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MALAYSIAN TEACHERS' PERSPECTIVES ON AI-BASED CLASSROOM ASSESSMENT: OPPORTUNITIES AND CHALLENGES IN 21ST-CENTURY EDUCATION

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Abstract

This study investigates the opportunities and challenges faced by Malaysian secondary school teachers in adopting Artificial Intelligence (AI) for classroom assessment within the context of 21st-century education. As digital transformation advances globally, AI tools are increasingly integrated into teaching and assessment processes. AI demonstrates the potential to automate assessments, deliver personalized feedback, and enhance data-informed teaching. However, its implementation poses several challenges, including limited teacher training, ethical concerns, data privacy issues, and inconsistent readiness. Using a quantitative exploratory design, data were collected from 280 secondary school teachers in urban public schools in Selangor, Malaysia. The structured questionnaire examined six key themes: awareness, readiness, attitudes, benefits, challenges, and misconceptions. Findings reveal that 78% of teachers expressed positive perceptions of AI's usefulness in reducing workload and providing real-time feedback. Nevertheless, 65% reported concerns about over-dependence on AI and possible threats to professional judgment and data ethics. These insights highlight the need for targeted training, robust infrastructure, and clear policy guidelines to ensure responsible and effective AI integration. The study offers data-driven recommendations to inform ethical and practical adoption of AI in educational assessment.

Keywords: *Artificial Intelligence, AI in Education, Classroom Assessment, Teachers' Perceptions, Educational Technology, 21st-Century Skills*

Introduction

The educational usefulness of Artificial Intelligence (AI) applications continues to rise, as AI supports modern learning approaches required for 21st-century education. Assessment processes are increasingly enhanced through AI tools, which help automate repetitive tasks, provide instant feedback, and generate personalized learning pathways. The Digital Educational Learning Initiative Malaysia (DELIMa), a national initiative under the Malaysian Education Blueprint 2013–2025, promotes the integration of technology into teaching and learning (Kementerian Pendidikan Malaysia, 2013).

However, multiple barriers continue to hinder the widespread adoption of AI in classroom assessment. According to Ku Fatahiyah et al. (2019) and Isa and Ahmad (2024), the actual implementation of AI in schools remains at an early stage. These limitations include inadequate infrastructure, ethical dilemmas, data privacy concerns, insufficient teacher training, and misalignment with subject-specific pedagogical practices.

Despite these challenges, AI shows considerable potential in classroom assessment by enabling intelligent grading systems, delivering tailored feedback, and supporting data-informed instructional decisions. As many education systems shift towards digital transformation, AI tools are becoming integral to teaching and assessment practices.

Moreover, the integration of AI in assessment aligns closely with established educational frameworks such as Bloom's Revised Taxonomy, which emphasises higher-order thinking skills. AI-powered tools have the potential to support analysis, evaluation, and even creation-level tasks when designed appropriately. Similarly, the incorporation of AI is reflective of the demands outlined in 21st-century skills frameworks, which prioritise digital literacy, problem-solving, innovation, and collaboration (Binkley et al., 2012). These frameworks provide a foundation for understanding why AI integration is not only relevant but necessary for modern education systems. For AI to meaningfully contribute to assessment practices, it must support learner-centred approaches, differentiate instruction, and assist teachers in tracking progress through data analytics.

This study investigates secondary school teachers' perceptions of the challenges and opportunities associated with AI-based classroom assessment. A quantitative exploratory survey was conducted among 280 public secondary school teachers in urban areas of Selangor, Malaysia. The instrument was developed based on extensive literature and assessed six dimensions: awareness, readiness, attitudes, benefits, challenges, and misconceptions regarding AI use in education.

The findings aim to inform stakeholders of the existing perception gaps and provide data-driven recommendations for professional development, policy formulation, and infrastructure enhancement. This will ensure the ethical, equitable, and effective integration of AI in classroom-based assessment practices.

Method

This study adopted a quantitative exploratory design using a structured questionnaire to examine secondary school teachers' perceptions of AI-based classroom assessment. This approach was appropriate for collecting data from a large sample efficiently and cost-effectively (Creswell, 2012).

Purposive sampling was used to select participants with relevant exposure to educational technology. A total of 280 teachers from public urban secondary schools in Selangor, Malaysia, participated in the study. Selangor was chosen due to its advanced digital infrastructure and broader access to telecommunications. Participants represented both early-career and experienced educators.

