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Development and Pilot Validation of an AI Integration Readiness Instrument for Tamil Language Teachers

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Abstract

This pilot study aimed to develop and validate a reliable instrument for assessing Tamil language teachers' readiness to integrate Artificial Intelligence (AI) into teaching and learning. The instrument consists of five constructs—Knowledge, Skills, Attitude, Challenges, and AI Usage Level—which collectively represent key dimensions of AI integration readiness. A quantitative descriptive design was employed, involving 36 Tamil language teachers from three primary schools near Kuala Lumpur. Data were analysed using SPSS Version 29.0 for descriptive statistics and reliability testing, while SmartPLS 4 was used solely for exploratory visualisation of inter-construct patterns due to the small pilot sample size. The findings showed high mean scores for Knowledge (4.18), Skills (4.15), and Attitude (4.20), indicating strong teacher readiness, whereas the Challenges construct recorded a moderate mean (3.05), reflecting limitations in infrastructure and training. Cronbach's Alpha values ranged from 0.810 to 0.986, with an overall reliability of 0.947, demonstrating excellent internal consistency across all constructs. Overall, the study provides a valid and psychometrically sound instrument suitable for larger-scale research examining AI readiness among teachers in vernacular school contexts.

Keywords: Artificial Intelligence (AI), Teacher Readiness, AI Integration, Tamil Language Education, Instrument Development

Introduction

Artificial Intelligence (AI) is rapidly transforming global education by reshaping how teachers design instruction, assess learning, and support student engagement. The integration of AI technologies such as adaptive learning platforms, automated feedback systems, and intelligent tutoring tools has enhanced teaching efficiency and enabled personalised learning experiences for diverse learners (UNESCO, 2023; Meylani, 2024). As AI becomes increasingly embedded in educational ecosystems, teachers must possess adequate knowledge, technical skills, and positive attitudes to apply these innovations effectively in their classrooms.

In Malaysia, the digital transformation of education is strongly driven by national policy initiatives. The Malaysia Education Blueprint (2013–2025) emphasises digital competence, higher-order thinking skills, and innovation as essential components of 21st-century learning (Ministry of Education Malaysia, 2025). More recently, the Digital Education Policy (DEP 2023) was introduced to strengthen digital literacy, enhance teacher professional development, and ensure equitable access to technology across schools (Ministry of Education Malaysia, 2023). These policies emphasise the centrality of teachers in realising digital excellence and highlight the importance of teacher readiness for the effective integration of emerging technologies, particularly AI.

Although Malaysia has articulated robust national commitments toward digital transformation within its education sector, the practical incorporation of Artificial Intelligence (AI) in classroom settings remains inconsistent and often lacks depth. While educators are increasingly exposed to digital technologies, empirical evidence indicates that many teachers have not received systematic training to embed AI effectively into their pedagogical practices. Existing studies further reveal that although teachers frequently express favourable dispositions toward AI adoption, they continue to face substantial obstacles, including gaps in pedagogical understanding, inadequate technical competencies, infrastructural limitations, and insufficient access to professional learning opportunities (Sivanganam, Yunus, & Said, 2025).

These challenges are particularly pronounced in vernacular primary institutions, notably Tamil national-type schools (Sekolah Jenis Kebangsaan Tamil—SJKT), where educators encounter compounded constraints such as limited availability of Tamil-language AI educational resources, unreliable digital infrastructure, and minimal organisational support. Despite the considerable potential of AI to enrich language pedagogy through adaptive feedback mechanisms, intelligent tutoring systems, and natural language processing applications (UNESCO, 2023; Subramaniam & Lee, 2024), the extent to which Tamil language teachers are adequately prepared to implement these technologies remains underexplored.

Current scholarship on AI integration in education has predominantly focused on English language instruction, science and mathematics education, or broad digital competency frameworks, leaving vernacular language teaching contexts comparatively underrepresented (Rahman et al., 2024). Moreover, much of the existing research relies on descriptive approaches without employing psychometrically validated instruments capable of systematically assessing teacher readiness across multiple dimensions. Consequently, there remains a notable absence of empirically robust measurement tools designed to evaluate AI integration readiness among Tamil language teachers, particularly with respect to their knowledge, technical skills, attitudinal orientations, perceived challenges, and actual AI usage in instructional practice

