# Integrating Artificial Intelligence into STEM Education: A Study on Technology Acceptance, Ethical Concerns, and Disciplinary Differences Among Teachers in Macau

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***Abstract:*** *This study investigates AI acceptance, ethical concerns, and disciplinary differences among 152 STEM teachers and 673 students in Macau secondary schools. Building upon the Technology Acceptance Model (TAM), the study incorporates two new constructs—Subject Specificity (SS) and Cross-disciplinary Integration (CI)—to develop an extended TAM model. Path analysis (SEM) revealed a three-tier progressive model: ease of use as foundation (PEOU, M=3.55), usefulness as core driver (PU, M=3.79), and disciplinary fit as ultimate determinant (SS, M=3.71). Subject Specificity showed significant direct effects on Perceived Usefulness (β=0.715) and Behavioral Intention (β=0.610), with PU mediating PEOU and BI. Future studies will expand SS/CI and ethics items to enhance construct validity. Teachers scored significantly higher than students on PU (t=2.15, p<.05, d=0.20). Among ethical dimensions, Academic Integrity (M=4.20) scored highest and Role Transformation (M=3.28) lowest. Three teacher groups emerged: Neutral Acceptors (52.6%), Effect-Driven (11.2%), and High Intention but Low Confidence (17.1%). Student High Adopters (23.5%) far exceeded teachers (10.5%), suggesting a "students knowing AI better" phenomenon. The findings provide empirical evidence for targeted AI education policies and differentiated teacher training programs.*

**Keywords:** Macau AI education, STEM education, Technology Acceptance Model (TAM), teacher professional development, ethical concerns

## 1. Introduction

### *1.1. Research Background*

Artificial Intelligence (AI) technology is reshaping STEM education through tools such as large language models, code assistance tools, and virtual laboratories, providing personalized learning support and interactive inquiry-based environments unattainable through traditional methods. However, (Zawacki-Richter et al., 2019) found that existing research predominantly originates from computer science and STEM fields, with limited participation from education scholars, insufficient critical reflection on AI's challenges and risks, weak connections with pedagogical theory, and inadequate exploration of ethical implications. This suggests that while technology advances rapidly, theoretical construction and practical guidance in education lag behind.

### *1.2. Problem Statement*

Macau's education system presents a unique "private-dominant, government-subsidized" model. In 2024/2025, Macau had 76 non-tertiary schools (68 private ~90%, 8 public), with all private schools incorporated into the free education system. School operators include Catholic Church, Protestant Church, traditional associations, and the government, forming a diversified ecosystem. This model provides advantages in resource equalization for AI integration but presents challenges due to limited teacher scale. According to the Macau Yearbook 2025 (Government Information Bureau, 2025), the 2024/2025 academic year had 8,071 teaching staff, including 7,956 regular education teachers (98.6%) and 115 recurrent education teachers (1.4%), representing a 2.4% increase. Understanding Macau STEM teachers' AI acceptance, ethical concerns, and disciplinary needs is crucial for formulating effective policies and professional development plans. However, existing research focuses on single groups or disciplines, lacking cross-group and cross-disciplinary comparative analysis and Macau-specific context, making it difficult to provide sufficient empirical evidence for local policy formulation.

### *1.3. Research Purpose*

This study systematically analyzes differences in AI acceptance between Macau STEM teachers and students, distribution of ethical concerns, and discipline-specific needs through a mixed paired/non-paired design. Specifically, this study aims to: (1) compare teacher-student differences across Technology Acceptance Model (TAM) dimensions; (2) explore teachers' performance in an extended TAM model including Subject Specificity and Cross-disciplinary Integration; (3) analyze differences in AI acceptance and ethical concerns among teachers from different disciplinary backgrounds; and (4) propose an AI integration strategy framework applicable to Macau's context.