The survey instrument consisted of 27 items developed based on a comprehensive review of related literature on AI in education and classroom assessment. It was constructed in Bahasa Melayu to ensure clarity and relevance for the target population. The instrument was designed to evaluate teachers' perceptions across six major themes: knowledge and awareness of AI, readiness and technical skills, challenges and concerns, perceived benefits of AI in assessment, misconceptions about AI, and attitudes toward AI in education. Each theme included four to five items that aligned with the study's objectives. For example, items under knowledge and awareness examined

teachers' familiarity with AI concepts and available tools, while items on challenges and concerns explored issues such as data privacy, ethical considerations, and limitations in infrastructure.

To establish content validity, the questionnaire was reviewed by a panel of three experts in educational technology and psychometrics. Their feedback was used to refine the items for clarity, relevance, and alignment with the research objectives. A pilot test involving 30 teachers was conducted, yielding a Cronbach's alpha of 0.89, indicating strong internal consistency.

Data were collected over two weeks using both digital (Google Forms) and paper-based formats to ensure broad accessibility. Participants were briefed on the purpose of the study and gave informed consent prior to participation. All data were treated confidentially, with anonymity guaranteed for all respondents.

The research instrument was accompanied by a clear explanatory note that informed respondents of the voluntary nature of participation and the confidentiality of their responses. To ensure accessibility, the survey was administered in the national language (Bahasa Melayu), which aligns with common practice in Malaysian public schools and minimises misinterpretation of terminology related to technology or assessment concepts. The mixed delivery method digital and manual ensured that responses were not limited to those with high digital access, promoting more inclusive participation.

Descriptive statistics, specifically means and standard deviations, were used to analyze the data using SPSS Version 26. Ethical approval was obtained from the university's research ethics committee. Participant privacy and data security were strictly maintained throughout the study.

Results

The analysis of responses from 280 secondary school teachers was organized according to six key themes: Positive Perceptions of AI in Assessment, Knowledge and Awareness of AI, Readiness and Technical Skills, Attitudes Toward AI, Teachers' Challenges and Concerns, and Misconceptions about AI. Descriptive statistics (mean and standard deviation) were used to summarize the central tendencies and variability in teachers' perceptions.

As shown in Table 1, the statistical analysis presents the average scores (means) and standard deviations for each of the six themes. These results reflect the diversity of views among respondents regarding the use of AI in the classroom.

Table 1. Mean and Standard Deviation of Teachers' Perceptions of AI in Classroom Assessment (n = 280)

No	Theme	Mean	SD	Interpretation
1	Positive Perceptions of AI in Assessment	3.52	0.82	High
2	Knowledge and Awareness of AI	3.44	1.08	Moderate-High
3	Readiness and Technical Skills to Use AI	3.40	1.04	Moderate-High

No	Theme	Mean	SD	Interpretation
4	Attitudes Toward AI in Education	3.40	0.75	Moderate-High
5	Teachers' Challenges and Concerns	3.24	0.88	Moderate
6	Misconceptions about AI	3.07	0.96	Moderate-Low

Note.
Interpretation levels are based on the following scale: 1.00–2.49 = Low, 2.50–3.49 = Moderate, 3.50–5.00 = High.

The results in Table 1 show that teachers generally had positive perceptions of AI-based assessment, particularly in terms of its practicality and potential to reduce workload. The highest mean was recorded for *Positive Perceptions of AI in Assessment* (M = 3.52), while the lowest was for *Misconceptions about AI* (M = 3.07), indicating ongoing misunderstandings that may affect adoption. The remaining themes fall within the moderate to moderately high range, suggesting generally favourable yet varied perceptions.

The high mean score for the Positive Perceptions of AI in Assessment theme's suggests that the majority of respondents acknowledged the benefits of AI in classroom assessment, particularly in areas such as automating grading, improving feedback delivery, and increasing efficiency. The relatively low standard deviation indicates that responses were fairly consistent, suggesting shared agreement across the teacher cohort.

The Knowledge and Awareness of AI theme's recorded a moderately high mean score, indicating that many teachers reported having some degree of familiarity with AI concepts, terminology, and general functions. However, the high standard deviation implies that levels of knowledge varied substantially between respondents, which could be attributed to differences in exposure or access to AI-related training.