To address this gap, the present pilot study developed and validated an AI Integration Readiness Instrument tailored specifically for Tamil language teachers in Malaysian primary schools. The instrument measures five interrelated constructs Knowledge, Skills, Attitude, Challenges, and AI Usage Level that collectively define teachers' preparedness for AI integration. Data were collected from 36 Tamil language teachers across three primary schools near Kuala Lumpur and analysed using SPSS Version 29.0 and SmartPLS 4. The study

provides a valid, reliable, and empirically grounded tool for assessing teacher readiness and offers baseline insights that can inform future large-scale studies, professional development initiatives, and AI-related educational policies in Malaysia

Study Background

Artificial Intelligence (AI) has emerged as one of the most transformative forces in 21st-century education. Globally, educators and researchers are increasingly exploring how AI can support teaching, learning, and assessment through automation, personalisation, and intelligent data analytics (UNESCO, 2023; Meylani, 2024). AI-powered systems such as adaptive learning platforms, intelligent tutoring systems, and automated feedback mechanisms have demonstrated potential in enhancing student learning outcomes while reducing teachers' administrative workload. As education systems worldwide transition toward technology-driven practices, teachers' readiness to integrate AI effectively into their pedagogy has become a crucial determinant of successful implementation.

In Malaysia, the integration of AI in education aligns with national reforms that prioritise digital transformation and innovation. The Malaysia Education Blueprint (2013–2025) and the Digital Education Policy (DEP 2023) emphasise the development of teacher digital competencies and AI-related skills as key drivers of educational excellence (Ministry of Education Malaysia, 2023; 2025). These policy frameworks aim to cultivate educators who are not only technologically literate but also capable of embedding AI meaningfully into teaching and learning processes. Despite these strong policy commitments, the practical readiness of teachers particularly in vernacular school contexts remains under-researched.

Tamil language education forms a vital component of Malaysia's multicultural education landscape. However, teachers in *Sekolah Jenis Kebangsaan Tamil* (SJKT) frequently face additional challenges such as limited access to Tamil-specific digital resources, inconsistent school infrastructure, and a lack of specialised AI training opportunities. These constraints mean that Tamil language teachers may experience AI integration differently from teachers in national schools. Understanding their readiness is essential not only to promote equity in digital education but also to preserve linguistic and cultural identity through modernised, technology-supported pedagogy.

Teacher readiness for AI integration is multidimensional. It encompasses conceptual knowledge of AI applications, practical skills for using AI-enabled tools, attitudes that encourage innovation, challenges that hinder adoption, and the actual level of AI usage in classroom practice. External barriers including limited technical support, weak internet connectivity, and insufficient institutional encouragement further shape teachers' willingness and ability to adopt AI tools. A holistic assessment of these dimensions provides a more accurate representation of teachers' preparedness for AI-based instruction.

Given the limited empirical evidence in this area, especially among Tamil language teachers, this study addresses a critical gap. By developing and validating an instrument to measure AI integration readiness, the research offers both conceptual and methodological contributions. The five constructs Knowledge, Skills, Attitude, Challenges, and AI Usage Level provide a structured framework for evaluating teachers' competencies and perceptions. The pilot study, conducted with 36 Tamil language teachers from primary schools near Kuala Lumpur, serves

as an initial step in establishing a reliable and contextually meaningful instrument. The findings will support the design of targeted professional development programmes, inform policy decisions, and guide strategic initiatives aimed at fostering effective and inclusive AI integration across Malaysia's vernacular schools.

Objectives

This pilot study was conducted to examine the validity, reliability, and preliminary construct patterns of the AI Integration Readiness Instrument developed for Tamil language teachers. The specific objectives are:

1) To evaluate the validity of the questionnaire designed to measure Tamil language teachers' readiness to integrate Artificial Intelligence (AI) in teaching and learning across five constructs Knowledge, Skills, Attitude, Challenges, and AI Usage Level.
2) To assess the reliability of the questionnaire through pilot testing among Tamil language teachers to determine internal consistency and measurement stability.
3) To conduct an exploratory visual examination of potential relationships among the five constructs Knowledge, Skills, Attitude, Challenges, and AI Usage Level using a preliminary SmartPLS 4 model, acknowledging the limitations of the small pilot sample (n = 36).