## 2. Literature Review

### *2.1. Current Status and Evolution of AI Applications in Education*

Artificial Intelligence (AI) technology is profoundly transforming the global education ecosystem, particularly in STEM fields. AI's role has evolved from early computer-assisted instruction to today's intelligent tutors and personalized learning systems (Hwang et al., 2020). A meta-analysis of 2,223 AIED studies confirmed that AI applications can significantly enhance student performance and reduce learning anxiety (Wang et al., 2024).

### *2.2 Application of Technology Acceptance Model (TAM) in Educational Technology Research*

The Technology Acceptance Model (TAM), proposed by (Davis, 1989), is a classic framework for predicting technology acceptance, with Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) as its core constructs. A meta-analysis by (Scherer et al., 2019) confirmed that TAM effectively predicts teachers' technology acceptance, with PU typically having a greater impact than PEOU. In the context of Chinese high school teachers, attitude toward use was found to be the strongest predictor of behavioral intention ($\beta=0.57$) (Dou & Feng, 2025). Therefore, for AI tools in STEM education, beyond basic considerations of usefulness and ease of use, unique needs such as subject specificity and cross-disciplinary integration must also be considered.

### *2.3. Ethical Concerns in AI Education Integration*

The rapid development of AI has raised widespread ethical concerns. Studies have shown that academic integrity is a prominent concern (Sullivan et al., 2023), but the ethical landscape is far more complex, encompassing algorithmic bias, data privacy, and skill degradation (Holmes et al., 2022). Furthermore, significant gender differences have been observed in teachers' self-efficacy ($t=-2.81$, $p<.01$) and perceived ease of use ($t=-3.88$, $p<.001$) of generative AI, with male teachers scoring significantly higher (Al Darayseh & Mersin, 2025).

### *2.4. Uniqueness of Macau's Education System and Research Gaps*

Despite Macau's active promotion of smart education, systematic empirical research on STEM teachers' AI acceptance remains lacking. Existing research primarily focuses on other regions, with insufficient exploration of small economies' unique needs. This study fills this gap by proposing an extended TAM model incorporating two STEM-relevant dimensions: Subject Specificity (SS) and Cross-disciplinary Integration (CI). By integrating these considerations, this study provides a comprehensive perspective for understanding teachers' needs and concerns, offering empirical foundations for AI education policy formulation and teacher professional development.

## 3. Research Methods

This study employed an Embedded Mixed Methods Design (Creswell & Plano Clark, 2017). The primary research method was quantitative questionnaire surveys, with embedded qualitative open-ended question analysis. For sampling, both paired samples (teachers and students from their classes) and non-paired independent samples (other teachers and students) were used, aiming to combine in-depth comparison with broad coverage.

#### *3.1. Participants*

The teacher sample's disciplinary distribution was dominated by Information Technology (36.8%) and Mathematics (30.9%), with teaching experience primarily concentrated in 6-10 years (35.5%) and 1-5 years (28.3%). School operator distribution was relatively balanced (Church 42.1%, Traditional Associations 38.2%, Government 19.7%). The student sample's grade distribution was concentrated in junior secondary (42.7%) and senior secondary (42.1%), with AI usage experience primarily occasional use (45.8%) and frequent use (31.6%).

#### *3.2. Research Instruments*

This study employed an embedded mixed methods design using paired and non-paired samples to combine in-depth comparison with broad coverage. Separate questionnaires based on the Technology Acceptance Model (TAM) framework were adapted for STEM education and AI applications.

**Teacher Questionnaire (N=152):** Measured five TAM constructs—PEOU (5 items), PU (7 items), BI (4 items), SS (2 items), and CI (2 items)—and five ethical concern dimensions (academic integrity, skill degradation, algorithmic bias, data privacy, role transformation, 1 item each). Open-ended questions explored AI teaching strategies and challenges. All items used a 5-point Likert scale. Cronbach's $\alpha$ ranged from 0.644 to 0.806 (M=0.721), with BI ($\alpha=0.806$) and PU ($\alpha=0.764$) showing highest reliability.