A mean score of 3.40 reflects a generally positive perception of teachers' Readiness and Technical Skills in classroom contexts. Nonetheless, the standard deviation demonstrates that there were considerable variations in how ready teachers felt, suggesting that while some feel confident, others lack the necessary technical or pedagogical support.

The Attitudes Toward AI in Education theme's mean score reveals a broadly favourable attitude among teachers toward integrating AI into educational practice. The relatively low variability (SD = 0.75) shows that these attitudes are relatively consistent among respondents, indicating a collective openness to technological innovation in teaching and assessment.

The moderate mean score in Teachers' Challenges and Concerns theme's suggests that teachers recognised the existence of various challenges in implementing AI. These include issues such as infrastructure limitations, insufficient technical support, and concerns over ethical implications. The standard deviation reflects a moderate spread of responses, implying that while challenges are commonly acknowledged, the degree to which they affect teachers differs.

The lowest mean score across all themes was recorded for this dimension, indicating that a smaller proportion of teachers held misconceptions about AI, though such views remain present. The moderate standard deviation suggests that these misconceptions are not uniformly held but are nevertheless significant enough to require clarification through professional learning.

To provide a clearer understanding of teachers' views, the data were visualized to illustrate the distribution and relative importance of each dimension. These figures allow for a more intuitive comparison and help uncover patterns not immediately apparent in tabulated data.

Figure 1. Contribution of Each Theme to Overall Perception

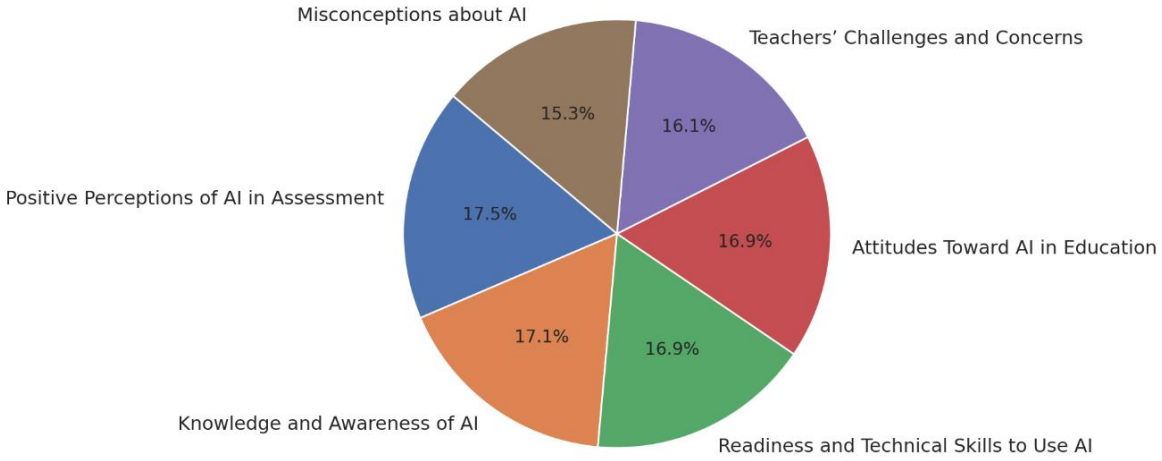

Figure 1 presents a pie chart representing the proportionate contribution of each theme based on average scores. The largest portion corresponds to *Positive Perceptions of AI in Assessment*, reflecting the general belief among teachers that AI can enhance efficiency in assessment tasks. In contrast, *Misconceptions about AI* constitutes the smallest segment, reinforcing the need for more accurate understanding through structured training and communication.

In addition to understanding proportional distribution, a direct comparison of mean scores across all six themes provides insight into the specific dimensions teachers endorse most or least strongly.