Research Questions

1) To what extent does the AI Integration Readiness Instrument demonstrate content validity in measuring Tamil language teachers' readiness to integrate Artificial Intelligence (AI) in teaching and learning across the five constructs of Knowledge, Skills, Attitude, Challenges, and AI Usage Level?
2) To what extent does the AI Integration Readiness Instrument exhibit reliability, specifically in terms of internal consistency and measurement stability, when administered to Tamil language teachers in a pilot study?
3) What preliminary structural patterns among Knowledge, Skills, Attitude, Challenges, and AI Usage Level can be visually identified through an exploratory SmartPLS 4 model in this pilot study?

Significance of the Study

The significance of this study lies in its contribution to understanding how Tamil language teachers in Malaysian primary schools perceive, experience, and apply Artificial Intelligence (AI) tools in teaching and learning. Although digital technologies have become central to the education system under the *Dasar Pendidikan Digital* (DPD) 2023 introduced by the Ministry of Education Malaysia (KPM), empirical evidence on the readiness and practical engagement of Tamil language educators with AI applications remains limited. By providing baseline insights, this study offers valuable guidance for policymakers, school leaders, and teacher training institutions in efforts to strengthen digital competency and pedagogical innovation among vernacular language teachers.

From an educational perspective, the findings illuminate teachers' levels of knowledge, skills, and attitudes toward AI integration in Tamil language instruction. Identifying both gaps and strengths within these dimensions enables curriculum developers and policymakers to design more targeted professional development programmes. This aligns with the aspirations of

Transformasi Sekolah 2025 (TS25), which emphasises creativity, innovation, and enhanced 21st-century learning through technology-enabled pedagogy (KPM, 2023).

From a pedagogical standpoint, the study underscores AI's potential to enrich linguistic instruction through personalised feedback systems, intelligent tutoring, and language-processing tools approaches that can enhance student engagement and learning outcomes (Rahman et al., 2024). Understanding teachers' current competencies, attitudes, and challenges is therefore crucial for ensuring the effective and sustainable integration of AI tools into classroom practice. The findings can guide teacher education programmes in aligning training content with the real-world needs and obstacles faced by Tamil language teachers as they incorporate AI in their lessons.

At the research level, this study contributes to the expanding body of literature on AI adoption in Malaysian education. While much of the existing research focuses on English, STEM, or general digital literacy very few studies address AI integration within Tamil language pedagogy. By situating AI usage in the context of vernacular language education, this study fills a critical knowledge gap and provides empirical groundwork for future comparative, cross-linguistic, or longitudinal studies.

The practical implications of the study are also substantial. Its findings can assist school leaders and education departments in formulating more inclusive digital education policies that ensure equitable support for teachers across all language streams. Strengthening teachers' confidence, competency, and readiness in using AI tools ultimately contributes to Malaysia's broader vision of cultivating a technologically fluent and future-ready teaching workforce capable of supporting the demands of the digital era.

Literature Review

Artificial Intelligence (AI) has emerged as a transformative force in education, reshaping how teachers teach, assess, and engage with students. Globally, the integration of AI tools has accelerated personalised learning, enabled data-driven instruction, and enhanced student engagement through intelligent feedback and adaptive systems (UNESCO, 2023; Meylani, 2024). As the role of teachers shifts from information transmitters to facilitators of inquiry, problem-solving, and creativity, their readiness to integrate AI becomes a crucial determinant of effective pedagogical transformation.

In Malaysia, the Digital Education Policy (DEP 2023) emphasises the importance of equipping teachers with the competencies required to harness emerging technologies in teaching and learning. Complementing this policy, the Malaysia Education Blueprint (2013–2025) highlights technological innovation as a core pillar of 21st-century education (Ministry of Education Malaysia, 2023 & 2025). Despite these national ambitions, literature identifies persistent gaps between policy expectations and classroom implementation, particularly in vernacular schools where infrastructural limitations, linguistic constraints, and unequal access to digital resources remain significant challenges.

Teachers' Knowledge of Artificial Intelligence (AI) in Education

Teachers' knowledge forms the foundation for successful technology integration. Rahman et al. (2024) argue that understanding Artificial Intelligence (AI) requires not only conceptual

awareness of AI algorithms and applications but also pedagogical insight into how AI tools can be meaningfully embedded in instruction. In language education, this knowledge includes familiarity with AI-based grammar correction tools, automated translation systems, and writing analytics platforms that support literacy development (Subramaniam & Lee, 2024).