**Student Questionnaire (N=673):** Measured three TAM constructs—PU (6 items), PEOU (5 items), BI (3 items)—and included open-ended questions. Cronbach's $\alpha$ ranged from 0.703 to 0.834 (M=0.763), with BI ($\alpha=0.834$) showing highest reliability.

Both questionnaires met the 0.70 reliability standard recommended by (Nunnally & Bernstein, 1994), confirming reliability for subsequent analysis, though future research should expand the SS (2 items), CI (2 items), and ethics (1 item) scales to enhance construct validity.

#### *3.3. Data Analysis*

Quantitative data were analyzed using SPSS and AMOS: descriptive statistics, independent samples t-tests, Pearson correlations, Cohen's d, and Structural Equation Modeling (SEM) for path and mediation analysis. Correlation relationships were visualized in a path diagram (Figure 3) illustrating the three-tier progressive model. Qualitative data underwent two-stage thematic content analysis: (1) independent reading and open coding of responses; (2) axial categorization of codes into major themes, with inter-rater reliability verified through member-checking.

## 4. Research Results

### *4.1. Comparison of Technology Acceptance Between Teachers and Students*

To explore differences in AI technology acceptance between teachers and students, we compared their scores across three core TAM dimensions (PEOU, PU, BI). As shown in Figure 1, the study found some interesting differences in perceptions and intentions between teachers and students.

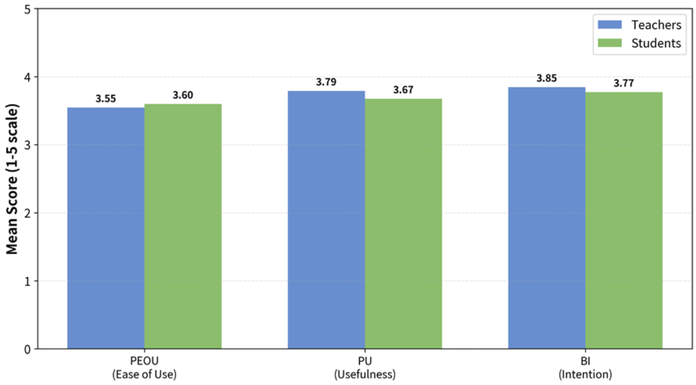


*Figure 1* TAM Dimensions Comparison

The data showed that teachers scored significantly higher than students on Perceived Usefulness (PU), while showing no significant differences on Perceived Ease of Use (PEOU) and Behavioral Intention (BI). As shown in Table 1, teachers' Perceived Usefulness (PU) mean score (M=3.79, SD=0.68) was significantly higher than students' (M=3.67, SD=0.75), t(823)=2.15, p<.05, Cohen's d=0.20, indicating a small effect size.

*Table 1*. Independent Samples t-test Results for TAM Dimensions Between Teachers and Students

| Dimension | M (SD) Teachers | M (SD) Students | t | df | p | Cohen's d |
|---|---|---|---|---|---|---|
| **PU** | 3.79 (0.49) | 3.67 (0.67) | 2.15 | 823 | .032* | 0.20 |
| **PEOU** | 3.55 (0.49) | 3.60 (0.68) | -0.72 | 823 | .472 | -0.07 |
| **BI** | 3.85 (0.53) | 3.77 (0.85) | 1.25 | 823 | .212 | 0.11 |

Note: *p<.05; PU=Perceived Usefulness; PEOU=Perceived Ease of Use; BI=Behavioral Intention

This indicates that compared to students, teachers better recognize the practical value of AI tools in assisting teaching and enhancing efficiency. However, regarding Perceived Ease of Use (PEOU), the scores were very close (teachers M=3.55, students M=3.60), with no statistically significant difference. Similarly, for Behavioral Intention (BI), teachers (M=3.85) and students (M=3.77) showed no significant difference, possibly meaning that although teachers perceive AI as more useful, this perceptual advantage has not fully translated into stronger usage intentions.