Figure 2. Ranking of Themes by Mean Score

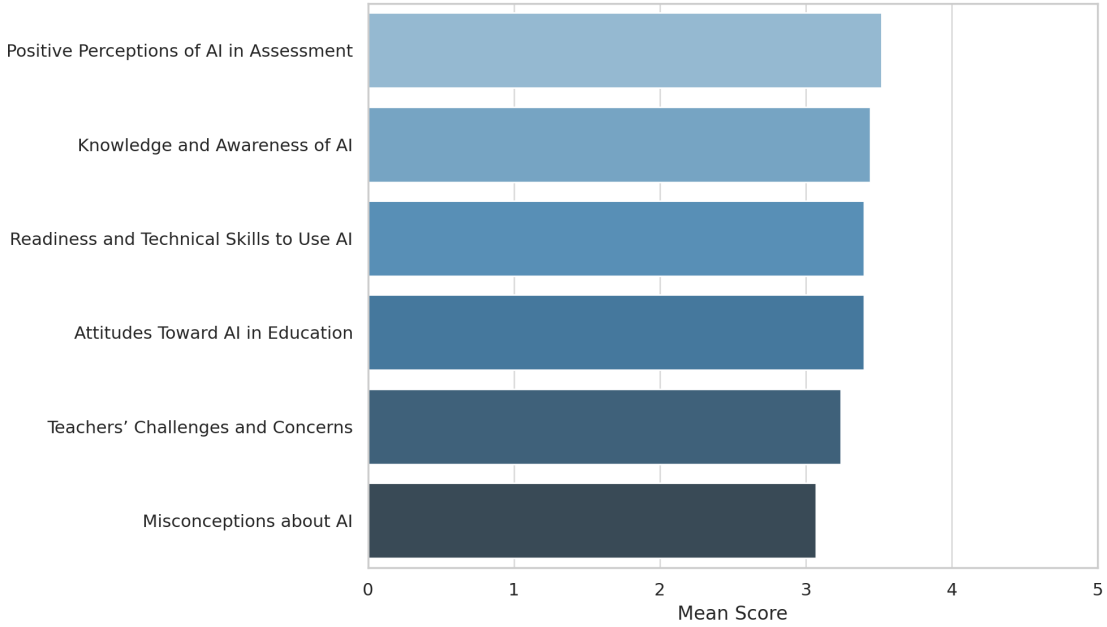

Figure 2 displays a horizontal bar chart comparing the mean scores of each theme. The figure clearly indicates that *Positive Perceptions of AI in Assessment* received the highest average score (M = 3.52), followed by *Knowledge and Awareness of AI* (M = 3.44) and *Readiness and Technical Skills* (M = 3.40). Meanwhile, *Challenges and Concerns* (M = 3.24) and *Misconceptions* (M = 3.07) reflect areas where teachers may hold doubts or face structural barriers.

The moderately high score for *Attitudes Toward AI in Education* (M = 3.40, SD = 0.75) suggests a general openness among teachers to adopt new assessment technologies. However, the relatively high standard deviations in *Knowledge and Awareness* (SD = 1.08) and *Readiness and Technical Skills* (SD = 1.04) point to significant variation in teachers' preparedness, indicating unequal levels of exposure and experience.

The theme *Teachers' Challenges and Concerns* highlights practical barriers such as insufficient digital infrastructure, unreliable internet access, and limited training opportunities findings consistent with earlier research on digital adoption in Malaysian education settings.

The theme *Misconceptions about AI* reveals some commonly held false assumptions, including beliefs that AI can entirely replace human judgment or that it requires advanced technical skills beyond teachers' reach. These misconceptions, while not dominant, must be addressed through targeted professional development to promote informed and confident use of AI tools.

Overall, the results show that while optimism and openness toward AI are prevalent, notable gaps in knowledge, technical readiness, and structural support remain. These findings underscore the need for comprehensive

professional learning programmes, policy clarity, and system-level investments to enable effective and ethical AI integration in classroom assessment.

Building on the initial findings, additional visual analyses were conducted to better understand the degree of alignment and variability in teachers' perceptions across each theme. These analyses allow for a deeper understanding of the internal variation and alignment within each theme, rather than relying solely on average scores.