In Malaysia, studies indicate that while teachers generally possess digital literacy, many lack exposure to AI-specific tools (Sivanganam, Yunus, & Said, 2025). For Tamil language teachers in SJKT schools, these challenges may be compounded by resource constraints specific to vernacular education contexts. Assessing teachers' AI-related knowledge is therefore essential for understanding their preparedness to integrate AI effectively.

Teachers' Skills in Using Artificial Intelligence (AI) Tools

Skills relate to teachers' practical ability to operate and apply Artificial Intelligence (AI) tools in meaningful classroom contexts. Effective skill competency includes planning lessons with AI-assisted resources, analysing student performance using intelligent systems, and integrating adaptive platforms into teaching. The Digital Education Policy (DEP) 2023 emphasises the development of teacher digital skills through in-service training and micro-credential programmes.

However, existing research suggests that digital skill development among Malaysian teachers remains inconsistent, particularly in rural and vernacular settings. Without structured training and collaborative learning environments, many teachers rely on trial-and-error approaches, limiting the effective use of AI tools. Measuring teachers' AI-related skills is vital for identifying professional development needs and designing targeted capacity-building initiatives.

Teachers' Attitudes Toward Artificial Intelligence (AI) Integration

Teachers' attitudes play a decisive role in determining whether new technologies are adopted or resisted. Positive attitudes toward Artificial Intelligence (AI) are associated with openness to experimentation, motivation to attend training, and confidence in using intelligent tools (Rahman et al., 2024). Conversely, negative attitudes may arise from fears of job displacement, loss of autonomy, or lack of understanding of AI's benefits.

In language education, attitudes shape how teachers perceive AI's role in fostering creativity, communication, and personalised learning. For Tamil language teachers, sustaining a positive mindset is essential to balancing cultural teaching traditions with modern digital tools. Research suggests that teachers who view AI as complementing rather than replacing human teaching exhibit higher motivation to adopt it (Rahman et al., 2024)

Challenges in Integrating Artificial Intelligence (AI) into Teaching

Despite growing interest in Artificial Intelligence (AI) adoption, numerous challenges hinder effective implementation in Malaysian schools. These include inadequate internet connectivity, insufficient AI-enabled hardware, lack of localised digital content, and limited time for exploring new tools. In SJKT schools, language-specific constraints and infrastructure disparities further intensify these barriers, leaving teachers with minimal institutional support.

Teachers also face internal challenges, such as low confidence, resistance to technological change, and uncertainty about ethical issues, data privacy, and classroom management when using AI tools. Addressing these challenges requires comprehensive strategies involving policy alignment, sustained professional development, and supportive school leadership to cultivate an AI-ready educational culture.

Level of Artificial Intelligence (AI) Usage in Teaching and Learning

AI usage refers to the extent to which teachers incorporate intelligent systems into everyday classroom practice. Usage ranges from basic digital tools (e.g., translation aids, online quizzes) to advanced AI applications such as automated essay scoring, personalised tutoring systems, and speech recognition (UNESCO, 2023). Current research indicates that most Malaysian teachers are still in the early stages of AI adoption, primarily relying on simple digital tools rather than fully AI-driven platforms (Sivanganam, Yunus, & Said, 2025).

For Tamil language teachers, effective AI integration has the potential to transform traditional literacy instruction by supporting vocabulary development, pronunciation analysis, creative writing, and real-time language feedback. Understanding their current level of AI usage provides insight into both readiness and systemic barriers that must be addressed to achieve equitable digital transformation across language streams.

Synthesis and Research Gap

Overall, previous studies indicate that teachers' readiness to integrate AI is shaped by five core dimensions: knowledge, skills, attitudes, challenges, and actual AI usage. However, the majority of research has focused on English, STEM, or general ICT competency, with limited attention to vernacular language contexts. This highlights the need for a validated instrument specifically tailored to Tamil language teachers to comprehensively assess these dimensions. The present pilot study addresses this gap by developing and validating such an instrument, thereby contributing meaningful insights to Malaysia's broader digital education transformation agenda.

Methodology

Research Design

This study employed a quantitative descriptive design to develop and validate an instrument measuring Tamil language teachers' readiness to integrate Artificial Intelligence (AI) into teaching and learning. This approach allowed for the systematic measurement of the five key constructs Knowledge, Skills, Attitude, Challenges, and AI Usage Level using numerical data and statistical analysis. A descriptive survey method was utilised, where a structured questionnaire captured teachers' perceptions and experiences related to AI integration (Creswell & Plano, 2023).

