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How AI-Assisted Learning Satisfies Students' Psychological Needs: Evidence from Taiwan Universities

¹Chiao-Chieh Chen, ²Yu-Ping Chiu

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ABSTRACT

Despite widespread AI adoption in universities globally, current implementations may inadvertently undermine learning engagement, with students reporting AI use primarily due to external pressures rather than genuine interest. This disconnect between technological sophistication and psychological understanding poses immediate challenges for educational institutions seeking to maximize AI benefits while supporting student wellbeing. This study examines how AI-assisted learning influences students' basic psychological needs satisfaction through Self-Determination Theory in Taiwanese university contexts, providing the first systematic investigation of all three psychological needs (competence, autonomy, relatedness) simultaneously within AI learning environments. A cross-sectional survey of 200 Taiwanese university students was conducted using structural equation modeling, with validated scales measuring AI-assisted learning usage and basic psychological needs satisfaction (competence, autonomy, relatedness). AI-assisted learning significantly influenced all three psychological needs, with competence showing the strongest effect, followed by autonomy and relatedness. Competence need satisfaction emerged as the primary factor in AI learning contexts, consistent with findings in Chinese educational settings. This research provides the first systematic application of Self-Determination Theory to AI education contexts, demonstrating that psychological need satisfaction determines AI learning effectiveness. Competence need primacy in AI contexts challenges traditional SDT applications where autonomy typically receives primary emphasis, suggesting that technological complexity and cultural factors moderate psychological need dynamics. The findings offer evidence-based guidance for designing culturally-informed AI educational systems that prioritize competence-centered features, integrate autonomy-supporting elements, and adopt hybrid implementation models combining AI's strengths with essential human instruction elements for emotional support and interpersonal connection.

Keywords: AI-assisted learning, Educational technology, Psychological needs, Self-determination theory

INTRODUCTION

The integration of artificial intelligence (AI) into educational settings represents one of the most significant technological transformations in contemporary higher education (Wang et al., 2025). AI-assisted learning systems, featuring adaptive algorithms, personalized content recommendations, and intelligent feedback mechanisms, have rapidly proliferated across university campuses worldwide (Gibson et al., 2023; Li et al., 2025). However, despite substantial investments in AI educational technologies and their widespread adoption, a critical knowledge gap persists regarding the psychological mechanisms underlying their educational effectiveness (Zhang & Zhang, 2024). This disconnect between technological sophistication and psychological understanding poses immediate challenges for educational institutions seeking to maximize the benefits of AI investments while supporting student wellbeing.

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acknowledging fundamental technological differences. AI-assisted learning incorporating adaptive algorithms and intelligent feedback represent qualitative learning environments from earlier digital technologies like e-learning platform based instruction. These unique AI capabilities, particularly real-time adaptive personalized scaffolding, may fundamentally alter psychological need dynamics in existing SDT applications fail to capture. For instance, while traditional SD

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infrastructure provides an ideal context for studying mature AI learning adoption. This culturally-situated approach directly addresses Gap 3, contributing evidence to the predominantly Western SDT literature while testing generalizability of motivational constructs across cultural contexts.

Research Objectives

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al., 2019; Zhang & Zhang, 2024). This design is particularly suitable for initial theoretical research examining whether established psychological frameworks (Self-Determination Theory) apply to emerging technological contexts (AI-assisted learning), as recommended by Singleton and Straits (2018) for exploratory investigations of novel phenomena.

The study adopted a correlational research approach within the cross-sectional design, specifically utilizing structural equation modeling (SEM) to test hypothesized relationships between constructs. SEM was chosen as the primary analytical strategy because

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Note. AVE = Average Variance Extracted; CR = Composite Reliability. All Cronbach's exceed .85, indicating excellent internal consistency reliability. All AVE values exceed .50, indicating excellent convergent validity. All CR values exceed .85, demonstrating adequate convergent validity.