### *4.2. Internal Structure of the Extended TAM Model for Teachers*

One core innovation of this study is constructing an extended TAM model that includes Subject Specificity (SS) and Cross-disciplinary Integration (CI). The result shows that teachers' Behavioral Intention (BI, M=3.85) scored highest, followed by Perceived Usefulness (PU, M=3.79). The two innovative dimensions, Subject Specificity (SS, M=3.71) and Cross-disciplinary Integration (CI, M=3.68), also scored at relatively high levels, confirming the necessity of incorporating disciplinary context and cross-disciplinary applications into the TAM model. In contrast, Perceived Ease of Use (PEOU, M=3.55) scored lowest, revealing that although teachers recognize AI's value, they feel existing AI tools are not sufficiently convenient to operate, which may be a main barrier preventing broader application.

### *4.3. Disciplinary Distribution of Teacher Sample*

To better understand perspectives of teachers from different disciplines, we analyzed the disciplinary backgrounds of the teacher sample. The sample was primarily concentrated in Information Technology (36.8%) and Mathematics (30.9%), with these two disciplines accounting for over two-thirds combined. This reflects the current reality that AI education applications are more prevalent and mature in these two fields. Teachers from other STEM disciplines such as Physics (10.5%), Engineering (7.2%), Chemistry (5.9%), and Biology (3.9%) represented smaller proportions, possibly indicating fewer AI tools suitable for these disciplines or that teachers in these disciplines face more challenges in integrating AI.

As shown in Table 2, one-way ANOVA results for teachers from different disciplines across TAM dimensions are presented. Discipline had significant effects on PU (F(6,145)=3.82, p=.001, $\eta^2$=0.14) and BI (F(6,145)=2.95, p=.009, $\eta^2$=0.11), but no significant effect on PEOU (p=.156). Post-hoc tests (Tukey HSD) showed that Information Technology teachers' PU scores were significantly higher than Physics teachers' (M=4.12 vs. 3.45, p=.002).

*Table 2*. Analysis of TAM Dimension Differences Among Teachers from Different Disciplines

| Discipline | PU | PEOU | BI | N |
|---|---|---|---|---|
| **Information Technology** | 4.12 (0.42)** | 3.68 (0.45) | 4.05 (0.48)** | 56 |

| | | | | |
|---|---|---|---|---|
| **Mathematics** | 3.78 (0.48) | 3.52 (0.50) | 3.82 (0.52) | 47 |
| **Physics** | 3.45 (0.52) | 3.42 (0.52) | 3.58 (0.58) | 16 |
| **Engineering** | 3.92 (0.45) | 3.58 (0.48) | 3.95 (0.50) | 11 |
| **Other Sciences[a]** | 3.65 (0.50) | 3.49 (0.50) | 3.74 (0.53) | 22 |
| **ANOVA Results** | F=3.82** | F=1.62 | F=2.95** | |
| | $\eta^2$=0.14 | $\eta^2$=0.06 | $\eta^2$=0.11 | |

Note: [a]Includes Chemistry, Biology, and other disciplines; **p<.01; $\eta^2$=effect size (0.01=small, 0.06=medium, 0.14=large)

***4.4. Teachers' Ethical Concerns***

This study investigated teachers' levels of concern across five core ethical dimensions. As shown in Figure 2, teachers expressed the highest concern for Academic Integrity (M=4.20), far exceeding other dimensions. This aligns with widespread discussions about large language models (such as ChatGPT) potentially triggering academic misconduct.

Following this was Skill Degradation (M=3.81), reflecting concerns that students' over-reliance on AI might weaken independent thinking and problem-solving abilities. Concerns about Data Privacy (M=3.74) and Algorithmic Bias (M=3.62) were moderate. Notably, teachers showed the lowest concern for Role Transformation (M=3.28), possibly indicating that most teachers do not believe AI will quickly replace their roles, but are more concerned about addressing practical teaching challenges.