To ensure clarity, accuracy, and contextual relevance, the instrument underwent both language and content validation by experts in Tamil education and educational technology. Following expert review and refinement, a pilot test was conducted with Tamil language teachers from selected SJKT schools. Reliability was assessed using Cronbach's Alpha, while SmartPLS 4 was employed to generate exploratory visualisations of construct relationships, acknowledging the limitations of the small pilot sample.

The results demonstrated strong reliability and satisfactory content validity, confirming that the instrument is suitable for wider application in future large-scale studies. Overall, this research design provided a rigorous, systematic, and evidence-based approach to evaluating AI readiness among Tamil language teachers in Malaysia.

Population and Sample

The population for this study comprised Tamil language teachers from *Sekolah Jenis Kebangsaan Tamil* (SJKT) across Malaysia, as they are responsible for delivering Tamil language instruction at the primary school level. For this pilot study, purposive sampling was applied to select Tamil language teachers from three SJKT schools located near Kuala Lumpur. These teachers were actively teaching Tamil from Year 1 to Year 6 and had at least basic experience in using digital or Artificial Intelligence (AI) related tools in their classroom practice. This sampling approach ensured that the selected participants were relevant to the study's objectives and had direct exposure to technology-assisted teaching and learning.

For the content validity phase, four experts were engaged two language specialists from the Teacher Education Institute and two field experts who were Tamil language master trainers and experienced Tamil teachers from Selangor. This number aligns with Lynn's (1986) guideline, which recommends between one and five experts for instrument validation. The experts reviewed the questionnaire for clarity, relevance, accuracy, and alignment with the study constructs. They evaluated word choice, sentence structure, conceptual representation, and item appropriateness for Tamil language teachers. Based on their feedback, several refinements were made to improve the linguistic clarity and content alignment of the instrument (Chua, 2018).

For the reliability phase, 36 Tamil language teachers from SJKT schools in Kuala Lumpur were randomly selected to participate in the pilot study. This sample size is consistent with recommendations from previous methodological literature: Chua (2020) suggests 10 to 30 participants for pilot testing, Mumtaz et al. (2020) recommend 30 to 50, and Creswell and Creswell (2018) identify 30 as adequate for initial instrument testing. The selected teachers represented a realistic and appropriate group for assessing item clarity and reliability.

Responses from the pilot test were analysed to determine internal consistency using Cronbach's Alpha and to evaluate the overall stability of the instrument. Feedback from the participants further contributed to refining item clarity and usability. The results confirmed that the instrument was reliable, practical, and suitable for broader application in future large-scale studies examining Tamil language teachers' readiness to integrate AI into teaching and learning.

Research Instrument

The instrument used in this study was a structured questionnaire designed to collect quantitative data on Tamil language teachers' readiness to integrate Artificial Intelligence (AI) into teaching and learning. The questionnaire was organised into six sections A, B, C, D, E, and F each addressing a specific dimension of the study. Several items were adapted and modified from established instruments used in previous research to ensure contextual suitability for the Malaysian Tamil education setting. Specifically, items were adapted from Jalil (2024),

Sundran et al. (2024), and Alwaqdani (2025) with linguistic and cultural adjustments made to reflect the realities of Tamil language teaching.

The final questionnaire consisted of 63 items, systematically categorised across the six sections as shown in Table 1. Section A captured demographic information, while Sections B through F measured the five core constructs of the study Knowledge, Skills, Attitude, Challenges, and AI Usage Level. These constructs were assessed using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The adaptation and refinement process ensured that all items were linguistically clear, culturally appropriate, and theoretically aligned with the construct definitions. Overall, the instrument served as a reliable and valid tool for assessing Tamil language teachers' readiness and perceptions regarding AI integration in the teaching and learning process.

