

Applying the Technology Acceptance Model to AI Integration in Early Childhood Education: Evidence from Malaysian Preschools

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ABSTRACT

The rapid diffusion of artificial intelligence (AI) into education has outpaced empirical understanding of how early childhood educators perceive and respond to it, particularly within Malaysia and the wider ASEAN region. This study examined the roles of perceived usefulness, AI self-efficacy, and institutional support in predicting early childhood educators' behavioural intention to integrate AI into preschool classrooms, using the Technology Acceptance Model as the guiding framework. A mixed-methods sequential explanatory design was employed, combining a structured survey of 150 preschool educators in the Klang Valley with semi-structured interviews of 12 purposively selected educators. All three constructs correlated strongly and significantly with behavioural intention (perceived usefulness, $r = .99$; AI self-efficacy, $r = .99$; institutional support, $r = .96$; all $p < .01$). However, multiple regression analysis, which explained 98.6% of the variance in behavioural intention, revealed that AI self-efficacy was the only variable to retain a robust, independent, positive effect ($\beta = 1.80$, $p < .001$) once the overlap among predictors was accounted for; perceived usefulness showed an unexpected negative coefficient ($\beta = -.79$, $p = .023$), and institutional support lost statistical significance ($\beta = -.02$, $p = .698$), a pattern consistent with high multicollinearity among the three intercorrelated constructs. Thematic analysis of the interviews identified personalised learning, time efficiency, and student engagement as key motivators, alongside persistent barriers of training gaps, unstable infrastructure, and parental scepticism about screen time. Educators consistently framed AI as a complement to, rather than a substitute for, human interaction. The findings suggest that building educators' confidence through sustained, hands-on professional development is a more actionable lever for AI adoption than generic usefulness messaging or infrastructure investment alone, with implications for teacher training curricula and early childhood technology policy in Malaysia.

Keywords: artificial intelligence; early childhood education; AI self-efficacy; Technology Acceptance Model; teacher perceptions

INTRODUCTION

Artificial intelligence (AI) is reshaping teaching and learning across all levels of education, and early childhood education (ECE) is no exception. AI-powered applications, adaptive learning platforms, and conversational assistants are increasingly embedded in young children's daily environments, yet the use of AI in ECE remains contested because it must be balanced against the developmental needs of young learners, for whom human interaction is central to cognitive, emotional, and social growth (Chaudron et al., 2021; Smutny & Schreiberova, 2020). Malaysia's national digital agenda, including the Malaysia Digital Economy Blueprint and the Digital Education Policy 2021–2025, has pushed for digital transformation across the education system, but neither policy instrument addresses the pedagogical and infrastructural realities of preschool settings in any depth (Noor et al., 2023).

Existing research on AI adoption in education is concentrated in secondary and higher education, leaving a marked gap in empirical understanding of how early childhood educators, the practitioners most directly

responsible for shaping young children's first encounters with technology, perceive and respond to AI (Latip et al., 2022; Rahim & Nordin, 2021).

Guided by the Technology Acceptance Model (TAM), this study investigated the extent to which perceived usefulness, AI self-efficacy, and institutional support predict early childhood educators' behavioural intention to integrate AI into their classrooms, and explored, through qualitative accounts, how educators experience the opportunities and constraints of AI adoption in practice. The specific research questions were: (RQ1) how does perceived usefulness influence educators' intention to integrate AI in the classroom; (RQ2) how does AI self-efficacy affect that intention; and (RQ3) how institutional support affects that intention. By addressing these questions among preschool educators in the Klang Valley, the study contributes context-specific evidence to inform teacher training, institutional planning, and policy on the responsible integration of AI in early learning.

LITERATURE REVIEW

The Technology Acceptance Model (Davis, 1989) proposes that perceived usefulness and perceived ease of use are the principal determinants of technology adoption, and it remains the dominant lens for studying educators' responses to emerging technologies, including AI. Extensions of TAM in education have consistently highlighted self-efficacy and organisational support as important antecedents that shape how usefulness beliefs translate into actual adoption behaviour (Ainin et al., 2020).