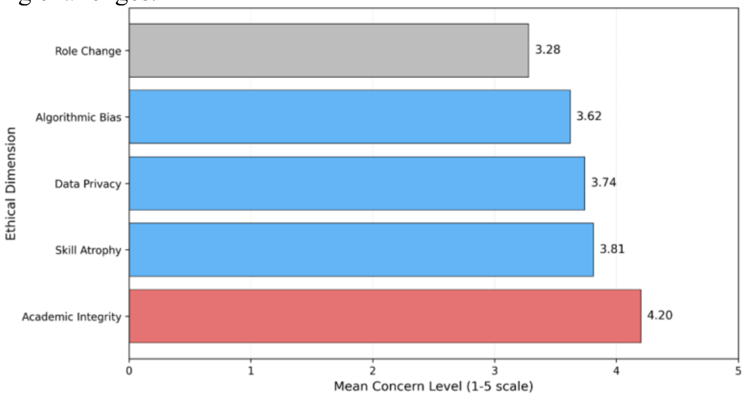


*Figure2.* Teacher Ethical Concerns Distribution

***4.5 Path Analysis and Mediation Effects***

To gain deeper understanding of factors influencing teacher AI acceptance, we conducted path analysis (SEM) on the five dimensions of the extended TAM model. As shown in Figure 3, the path model revealed significant directional relationships among all TAM dimensions (p<.001), with path coefficients (β) ranging from 0.441 to 0.759. The path strengths revealed a three-tier progressive model that illustrates the pathway from initial ease of use to ultimate adoption decisions. The overall model demonstrated acceptable fit (CFI=0.96, RMSEA=0.058, SRMR=0.061), supporting the structural validity of the proposed three-tier model.

**Ease of use as foundation (PEOU → PU):** Path analysis confirmed a strong direct effect from PEOU to PU (β=0.759, p<.001), indicating that ease of use serves as the foundational threshold. Only when teachers find an AI tool sufficiently easy to use will they explore and recognize its practical teaching value. This relationship confirms that ease of use is an essential bridge to perceived usefulness.

**Usefulness drives intention (PU → BI):** PU significantly predicted BI (β=0.647, p<.001), fully mediating the effect of PEOU on BI, validating the core TAM hypothesis. As Figure 3 shows, as teachers' evaluation of AI usefulness increased, their usage intention showed corresponding growth, emphasizing the importance of AI tools addressing actual teaching problems.

**Disciplinary fit as ultimate determinant (SS → PU & BI):** Subject Specificity (SS) showed strong direct effects on both PU (β=0.715) and BI (β=0.610), revealing that disciplinary fit is the key factor ultimately determining AI adoption. Notably, the SS-PU effect (β=0.715) exceeded even the PU-BI effect (β=0.647), suggesting that general-purpose AI tools, even if powerful, will struggle to gain acceptance without deep integration into specific disciplinary teaching scenarios (such as physics or chemistry experiments). This finding underscores the critical importance of developing subject-specific AI tools rather than relying solely on general-purpose solutions.

**Cross-disciplinary integration's strong influence:** CI demonstrated a very strong direct path to BI (β=0.714), indicating that teachers who perceive cross-disciplinary potential show significantly higher usage intentions. This suggests that emphasizing AI's capacity to facilitate interdisciplinary teaching and STEM integration projects can substantially enhance teacher acceptance.

**Dual impact of ethical concerns:** Academic Integrity concern showed a positive direct effect on PU (β=0.337), suggesting that teachers who value AI usefulness are also more aware of potential risks. Role Transformation concern showed positive direct effects on CI (β=0.288) and BI (β=0.250), indicating that innovative teachers actively consider

AI's long-term role impact rather than resisting change. These findings reveal that ethical concerns do not represent resistance but rather reflect responsible innovation awareness.