Table 1
Structure of the Questionnaire Instrument

No.	Section	Description	Item Number	**Number of Item**
1	A	Respondents' demographic information	1–7	7
2	B	Teachers' level of AI usage	PA1–PA12	12
3	C	Teachers' level of AI knowledge	PG1–PG10	10
4	D	Teachers' level of AI skills	KG1–KG11	11
5	E	Teachers' attitude toward AI	SG1–SG10	10
6	F	Challenges faced in using AI in Tamil language teaching	CB1–CB13	13
		Total		63

Each construct was measured using multiple items on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The instrument was developed through a combination of literature synthesis, expert consultation, and adaptation of established frameworks related to technology readiness and digital competency (Rahman et al., 2024). The structured format of the questionnaire enabled comprehensive data collection across all five key constructs Knowledge, Skills, Attitude, Challenges, and AI Usage Level thereby providing a robust foundation for assessing AI integration readiness among Tamil language teachers.

Data Collection and Analysis
Data collection was carried out in October 2025 using an online questionnaire administered via Google Forms. The survey link was disseminated through school administrators and Tamil language teacher networks. Participation was voluntary, and all respondents provided informed consent prior to completing the questionnaire. On average, respondents required approximately 10–12 minutes to complete the survey.

The collected data were then exported into Statistical Package for the Social Sciences (SPSS) Version 29.0 for initial processing, followed by SmartPLS 4 for exploratory model visualisation. The data analysis procedures consisted of descriptive statistics, reliability testing, and exploratory construct modelling, as described below. Descriptive statistics, including mean

and standard deviation, were computed to summarise teachers' readiness levels across all constructs. Reliability analysis was conducted to assess internal consistency using Cronbach's Alpha and Composite Reliability. In accordance with the guidelines by Hair et al. (2022), Cronbach's Alpha values exceeding 0.70 were considered acceptable, while values above 0.90 indicated excellent internal consistency.

Subsequently, a simple exploratory model was developed using SmartPLS 4 to visualise the directional relationships among the five constructs. Given the small pilot sample size (n = 36), this analysis was strictly exploratory in nature and not intended for inferential or structural modelling. The visualisation offered preliminary insights into potential construct relationships and served as a foundation for future large-scale research.

Findings

Validity of the Instrument

The validity of the questionnaire was evaluated by a panel of experts to ensure that all items accurately represented the constructs measured in this study. Feedback from three to five experts was deemed sufficient to assess the content, clarity, and relevance of the questionnaire items. To determine the level of expert agreement, the Content Validity Index (CVI) method was employed, as it provides a systematic measure of item relevance based on expert judgement (Chua, 2020; Bull et al., 2022; Lukmanul Hakim et al., 2025). Two approaches are commonly used in CVI assessment: the Item Content Validity Index (I-CVI) and the Scale Content Validity Index (S-CVI) (Creswell & Creswell, 2018). For this study, the I-CVI was selected because it allows for precise evaluation of individual item relevance.

Each expert received the questionnaire and a structured evaluation form and was instructed to rate every item using a four-point scale: 1 = Not Relevant, 2 = Somewhat Relevant, 3 = Relevant, and 4 = Highly Relevant (Bull et al., 2022; Lukmanul Hakim et al., 2025). The I-CVI for each item was calculated by dividing the number of experts rating the item as "3" or "4" by the total number of experts. Items that failed to meet the minimum I-CVI threshold were revised or removed based on the experts' feedback.

Following this refinement process, all 63 items were retained in the final version of the questionnaire. A summary of the overall CVI results reflecting the average level of expert agreement regarding content relevance is presented in Table 2.

Table 2 presents the CVI values for the instrument based on the expert validation process. In general, a CVI value of 0.80 or higher is considered indicative of strong content validity, demonstrating that items are clear, relevant, and adequately represent the intended constructs (Lau et al., 2018; Shrotryia & Dhanda, 2019). Previous research also recommends a minimum threshold of 0.78 when three or more experts are involved, reflecting acceptable levels of agreement among expert reviewers (Polit et al., 2007). Guided by these standards, the present study evaluated the overall agreement and relevance of the questionnaire items using expert ratings. The expected outcome was that the instrument would achieve a CVI value above 0.80, thereby confirming that the items are appropriate, meaningful, and aligned with the constructs used to assess Tamil language teachers' readiness to integrate Artificial Intelligence (AI) into teaching and learning.