Internationally, AI in ECE has been associated with gains in personalised learning, language development, and administrative efficiency, alongside concerns about screen time, data privacy, and the erosion of human-centred pedagogy (Chaudron et al., 2021; Smutny & Schreiberova, 2020). Within Malaysia, empirical work on educators' digital competencies and AI readiness has begun to emerge (Latip et al., 2022), but studies specific to preschool practitioners remain scarce, and most available evidence addresses higher or secondary education (Chin et al., 2023).

Self-efficacy, drawn from Social Cognitive Theory (Bandura, 1997), captures educators' confidence in their own capability to use a technology effectively, and prior studies have found it to be a stronger predictor of sustained technology use than usefulness beliefs alone, because confidence directly shapes willingness to experiment and persist through early difficulties. Institutional support, comprising formal training, technical infrastructure, and administrative encouragement, has similarly been identified as a precondition for adoption, particularly in under-resourced or rural contexts where infrastructural disparities can widen existing inequities (Lim et al., 2022; Razali & Khalid, 2023).

Ethical considerations specific to early childhood, such as informed consent, data privacy, and age-appropriateness of AI-driven content, add a layer of complexity not present in adoption studies conducted at other educational levels (Chin et al., 2023; Kurian, 2024). Taken together, the literature suggests that usefulness, self-efficacy, and institutional support are conceptually distinct but empirically overlapping constructs, and that their relative contribution to behavioural intention may differ once their shared variance is accounted for, a possibility that is examined directly in the present study. Recent regional scholarship reinforces that AI adoption intentions among educators are shaped as much by confidence and readiness as by policy design (Saravanan & Kamrozzaman, 2025) and that professional development models grounded in practical, self-regulated engagement with AI tools yield stronger uptake than one-off training sessions (Saro et al., 2025).

METHODOLOGY

Research Design

This study employed a mixed-methods sequential explanatory design, in which quantitative data were collected and analysed first to establish statistical relationships among the study variables, followed by qualitative data collection to explain and contextualise the quantitative results (Creswell & Creswell, 2018).

This design was selected because it allows triangulation between generalisable statistical patterns and the situated, experiential accounts of educators, producing a more complete picture of AI adoption than either method alone.

Participants and Sampling

The target population comprised early childhood educators, namely teachers, curriculum designers, and centre administrators, working in Malaysian preschools. For the quantitative phase, 150 educators were recruited from public, private, and NGO-operated preschools in Klang Valley using stratified random sampling by region and institution type; this sample size was determined a priori using power analysis for multiple regression. For the qualitative phase, 12 educators with one to twenty years of teaching experience and at least one year of exposure to AI or digital learning tools were purposively selected for semi-structured interviews, a number considered sufficient to reach thematic saturation. Eligible participants were currently engaged in teaching or curriculum-related duties in Malaysia; those in purely administrative roles or based outside Malaysia were excluded.

Instrument and Data Collection

Behavioural intention and its three predictors perceived usefulness, AI self-efficacy, and institutional support were each measured using five-item, five-point Likert scales adapted from established TAM instruments and administered as an online questionnaire. The interview protocol used open-ended prompts aligned with the three research objectives to elicit educators' experiences, motivations, and concerns regarding AI integration. All instruments were reviewed for content validity prior to administration, and every returned questionnaire was complete and retained for analysis.

Data Analysis

Quantitative data were analysed in SPSS. Internal consistency of each scale was assessed using Cronbach's alpha; bivariate relationships were examined using Pearson correlation; and a multiple linear regression was conducted with behavioural intention as the dependent variable and perceived usefulness, AI self-efficacy, and institutional support as simultaneous predictors, to test hypotheses H1–H3. Qualitative data from the interviews were analysed thematically following Braun and Clarke's six-phase approach, comprising 320standardized320on, initial coding, theme searching, theme review, theme definition, and reporting. Ethical approval and informed consent procedures were followed throughout, with participant confidentiality and voluntary participation assured at every stage.

RESULTS

The 150 quantitative respondents were predominantly female (62.7%) and aged between 26 and 35 years (42.0%); 42.0% reported two to five years of teaching experience, and educational qualifications ranged from diploma to master's degree level. Respondents were drawn from both public (57.3%) and private (42.7%) preschools. Full demographic details are presented in Table 1.