Figure 3. Mean vs Standard Deviation by Theme

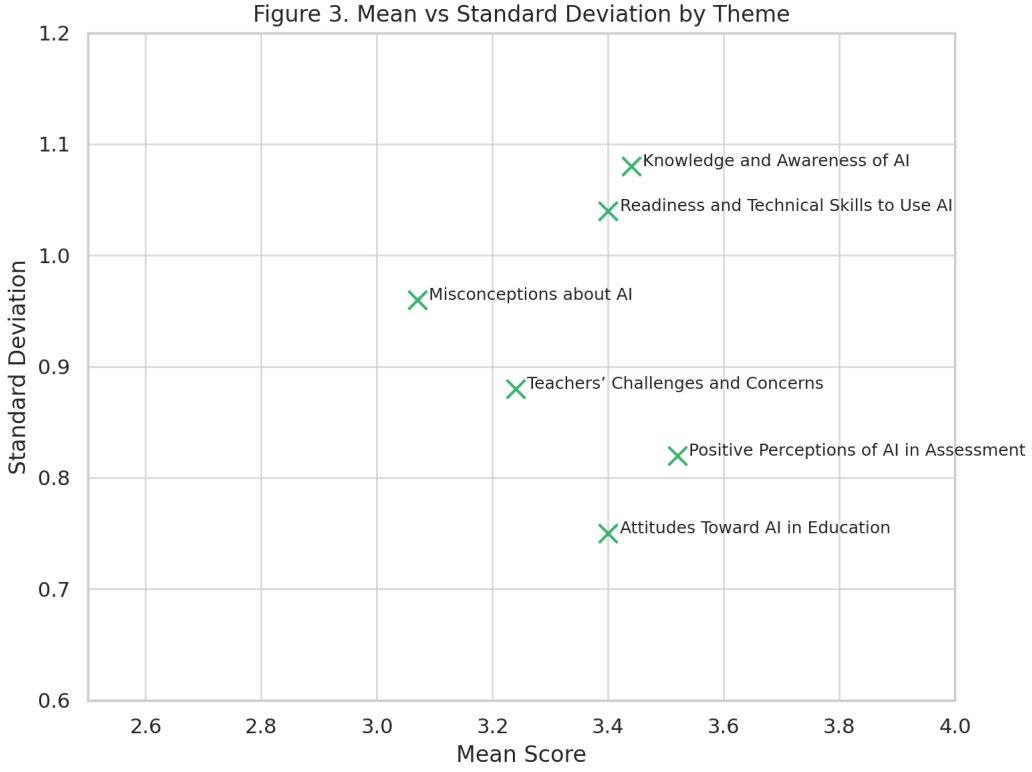

Figure 3 illustrates a scatter plot mapping the mean scores of each theme against their respective standard deviations. This two-dimensional view offers a clearer understanding of the relationship between the strength of teachers' views and the consistency with which those views are held.

As shown in Figure 3, *Attitudes Toward AI in Education* appears in the high-mean, low-variability quadrant, indicating a generally positive and consistent outlook among teachers. In contrast, *Knowledge and Awareness of AI* and *Readiness and Technical Skills* occupy areas with higher standard deviations, suggesting greater variability in responses. Meanwhile, *Misconceptions about AI* shows both low mean and low variability, reflecting a shared but limited belief in several common misconceptions. These findings suggest that although overall acceptance of AI is growing, the extent of understanding and preparedness varies considerably.

To complement this, a heatmap was constructed to provide an integrated view of both the intensity and stability of teacher perceptions across the six themes. This visual approach highlights where support is strong and uniform, and where perceptions are weak or inconsistent.