Table 2
Expert Content Validity Index (CVI) Results

n	CVI				
63	1	2	3	4	
	0.93	0.86	0.91	0.90	0.90

Reliability of the Instrument

Reliability analysis was conducted to determine the internal consistency of each construct within the instrument. Using SPSS Version 29.0, Cronbach's Alpha and Composite Reliability (CR) coefficients were calculated. Table 3 presents the reliability analysis of the instrument, assessed using Cronbach's Alpha and CR for each construct. Both indicators measure internal consistency, reflecting how closely related the items within each construct are in capturing the same underlying concept (Hair et al., 2021). According to established guidelines, Cronbach's Alpha and Composite Reliability values above 0.70 indicate acceptable reliability, values above 0.80 reflect good reliability, and values exceeding 0.90 demonstrate excellent internal consistency.

Table 3
Range of Cronbach's Alpha Coeffcients (Hair, 2016)

Aplha Range	Reliability Strenght
0.6-< 0.7	Moderate
0.7 -< 0.8	Good
0.8 -< 0.9	Very Good
0.9	Excellent

As shown in Table 4, all five constructs Knowledge (α = 0.918; CR = 0.934), Skills (α = 0.879; CR = 0.905), Attitude (α = 0.986; CR = 0.990), Challenges (α = 0.810; CR = 0.852), and AI Usage Level (α = 0.875; CR = 0.901) recorded values substantially above the minimum threshold. This confirms strong internal consistency across all measurement categories. The overall reliability score of 0.947 further demonstrates excellent consistency for the instrument as a whole.

These findings indicate that the questionnaire is both dependable and robust for measuring Tamil language teachers' readiness to integrate Artificial Intelligence (AI) into teaching and learning. The high reliability values suggest that the instrument is suitable for broader application in future large-scale studies.

Table 4
Reliability Statistics for the Pilot Study (n = 36)

Construct	No. of Items	Cronbach's Alpha	Composite Reliability	Interpretation
Knowledge		0.918	0.934	Excellent
Skills		0.879	0.905	Excellent
Attitude		0.986	0.990	Excellent
Challenges		0.810	0.852	Good
AI Usage Level		0.875	0.901	Excellent
Overall Reliability	—	**0.947**	—	Excellent

Preliminary SmartPLS Model

A preliminary SmartPLS 4 model was generated to provide an exploratory visualisation of the potential relationships among the five main constructs: Knowledge, Skills, Attitude, Challenges, and (AI) Usage Level. Given the small pilot sample (n = 36), the model was not used for inferential testing or statistical estimation of path coefficients. Instead, it served solely as a visual tool to observe possible directional tendencies and to examine whether the constructs aligned with theoretical expectations.

The visual layout of the model suggested that the constructs of Knowledge, Skills, and Attitude appeared to orient towards AI Usage Level in a manner that reflected a potentially positive directional tendency. In contrast, the Challenges construct appeared to be oriented in the opposite direction, visually indicating a possible inverse tendency. These patterns should be interpreted strictly as preliminary, non-statistical cues derived from visual inspection rather than as empirically validated relationships.

Despite its exploratory nature, the SmartPLS visualisation provided useful insights into the structural coherence of the instrument. The directional arrangement of the constructs was theoretically consistent, offering early support for the conceptual design of the instrument. These visual tendencies form a basis for future large-scale studies, where a sufficiently powered sample will allow confirmatory testing and full structural modelling to further validate and refine the instrument.