Scale Validation for Current Study: All scales demonstrated excellent psychometric properties in the current sample. Confirmatory factor analysis (CFA) confirmed the five-factor structure of the scales. The fit indices for the five-factor model were excellent, $\chi^2(1, N=200) = 1.23, p = .29, CFI = 0.99, RMSEA = 0.01, SRMR = 0.01$. The standardized factor loadings for all items were greater than 0.70, indicating excellent convergent validity. The average variance extracted (AVE) for all scales was greater than 0.50, indicating excellent convergent validity. The composite reliability (CR) for all scales was greater than 0.85, indicating excellent internal consistency reliability.

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procedures. **Stage 1:** Measurement Model Evaluation assessed the validity and reliability of the measurement instruments through confirmatory factor analysis (CFA). This stage examined whether observed items adequately represent underlying latent constructs and tested if the constructs are empirically distinct. **Stage 2:** Structural Model Testing examined the hypothesized relationships between AI-assisted learning usage and three psychological needs dimensions, providing statistical tests for each hypothesis.

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Ethical Considerations

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moderated by technological and cultural contexts. This finding advances SDT by demonstrating that while the three needs are universally important, their relative salience varies systematically across contexts rather than remaining constant.

Second, Technological Complexity as a Moderator of Psychological Need Satisfaction. The competence primacy pattern observed in this study suggests that technological complexity may function as a contextual moderator that amplifies certain psychological needs while moderating others. When learning environments involve sophisticated technological

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psychological needs, provide comprehensive implementation support including p
development and technical infrastructure, develop clear ethical guidelines address
and algorithmic transparency, and adopt policies emphasizing complementary inte
maintains essential human elements in education. This evidence-based approach e
AI investments maximize both learning effectiveness and student wellbeing.

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Despite widespread AI adoption in universities globally, current implementations may inadvertently undermine learning engagement, with students reporting AI use primarily due to external pressures rather than genuine interest. This disconnect between technological sophistication and psychological understanding poses immediate challenges for educational institutions seeking to maximize AI benefits while supporting student wellbeing. This study examines how AI-assisted learning influences students' basic psychological needs satisfaction through Self-Determination Theory in Taiwanese university contexts, providing the first systematic investigation of all three psychological needs (competence, autonomy, relatedness) simultaneously within AI learning environments. A cross-sectional survey of 200 Taiwanese university students was conducted using structural equation modeling, with validated scales measuring AI-assisted learning usage and basic psychological needs satisfaction (competence, autonomy, relatedness). AI-assisted learning significantly influenced all three psychological needs, with competence showing the strongest effect, followed by autonomy and relatedness. Competence need satisfaction emerged as the primary factor in AI learning contexts, consistent with findings in Chinese educational settings. This research provides the first systematic application of Self-Determination Theory to AI education contexts, demonstrating that psychological need satisfaction determines AI learning effectiveness. Competence need primacy in AI contexts challenges traditional SDT applications where autonomy typically receives primary emphasis, suggesting that technological complexity and cultural factors moderate psychological need dynamics. The findings offer evidence-based guidance for designing culturally-informed AI educational systems that prioritize competence-centered features, integrate autonomy-supporting elements, and adopt hybrid implementation models combining AI's strengths with essential human instruction elements for emotional support and interpersonal connection.

Keywords: AI-assisted learning, Educational technology, Psychological needs, Self-determination theory

educational settings represents most significant technological transformations in contemporary higher education (Wang et al., 2025). AI-assisted learning systems, featuring adaptive algorithms, personalized content recommendations, and intelligent feedback mechanisms, have rapidly proliferated across university campuses worldwide (Gibson et al., 2023; Li et al., 2025). However, despite substantial investments in AI educational technologies and their widespread adoption, a critical knowledge gap persists regarding the psychological mechanisms underlying their educational effectiveness (Zhang & Zhang, 2024). This disconnect between technological sophistication and psychological understanding poses immediate challenges institutions maximize investments while supporting student wellbeing.

Research Urgency and Contemporary Significance