Table 1. Demographic profile of quantitative respondents (N = 150)

Variable	Category	n	%
Gender	Female	94	62.7
	Male	56	37.3
Age group	Below 25	33	22.0
	26–35	63	42.0
	36–45	36	24.0

	46 and above	18	12.0
Teaching experience	< 2 years	33	22.0
	2–5 years	63	42.0
	6–10 years	36	24.0
	> 10 years	18	12.0
Highest qualification	Diploma	31	20.7
	Bachelor's degree	60	40.0
	Postgraduate diploma	15	10.0
	Master's degree	42	28.0
School type	Public	86	57.3
	Private	64	42.7

Note. Percentages are rounded and may not sum exactly to 100.

All four scales demonstrated excellent internal consistency (Cronbach's $\alpha = .981-.985$). Bivariate Pearson correlations showed that perceived usefulness, AI self-efficacy, and institutional support were each very strongly and significantly associated with behavioural intention ($r = .99, .99$, and $.96$ respectively, $p < .01$). A multiple linear regression with all three predictors entered simultaneously was highly significant, $R = .993$, $R^2 = .986$, adjusted $R^2 = .986$, $F(3, 146) = 3424.12$, $p < .001$, indicating that the model explained 98.6% of the variance in behavioural intention.

Examination of the individual regression coefficients, however, produced a more nuanced picture than the bivariate correlations alone would suggest. AI self-efficacy emerged as the only predictor with a robust, independent, positive effect on behavioural intention ($\beta = 1.80$, $t = 5.35$, $p < .001$), supporting Hypothesis 2. Perceived usefulness retained statistical significance but showed an unexpected negative coefficient ($\beta = -.79$, $t = -2.29$, $p = .023$), and institutional support was not a significant independent predictor once the other two variables were controlled ($\beta = -.02$, $t = -.39$, $p = .698$), meaning Hypothesis 3 was not supported in the regression model. This divergence between strong positive bivariate correlations and the mixed pattern of regression coefficients is a signature of multicollinearity: because perceived usefulness, AI self-efficacy, and institutional support were themselves very highly intercorrelated, the regression model could not cleanly separate their unique contributions, and the coefficients for perceived usefulness and institutional support should be interpreted with caution. In practical terms, when predictors share this much variance, the estimation procedure cannot cleanly apportion explanatory credit among them: standard errors become inflated, coefficient estimates grow unstable, and a predictor can even return a sign that contradicts its bivariate relationship with the outcome, as observed here for perceived usefulness. Variance inflation factors were not computed for the original analysis but would be a useful diagnostic in any replication of this model. Table 2 summarises the reliability, correlation, and regression results.

Table 2. Reliability, correlation, and regression summary for TAM constructs predicting behavioural intention

Construct	Cronbach's α	r with BI	β (standardized)	t	p
Perceived usefulness (PU)	.981	.992**	-.787	-2.291	.023
AI self-efficacy (AISE)	.984	.993**	1.795	5.348	< .001
Institutional support (IS)	.983	.961**	-.016	-.389	.698
Behavioural intention (BI)	.985	—	—	—	—

Note. BI = behavioural intention. ** $p < .01$ (correlation, 1-tailed). Regression: $R^2 = .986$, $F(3, 146) = 3424.12$, $p < .001$.

Thematic analysis of the 12 semi-structured interviews followed Braun and Clarke's six-phase approach and produced themes aligned with the study's three research questions, plus two additional emergent themes. The source thesis reports these findings as a narrative discussion with illustrative quotations rather than a coded frequency count; accordingly, the prevalence of each code below is described using the same attribution language used in the original data (e.g., "one teacher," "many teachers"), rather than a specific number or percentage that the underlying transcripts do not support.

Table 3. Summary of qualitative themes by research question and reported prevalence

Research question	Theme	Reported prevalence (source thesis)
RQ1: Perceived usefulness	Personalised learning	Raised by one teacher
	Time efficiency	Raised by one teacher
	Increased student engagement	Raised by one participant
RQ2: AI self-efficacy	Training gaps and peer support	Raised by one participant; peer-based learning separately described as common ("many teachers"), count not specified
	Teacher confidence	Raised by at least one participant; broader extent not specified
	Technical difficulties	Reported as a general pattern; count not specified
RQ3: Institutional support	Technical assistance and resources	Described as a common concern ("many teachers")
	Administrative encouragement	Raised by one educator
	Parental scepticism	Raised by one educator
Emergent theme	Need for ongoing professional development	Raised by one participant
	AI as a complement to human interaction	Presented as a shared, moderate view across participants; exact count not specified

Note. Prevalence descriptions use the same attribution language as the source thesis (e.g., "one teacher," "many teachers"). The source thesis does not report a coded frequency count or percentage for any theme; exact counts, if required for publication, should be derived from the original interview transcripts or NVivo coding file rather than estimated.