Figure 4. Theme Summary: Strength and Consistency of Perceptions

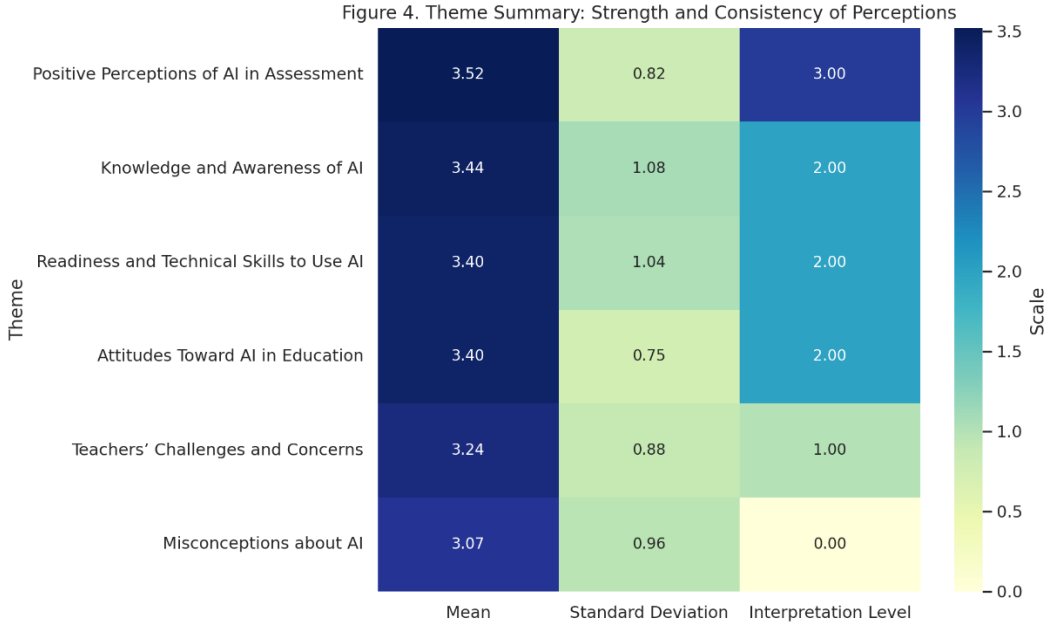

Figure 4 presents a heatmap that categorises each theme based on its average score and standard deviation. The combination of colour gradation and placement allows for intuitive interpretation of the overall strength and coherence of teachers' responses.

As illustrated, *Positive Perceptions of AI in Assessment* shows strong support with moderate consistency, while *Attitudes Toward AI* is both positive and stable, representing a solid foundation for further AI integration. On the other hand, *Knowledge and Readiness* are positioned in zones of high variability, reinforcing the need for differentiated support and capacity-building. *Misconceptions*, though receiving lower agreement, are still present across the cohort and should be addressed directly through awareness campaigns and professional training.

To consolidate these findings, a summary table was developed to classify each theme according to its mean score and the degree of response variability. This synthesis offers a practical reference for policymakers and educational leaders in identifying which areas require immediate intervention and which can be further strengthened to support sustainable AI integration in schools.

Table 2: Summary of Teachers' Perceptions by Mean Score and Variability

No	Theme	Mean Score	Variance (from SD)	Interpretation
1	Positive Perceptions	High	Moderate	Strong support

No	Theme	Mean Score	Variance (from SD)	Interpretation
2	Knowledge & Awareness	Moderate	High	Mixed understanding
3	Readiness & Technical Skills	Moderate	High	Uneven preparation
4	Attitudes Toward AI	Moderate	Low	Consistent positivity
5	Challenges and Concerns	Moderate	Moderate	Real barriers exist
6	Misconceptions	Low	Moderate	Needs clarification

The synthesis in Table 2 reinforces earlier findings. While teachers express high levels of optimism and positive attitudes toward AI, many remain unevenly prepared and uncertain about core concepts. Misconceptions persist and, though not dominant, present risks to meaningful adoption. Professional development efforts should therefore be tiered, addressing the different starting points among teachers and aligning technical, pedagogical, and ethical competencies in a holistic way.

These patterns point clearly to the need for policy-driven strategies that are responsive to both the enthusiasm and the apprehension teachers feel toward AI. Only with such support systems in place can AI become a truly transformative tool in educational assessment.

Discussion

The findings highlight the areas where AI-based classroom assessment offers advantages for Malaysian secondary school teachers, as well as the limitations and challenges that must be addressed for effective adoption. Overall, teachers expressed that AI has significant potential to enhance classroom assessment, particularly in automating repetitive tasks and providing immediate feedback features aligned with the demands of 21st-century education. This perspective is supported by earlier work suggesting that AI enables more efficient, personalised, and data-informed assessment processes (Luckin et al., 2016; Holmes et al., 2019).

Among the six themes, teachers expressed the strongest agreement with the practical value of AI in assessment, as shown by the highest mean score (M = 3.52), indicating strong support for AI's practicality in reducing workload and identifying learning gaps. Similarly, the consistent responses under *Attitudes Toward AI in Education* (M = 3.40, SD = 0.75) suggest that most teachers are open to adopting AI tools in their teaching practice. This positive mindset provides a solid foundation upon which implementation efforts can be built.

However, this enthusiasm is not equally matched by readiness or understanding. The study revealed significant variability in teachers' *Knowledge and Awareness of AI* (SD = 1.08) and *Readiness and Technical Skills* (SD = 1.04), indicating inconsistency in familiarity and confidence among respondents. While some teachers show awareness of AI functions and are eager to use them, others remain unsure or underprepared. These findings echo previous research in Malaysia highlighting uneven levels of digital competency among educators (Zawawi & Yusof, 2021; Norazah et al., 2021).

The theme *Teachers' Challenges and Concerns* (M = 3.24) also reflects real obstacles on the ground, including inadequate infrastructure, unreliable internet connectivity, and a lack of professional development opportunities. These concerns are especially relevant in schools that have limited access to digital tools, even within urban areas. Moreover, many teachers remain unconvinced of AI's capacity to assess complex skills such as creativity, critical thinking, or emotional development. As noted by Wang and Williamson (2021), AI systems are efficient at managing structured data, but less effective when it comes to evaluating higher-order thinking or affective domains. Consequently, participants emphasised the importance of retaining human judgement in formative and summative assessments.

