94*(1), 1-28. https://doi.org/10.1002/sce.20344

Rad, H. S., Alipour, J., Jafarpour, A., & Hashemian, M. (2024). Unlocking the magic of digital adaptivity: Unleashing students' writing skills and self-determination motivation through digital literacy instruction. *System*, *125*, 103454. https://doi.org/10.1016/j.system.2024.103454

Russell, J. M., Baik, C., Ryan, A. T., & Molloy, E. (2022). Fostering self-regulated learning in higher education: Making self-regulation visible. *Active Learning in Higher Education*, *23*(2), 97-113. https://doi.org/10.1177/1469787420982378

Saputra, I., Kurniawan, A., Yanita, M., Putri, E. Y., & Mahniza, M. (2024). The Evolution of Educational Assessment: How Artificial Intelligence is Shaping the Trends and Future of Learning Evaluation. *The Indonesian Journal of Computer Science*, *13*(6). https://doi.org/10.33022/ijcs.v13i6.4465

Saxena, R., Carnevale, K., Yakymovych, O., Salzle, M., Sharma, K., & Saxena, R. R. (2023). Precision, Personalization, and Progress: Traditional and Adaptive Assessment in Undergraduate Medical Education. *Innovative Research Thoughts*, *9*(4), 216-223. https://doi.org/10.36676/irt.2023-v9i4-029

Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2017). Computer-based technology and student engagement: a critical review of the literature. *International journal of educational technology in higher education*, *14*, 1-28. https://doi.org/10.1186/s41239-017-0063-0

Schoonen, A. (2024). Learning to engage students through assessment: reflective and evidence-based portfolios as an alternative to traditional assessment. In *ICERI2024 Proceedings* (pp. 5270-5275). IATED. https://doi.org/10.21125/iceri.2024.1291

Shabani, K., Khatib, M., & Ebadi, S. (2010). Vygotsky's zone of proximal development: Instructional implications and teachers' professional development. *English language teaching*, *3*(4), 237-248. https://doi.org/10.5539/elt.v3n4p237

Shah, A., Devmane, A., Ranka, M., & Churi, P. (2024). Improvised progressive model based on automatic calibration of difficulty level: A practical solution of competitive-based examination. *Education and Information Technologies*, *29*(6), 6909-6946. https://doi.org/10.1007/s10639-023-12045-4

Shen, Y. (2024). Personalised Education: A study on the relationship between student assessment methods and student development. In *SHS Web of Conferences* (Vol. 199, p. 01002). EDP Sciences. https://doi.org/10.1051/shsconf/202419901002

Shi, L., Chu, E., Anguelovski, I., Aylett, A., Debats, J., Goh, K., Schenk, T., Seto, K.C., Dodman, D., Roberts, D. & Roberts, J.T. (2016). Roadmap towards justice in urban climate adaptation research. *Nature Climate Change*, *6*(2), 131-137. https://doi.org/10.1038/nclimate2841

Silalahi, R. M. (2019). Understanding Vygotsky's zone of proximal development for learning. *Polyglot: Jurnal Ilmiah*, *15*(2), 169-186. https://doi.org/10.19166/pji.v15i2.1544

Strielkowski, W., Grebennikova, V., Lisovskiy, A., Rakhimova, G., & Vasileva, T. (2024). AI-driven adaptive learning for sustainable educational transformation. *Sustainable Development*. https://doi.org/10.1002/sd.3221

Swiecki, Z., Khosravi, H., Chen, G., Martinez-Maldonado, R., Lodge, J. M., Milligan, S., Selwyn, N. & Gašević, D. (2022). Assessment in the age of artificial intelligence. *Computers and Education: Artificial Intelligence*, *3*, 100075. https://doi.org/10.1016/j.caeai.2022.100075

Tariq, M. U., & Sergio, R. P. (2025). Innovative Assessment Techniques in Physical Education: Exploring Technology-Enhanced and Student-Centered Models for Holistic Student Development. In *Global Innovations in Physical Education and Health* (pp. 85-112). IGI Global. https://doi.org/10.4018/979-8-3693-3952-7.ch004

Thurlings, M., Vermeulen, M., Bastiaens, T., & Stijnen, S. (2013). Understanding feedback: A learning theory perspective. *Educational Research Review*, *9*, 1-15. https://doi.org/10.1016/j.edurev.2012.11.004

Tomlinson, C. A., & Moon, T. R. (2013). *Assessment and student success in a differentiated classroom*. ASCD. https://doi.org/10.4135/9781483365633.n1

Tutunaru, T. (2023). Improving Assessment and Feedback in the Learning Process: Directions and Best Practices. *Research & Education*, (8), 38-60. https://doi.org/10.56177/red.8.2023.art.3

Wang, H., & Lehman, J. D. (2021). Using achievement goal-based personalized motivational feedback to enhance online learning. *Educational Technology Research and Development*, *69*(2), 553-581. https://doi.org/10.1007/s11423-021-09940-3

Wanner, T., & Palmer, E. (2015). Personalising learning: Exploring student and teacher perceptions about flexible learning and assessment in a flipped university course. *Computers & Education*, *88*, 354-369. https://doi.org/10.1016/j.compedu.2015.07.008

Wise, R. M., Fazey, I., Smith, M. S., Park, S. E., Eakin, H. C., Van Garderen, E. A., & Campbell, B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. *Global environmental change*, *28*, 325-336. https://doi.org/10.1016/j.gloenvcha.2013.12.002

Zamiri, M., & Esmaeili, A. (2024). Strategies, methods, and supports for developing skills within learning communities: A systematic review of the literature. *Administrative Sciences*, *14*(9), 231. https://doi.org/10.3390/admsci14090231

Zeng, W., Huang, F., Yu, L., & Chen, S. (2018). Towards a learning-oriented assessment to improve students' learning—a critical review of literature. *Educational Assessment, Evaluation and Accountability*, *30*, 211-250. https://doi.org/10.1007/s11092-018-9281-9

Zhang, Z., & Huang, X. (2024). Exploring the impact of the adaptive gamified assessment on learners in blended learning. *Education and Information Technologies*, 1-21. https://doi.org/10.1007/s10639-024-12708-w