Research Question 1

How does perceived usefulness influence early childhood educators' intention to integrate AI in the classroom?

Theme 1: Perceived Usefulness of Ai

Table 4. Illustrative quotations and reported prevalence for Research Question 1 themes (perceived usefulness)

Codes	Educators' statements	Prevalence (as reported in source thesis)
Personalised Learning	"AI can offer an individualised learning approach wherein the content is adapted to the pace and interests of a specific child as needed and/or desired."	Raised by one teacher

Time Efficiency	“AI has the potential to allow us more time to write curriculum that is more creative and engaging and more time with students rather than grading or tracking student progress.”	Raised by one teacher
Increased Student Engagement	“AIs can attract children to multisensory experiences, and they can customise the lesson to the stage of their development to encourage them to seek knowledge in the long term.”	Raised by one participant

Research Question 2

How does AI self-efficacy affect early childhood educators’ intention to integrate AI in the classroom?

Theme 2: Ai Self-Efficacy

Table 5. Illustrative quotations and reported prevalence for Research Question 2 themes (AI self-efficacy)

Codes	Educators’ statements	Prevalence (as reported in source thesis)
Training Gaps and Peer Support	“Training has been minimal... most of us have had to learn ourselves or rely on a peer.”	Quote attributed to one participant (“one says”); source thesis’s summary table separately characterizes peer-based learning as common (“many teachers”) without specifying a count
Teacher Confidence	“Confidence with using AI varies by prior exposure; automated AI tools were described as slightly intimidating to at least one participant because of limited training (paraphrased from interview data).”	Raised by at least one participant; broader extent not specified in source
Technical Difficulties	“Troubleshooting and the complexity of advanced features were described as recurring sources of frustration that reduced confidence (paraphrased from interview data).”	Reported as a general pattern; participant count not specified in source

Research Question 3

How does institutional support impact early childhood educators’ intention to integrate AI in the classroom?

Theme 3: Institutional Support

Table 6. Illustrative quotations and reported prevalence for Research Question 3 themes (institutional support)

Codes	Educators’ statements	Prevalence (as reported in source thesis)
Technical Assistance and Resources	“Limited device access and unstable internet.”	Described as a common concern (“many teachers,” per source narrative)
Administrative Encouragement	“The atmosphere is collaborative, and teachers can exchange their tips and advice.”	Raised by one educator
Parental Scepticism	“Some parents are wary of screen time, which can sometimes complicate integrating AI thoroughly (paraphrased from interview data).”	Raised by one educator

Additional Emergent Theme: Future Intentions and Motivation

Beyond the three research questions, educators consistently expressed intent to continue using AI and framed it as a complement to, rather than a substitute for, human interaction.

Table 7. Illustrative quotations and reported prevalence for the emergent theme (future intentions and motivation)

Codes	Educators' statements	Prevalence (as reported in source thesis)
Need for Ongoing Professional Development	"Professional development and durable support of strong institutions are the keys to successful integration of AI."	Raised by one participant
AI as a Complement to Human Interaction	"AI may never substitute but always complement human interactions."	Presented in source as a shared, moderate view across participants; exact count not specified

Note. Prevalence descriptions reflect the attribution language used in the original thesis narrative (e.g., "one teacher," "another participant," "many teachers"). The source thesis does not report a coded frequency count or percentage for any theme; if exact counts are required for publication, they should be derived from the original interview transcripts or NVivo coding file.

DISCUSSION

The results position AI self-efficacy, rather than perceived usefulness or institutional support, as the most defensible independent predictor of Malaysian early childhood educators' intention to integrate AI. This finding aligns with Social Cognitive Theory's emphasis on self-efficacy as a proximal determinant of behaviour. It also extends TAM-based research in education by showing that, in a context where formal AI training is scarce and inconsistently delivered, educators' confidence, built largely through informal peer learning and self-directed experimentation, does more to explain adoption intention than beliefs about AI's usefulness in the abstract.