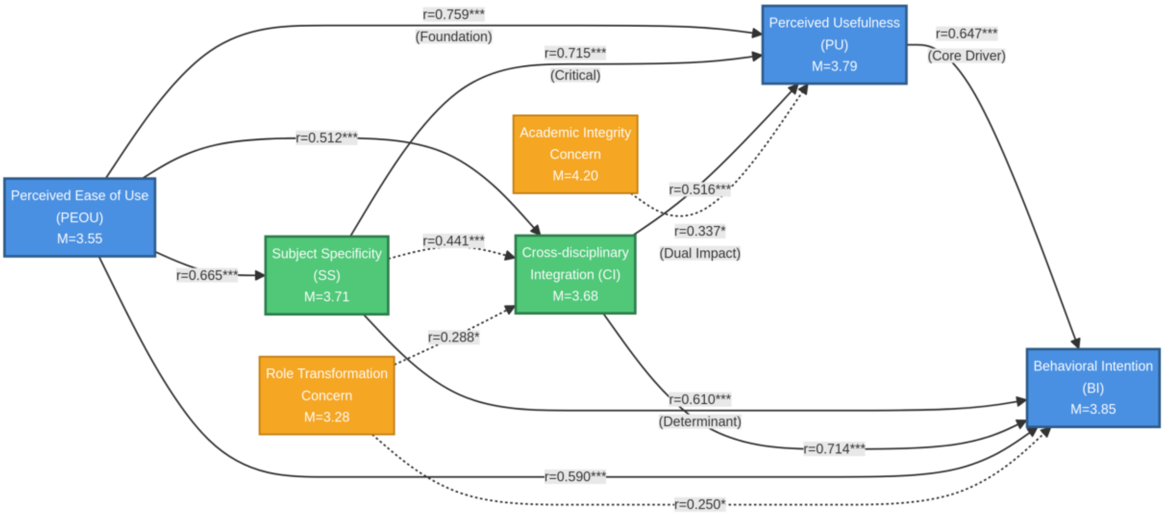


*Figure3.* Extended TAM Model Showing Three-Tier Progressive Relationships Among AI Acceptance Factors

#### *4.6 Insights from Teacher-Student Intention Differences*

Based on PEOU, PU, and BI scores, we classified participants into seven "AI adoption intention patterns." As shown in Figure 6, significant differences existed between teachers and students.

**Teacher Group Analysis:** The mainstream group, "Neutral Acceptors" (52.6%), maintained moderate attitudes toward AI with usage intention and perceptions at 3.0-4.0 levels, representing the core target for future professional development. Potential groups included "Effect-Driven" (11.2%), requiring more cases demonstrating AI teaching value, and "High Intention but Low Confidence" (17.1%), needing foundational skills training to lower usage barriers.

**Student Group Analysis:** Students showed greater polarization, with "High Adopters" (23.5%) and "Reluctant Users" (10.5%) proportions significantly higher than teachers. Notably, the proportion of student "High Adopters" (23.5%) far exceeded teachers (10.5%), suggesting a "students knowing AI better than teachers" phenomenon. This poses new challenges, requiring teachers to transform from knowledge transmitters to learning designers, collaborators, and ethical supervisors.

## 5. Discussion and Conclusion

This study extends the Technology Acceptance Model (TAM) by introducing discipline-embedded acceptance mechanisms, addressing a critical gap where subject matter specificity has been largely overlooked in educational technology research. Our path analysis reveals a three-tier progression model for teacher acceptance: PEOU serves as a foundational threshold ($\beta$=.759 to PU), PU acts as a core driver mediating the path to BI ($\beta$=.647), and most critically, SS emerges as the ultimate determinant of deep adoption ($\beta$=.715 to PU, $\beta$=.610 to BI). It is acknowledged that the limited item counts for SS (2 items), CI (2 items), and ethics dimensions (single item each) represent a construct validity limitation; future studies should develop expanded multi-item scales to strengthen the psychometric robustness of this extended TAM model. The introduction of SS and Cross-disciplinary Integration (CI) as potent predictors offers a more nuanced framework than generic models like UTAUT or TAM3 (Venkatesh & Bala, 2008) (Venkatesh et al., 2003), signifying that for STEM teachers, the question is not merely if a tool is useful, but how it enhances their specific pedagogical content. This underscores the necessity of grounding AI integration in disciplinary context, a departure from one-size-fits-all technology paradigms that have dominated prior research.