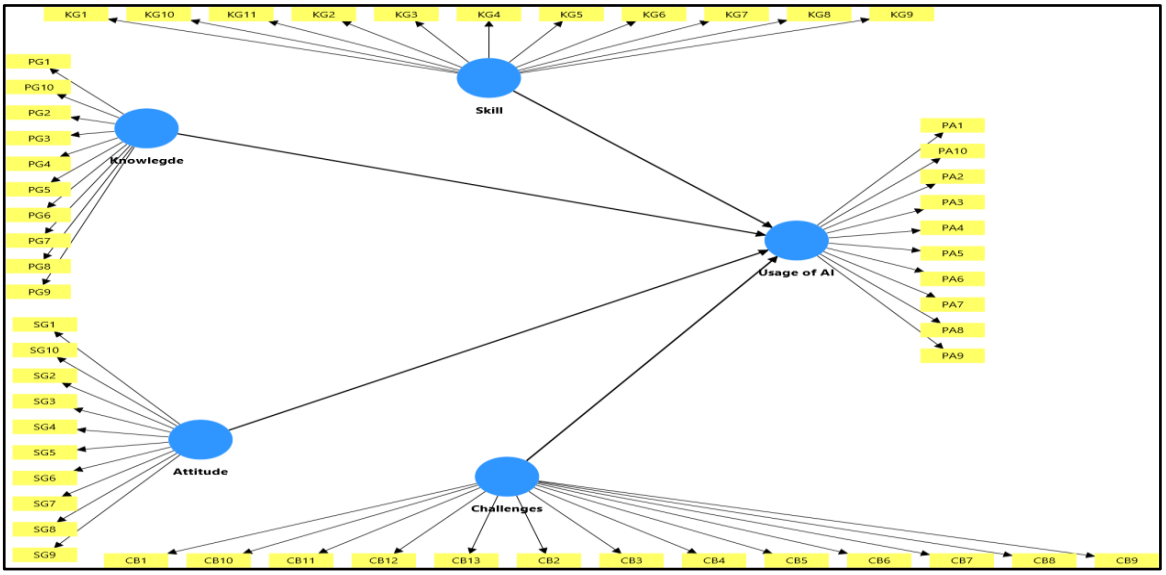

Figure 1. *Preliminary SmartPLS 4 Model Showing Relationships Among Knowledge, Skills, Attitude, Challenges, and (AI) Usage Level.*

Future Research

Based on the outcomes of this pilot study, several recommendations are proposed to guide future research:

1) Administer the Artificial Intelligence (AI) Integration Readiness Instrument to a larger and more diverse sample of Tamil language teachers across various states and school types to further confirm its validity, reliability, and generalisability. Future studies should employ more rigorous statistical techniques such as CFA and Structural

Equation Modelling (SEM) using SmartPLS or AMOS with an adequately powered sample to validate both the measurement and structural models.

2) Incorporate qualitative methods, such as interviews or focus group discussions, to obtain deeper insights into teachers' attitudes, lived experiences, and contextual challenges related to AI integration. Such approaches would complement quantitative findings and offer richer, more nuanced understandings of AI readiness.
3) Adapt and localise the instrument for use among other vernacular or national language teachers, enabling cross-linguistic comparisons of AI readiness within Malaysian schools. This would support broader research on digital equity and technology adoption across different linguistic and cultural contexts.
4) Conduct longitudinal studies to track changes in teachers' knowledge, skills, attitudes, and usage levels over time, particularly following targeted professional development initiatives or the implementation of national digital education policies. Such studies would provide valuable insights into the long-term effectiveness of interventions designed to enhance AI integration in education.

Conclusion

This pilot study successfully developed and validated an Artificial Intelligence (AI) Integration Readiness Instrument designed to assess Tamil language teachers' preparedness to integrate Artificial Intelligence (AI) into teaching and learning. The instrument comprised five essential constructs Knowledge, Skills, Attitude, Challenges, and AI Usage Level which collectively capture the multidimensional nature of teachers' AI readiness in educational settings. Validity analysis confirmed that the questionnaire items were clear, relevant, and contextually appropriate for Tamil language teachers in *Sekolah Jenis Kebangsaan Tamil* (SJKT). Reliability testing demonstrated strong internal consistency, with Cronbach's Alpha values ranging from 0.810 to 0.986 and an overall reliability score of 0.947. These results indicate that the instrument is statistically robust and suitable for assessing AI readiness.

The exploratory SmartPLS 4 visualisation provided initial insights into possible directional tendencies among the constructs. Knowledge, Skills, and Attitude appeared to orient towards AI Usage Level, while Challenges appeared to align in the opposite direction. These observations should be interpreted as preliminary visual cues only, given the limited pilot sample (n = 36), and are not indicative of statistically validated relationships. The pilot study offers a psychometrically sound and contextually relevant instrument for evaluating Tamil language teachers' readiness to integrate AI into teaching. The tool can be refined and administered to larger and more diverse teacher populations to support Malaysia's ongoing digital transformation and educational innovation efforts.

Future research should involve administering the instrument to a broader sample across different states and school types, incorporating rigorous statistical techniques such as Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM), and exploring teachers' lived experiences through qualitative approaches to provide a comprehensive understanding of AI integration readiness. In conclusion, this study provides a foundational tool for assessing AI readiness among Tamil language teachers, offering valuable insights for policymakers, educational leaders, and teacher educators. By addressing both the technical and pedagogical aspects of AI integration, the instrument can guide targeted professional

development, inform policy implementation, and ultimately contribute to enhancing the quality and innovation of language education in Malaysia.

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