The theme *Misconceptions about AI* (M = 3.07) reveals a troubling presence of inaccurate beliefs some teachers assumed that AI could fully replace teachers or that AI tools require advanced programming knowledge. Such misconceptions, if uncorrected, may discourage teachers from engaging with AI-based tools. These concerns resonate with Selwyn's (2020) arguments that fear of automation and misunderstanding of AI's function can undermine teacher confidence and agency.

The findings also point to critical implications for teacher education and curriculum development. To ensure long-term AI readiness, pre-service and in-service teacher training programmes should embed modules focused on AI literacy, algorithmic thinking, and ethical digital pedagogy. Equipping teachers with not only tools but also conceptual frameworks will allow them to evaluate and adapt AI systems appropriately. Curricula should also prepare teachers to engage with AI critically, understanding both its capabilities and its limitations within educational settings. This curricular shift is necessary to move beyond ad-hoc training workshops and toward sustainable, systemic transformation.

Ethical considerations were also a recurrent theme. Teachers voiced apprehension over issues such as student data privacy, algorithmic fairness, and the long-term implications of digital surveillance in schools. They were wary of adopting AI systems without clear regulations on how data are collected, stored, and used concerns that have been raised globally (Williamson & Eynon, 2020). These findings suggest that AI integration must be accompanied by institutional policies that address ethical governance and protect the rights of both teachers and learners.

These diverse findings suggest that while many teachers are receptive to AI, their practical ability to integrate such tools remains limited by both systemic and conceptual barriers. In light of the identified challenges and mixed readiness levels, these findings align with the TPACK framework (Mishra et al., 2006), which posits that effective educational technology use lies at the intersection of technological knowledge, pedagogical strategies, and subject content. Simply having access to AI tools is not enough teachers must understand how to integrate these tools into their specific instructional goals and assessment practices.

In guiding teachers through this transformation, the SAMR model (Puentedura, 2006) offers a useful framework. This model encourages progressive integration of technology beginning with substitution of traditional methods and moving toward full redefinition of assessment practices. Supporting teachers along this continuum is crucial for long-term impact.

To achieve effective and ethical implementation of AI in classroom assessment, several key areas must be prioritised. Professional development should be sustained and targeted, addressing both technical skills and pedagogical integration. Investments in infrastructure are necessary to ensure that all schools including those in rural areas have reliable access to AI-compatible technologies. Clear policy frameworks must be established to govern data ethics, algorithm transparency, and equitable access. In parallel, teachers should be actively involved in the design and contextual adaptation of AI tools so that these technologies remain responsive to curriculum needs and classroom realities.

Although this study provides valuable insights, it is not without limitations. The use of descriptive statistics limits the ability to explore causal relationships or predictive factors. Additionally, the sample was confined to urban public schools in Selangor, which may not reflect the conditions or perspectives in rural or private educational settings. Future research should consider employing comparative designs such as urban versus rural analyses or mixed-methods approaches that incorporate interviews, classroom observations, and inferential statistical techniques including regression or structural equation modelling.

Conclusion

In conclusion, this study on teachers' perceptions of AI-based classroom assessment has successfully met its objective by revealing key insights into the benefits, challenges, and readiness factors influencing AI integration in Malaysian secondary schools. The data demonstrate that while teachers show clear optimism and openness toward AI especially in enhancing efficiency and feedback they also face critical gaps in preparedness, conceptual understanding, and ethical assurance. These findings validate the significance of addressing structural limitations and correcting misconceptions to enable more meaningful adoption. Academically, the study contributes empirical evidence that affirms the need for targeted professional development, robust infrastructure, and inclusive policy frameworks as foundational pillars for AI integration in assessment practices. As education systems continue to adopt technology at scale, AI is no longer a futuristic innovation but a present necessity. The role of teachers in navigating, adapting, and leading this shift is central to its success. Effective implementation of AI in assessment requires not just technical integration but also a human-centric approach that reinforces professional judgment and pedagogical intent. It is hoped that this research will inform future educational strategies and catalyse more equitable, ethical, and pedagogically grounded use of AI in classrooms.

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