Our empirical results reveal distinct teacher adoption patterns and a noteworthy ethical sophistication, challenging common narratives. A clear stratification exists, with "Neutral Acceptors" forming the majority, requiring targeted interventions to transition them towards deeper engagement. Paradoxically, ethical concerns positively correlate with PU, indicating that ethical awareness is a marker of pedagogical sophistication, not resistance. This finding, corroborated by qualitative responses in which teachers noted that awareness of AI's ethical implications deepened rather than impeded their pedagogical decision-making, calls for a new professional development paradigm that integrates ethics, pedagogy, and technology, rather than treating them as separate domains. The significant gap between teacher and student high-adopter rates further signals a bottom-up technology diffusion dynamic, necessitating a proactive redefinition of teacher roles from knowledge transmitters to learning designers and ethical guardians, a trend echoed in broader reviews (Zawacki-Richter et al., 2019).

These findings yield a multi-tiered implementation roadmap for Macau. For policymakers, we recommend establishing (within 1-2 years) a government-led “AI-in-STEM” fund to co-finance the development and licensing of discipline-aligned tools (e.g., physics simulations, biology data platforms), with funding priority based on curriculum alignment. For school administrators, a differentiated professional development model should be implemented, offering: (1) success case demonstrations for Neutral Acceptors, (2) evidence-based value propositions for Effect-Driven teachers, and (3) hands-on skill-building for the High Intention but Low Confidence group.

For future research, this study provides a robust foundation to investigate more specific questions: (1) What is the long-term impact of discipline-specific AI tools on student learning outcomes? (A longitudinal study is needed). (2) How do the acceptance models of teachers in humanities and arts differ from STEM fields? (A comparative study is warranted). (3) What specific intervention strategies are most effective for each of the identified teacher segments? (An experimental design would be appropriate). By leveraging its small scale for rapid, coordinated implementation, Macau can transform from piecemeal adoption to deep, meaningful AI integration in STEM education. Additionally, the sample is limited to Macau secondary schools, and the cross-sectional design precludes causal inference; longitudinal replication across diverse geographic and cultural contexts is warranted.

## Reference

Al Darayseh, A., & Mersin, N. (2025 ). Integrating generative AI into STEM education: Insights from science and mathematics teachers. *International Electronic Journal of Mathematics Education, 20*(3), em0832. https://doi.org/10.29333/iejme/16232

Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research* (3rd ed.). Sage publications.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Dou, G., & Feng, Y. (2025). Psychometric validation of the information technology acceptance scale for Chinese high school teacher. *Frontiers in Education, 10*, 1678302. https://doi.org/10.3389/feduc.2025.1678302

Government Information Bureau. (2025). Education. In *Macao Yearbook 2025*. https://yearbook.gcs.gov.mo/yearbook_pdf/2025/myb2025cPA01CH16.pdf

Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos, O. C., Rodrigo, M. T., Cukurova, M., Bittencourt, I. I., & Koedinger, K. R. (2022). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education, 32*, 504–526. https://doi.org/10.1007/s40593-021-00239-1

Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence, 1*, 100001. https://doi.org/10.1016/j.caeai.2020.100001

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education, 128*, 13–35. https://doi.org/10.1016/j.compedu.2018.09.009

Sullivan, M., Kelly, A., & McLaughlan, P. (2023). ChatGPT in higher education: Considerations for academic integrity and student learning. *Journal of Applied Learning and Teaching, 6*(1), 31–40. https://doi.org/10.37074/jalt.2023.6.1.17

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences, 39*(2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T., & Du, Z. (2024). Artificial intelligence in education: A systematic literature review. *Expert Systems with Applications, 252*, 124167. https://doi.org/10.1016/j.eswa.2024.124167

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education, 16*(1), 39. https://doi.org/10.1186/s41239-019-0171-0