The negative regression coefficient for perceived usefulness and the loss of significance for institutional support should not be read as evidence that these constructs are unimportant. Rather, the very high bivariate correlations ($r > .96$ for all three predictors) indicate substantial overlap among them, and the regression coefficients reflect each variable's unique contribution once that overlap is removed, a condition under which suppression effects and sign reversals are a known statistical phenomenon, not a substantive finding that usefulness reduces intention. Read this way, the quantitative and qualitative strands converge on a consistent story: educators who feel capable of using AI are more likely to intend to use it, and that capability is currently under-supported by formal institutional structures, a gap educators are filling informally through peer networks.

These findings extend prior Malaysian research on digital readiness in early education (Latip et al., 2022) by isolating self-efficacy as the more actionable lever, rather than blanket investment in infrastructure or generic usefulness messaging. This is not to dismiss the qualitative evidence that infrastructure and parental engagement remain necessary conditions for sustained adoption. The consistent framing of AI as a complement to, rather than a substitute for, human interaction echoes ethical concerns raised elsewhere in the literature regarding the centrality of relational, socio-emotional engagement in early childhood pedagogy (Chin et al., 2023; Kurian, 2024), and suggests that Malaysian educators are approaching AI adoption with considered caution rather than uncritical enthusiasm.

Situated within the broader ASEAN literature, these findings contribute to an emerging regional picture in which educators' confidence and readiness, rather than policy design alone, appear to drive AI adoption intentions (Saravanan & Kamrozzaman, 2025), and in which practical, self-regulated professional development outperforms one-off training (Saro et al., 2025). By identifying self-efficacy as the dominant

predictor within a Malaysian early childhood setting, this study offers a comparative data point for other ASEAN education systems facing similar infrastructural and training constraints as they design their own approaches to AI integration.

The study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design captures perceptions, self-efficacy, and behavioural intention at a single point in time, and therefore precludes causal inference about the direction of influence among the study variables; it also cannot capture how these relationships might change as educators gain further experience with AI tools. Second, the very high intercorrelation among the three predictors ($r > .96$) limits confidence in the individual regression coefficients reported in Table 2; future studies should consider structural equation modelling, hierarchical regression, or longitudinal designs to disentangle these overlapping constructs and establish temporal precedence.

Third, the sample was geographically concentrated in the Klang Valley, an urbanised and comparatively well-resourced region, which may limit generalisability to rural and East Malaysian contexts where infrastructural disparities, staffing patterns, and community attitudes towards technology are likely to differ. Finally, because behavioural intention and its predictors were measured through self-report questionnaires, the findings may be subject to social desirability bias, particularly given the professional expectation that educators view emerging educational technologies favourably; future research could triangulate self-reported intention with observed classroom practice or supervisor ratings to reduce this risk.

CONCLUSION

This study examined the perceptions of early childhood educators in Malaysia regarding the opportunities and challenges of AI integration, using a mixed-methods design grounded in the Technology Acceptance Model. The findings indicate that AI self-efficacy is the most robust independent predictor of educators' behavioural intention to adopt AI, ahead of perceived usefulness and institutional support, and that this confidence is currently sustained more by informal peer learning than by formal institutional structures. Qualitative accounts reinforce that educators view AI as a pedagogical aid that should support, not replace, human interaction, while flagging persistent barriers of training, infrastructure, and parental concern. The study contributes context-specific evidence from an under-researched setting and offers practical implications for teacher training programmes, preschool administrators, and policymakers. For teacher training curricula specifically, the findings point towards embedding a dedicated AI-in-early-childhood-education module within both pre-service teacher education and continuing professional development: one built around scaffolded, hands-on practice rather than one-off workshops, and structured to pair novice educators with confident peers through formal mentoring arrangements that mirror the informal peer learning educators already rely on.

Beyond curricula, institutions should invest in reliable infrastructure and formalise these peer-learning structures rather than leaving them to arise informally, and policy frameworks should mandate AI literacy in teacher certification while safeguarding data privacy and developmentally appropriate use. Future research should employ longitudinal and structural equation modelling approaches to disentangle the overlapping predictors identified here and should extend this inquiry to rural and East Malaysian contexts to assess how infrastructural disparities shape AI adoption beyond the Klang Valley.

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