

Intervening in Academic Procrastination through MCII: A Theory-Based Model for Smart Learning Environments to Support Sustainable Development Goals

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Abstract

Academic procrastination poses a significant challenge in higher education, particularly within digitally mediated and autonomous learning environments. This issue not only affects individual academic performance but also undermines broader efforts to achieve Sustainable Development Goal (SDG) 4, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. This conceptual paper introduces an integrated framework combining the Temporal Decision Model (TDM) with Mental Contrasting and Implementation Intentions (MCII) to address procrastination as a barrier to educational sustainability. The proposed model leverages AI-supported smart education systems to deliver scalable, cost-effective interventions, aligning with SDG 9 (Industry, Innovation, and Infrastructure) and SDG 17 (Partnerships for the Goals). By fostering self-regulation and resilience, this framework contributes to creating adaptive, future-ready learners capable of navigating global challenges.

Keywords

Academic procrastination, Sustainable Development Goals (SDGs), Mental Contrasting with Implementation Intentions (MCII), Smart learning environments, Educational sustainability

Introduction

Academic procrastination, whether viewed as a situational behavior or a persistent self-regulation failure, remains a significant challenge across higher education (Brahma & Saikia, 2023). It is commonly defined as the voluntary delay in starting or completing academic tasks despite being aware of the negative consequences such delay may bring (Svartdal & Nemtcan, 2022). These consequences extend far beyond academic underperformance (Pereira, 2021), encompassing elevated stress levels (Bu et al., 2021), reduced emotional well-being (Alexander Govicar, Purwaningrum, & Umaroh, 2024), disrupted sleep (Dardara, 2021), and long-term declines in self-efficacy and academic identity (Kim & Seo, 2015). These consequences pose a critical obstacle to achieving SDG 4's targets for quality education and lifelong learning

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(United Nations, 2015). The challenge is particularly acute in smart education environments, where the digital transformation (SDG 9) has created both opportunities and risks. While AI-mediated systems enable flexible, personalized learning, they also introduce intensified digital distractions, fragmented attention, and weakened interpersonal accountability (Cheng & Xie, 2021; Derakhshan & Gao, 2025; Maypa et al., 2023). This paradoxical combination of increased autonomy and reduced structure further entrenches procrastination behaviors, threatening both individual academic outcomes and broader educational sustainability goals.

Over the past two decades, researchers and educators have developed a wide range of intervention strategies to address the pervasiveness of academic procrastination. These interventions can be broadly categorized into three types: self-regulation strategies, social group-based training, and therapeutic approaches (Salguero-Pazos & Reyes-de-Cózar, 2023). Self-regulation approaches, such as training in goal-setting, time management, and motivational enhancement, are widely used (Grunschel et al., 2018). Social group-based interventions, including peer feedback and technology-assisted reminders, are also common (Loeffler et al., 2019). Both strategies are considered relatively accessible and scalable in educational contexts (Kizilcec et al., 2020). However, despite their practical appeal, these approaches often lack a comprehensive theoretical framework to explain the underlying mechanisms of procrastination and guide sustainable change (Salguero-Pazos & Reyes-de-Cózar, 2023). As Glick and Orsillo (2015) observed, effective intervention design still suffers from the absence of an integrative model that accounts for both the origins and maintenance of procrastinatory behavior. In contrast, therapeutic approaches such as Cognitive Behavioral Therapy (CBT) and Acceptance and Commitment Therapy (ACT) are grounded in well-established psychological theories and directly target maladaptive beliefs and emotional avoidance patterns associated with chronic procrastination (Wang et al., 2017). However, their effectiveness comes at a cost: they are resource-intensive, require trained professionals to deliver, and are typically reserved for individuals already experiencing severe procrastination (Rozental et al., 2017). Given these limitations, there is a pressing need for instructor-led, theory-informed interventions that can be integrated into everyday teaching contexts. Such proactive strategies may help students recognize and address procrastination tendencies before they escalate into entrenched behavioral patterns (Miyake & Kane, 2022).

To address the existing gaps, including the absence of a unified theoretical framework and the demanding nature of current therapeutic methods, recent theoretical developments have introduced new opportunities for designing interventions. One such advancement is the Temporal Decision Model (Zhang et al., 2020), which reconceptualizes procrastination as a breakdown in temporal self-regulation, largely driven by low engagement utility (e.g., task aversiveness) and low outcome utility (e.g., delayed academic rewards). This model offers a clearer understanding of why procrastination occurs and provides a foundation for designing interventions that target both emotional and motivational factors. Building on the principles of TDM, the strategy of Mental Contrasting with Implementation Intentions (MCII) has emerged as a particularly promising solution. MCII not only addresses the emotional resistance associated with task initiation but also enhances motivational clarity through the formulation of specific goal-directed plans. Unlike therapeutic interventions, MCII is brief, low-cost, and highly adaptable, making it suitable for use in educational settings without the need for clinical expertise (Oettingen, 2014).

The aim of the present paper is to propose a theory-driven conceptual framework that combines TDM and MCII to provide a psychologically grounded and practically feasible approach for addressing academic procrastination in universities. Beyond establishing the

cognitive-affective basis for this framework, the paper further explores its application within AI-driven smart education systems, where real-time learning analytics and intelligent instructional platforms offer unique opportunities for personalized intervention (Castro et al., 2024). In these environments, behavioral indicators such as delayed logins, incomplete assignments, or irregular engagement patterns can be used to trigger just-in-time MCII-based micro-interventions (O'Driscoll et al., 2024). By aligning psychological insight with technological affordances, this model not only contributes to the development of emotionally responsive, scalable solutions to academic procrastination, but also responds to SDG 17's call for innovative cross-sector partnerships to enhance educational resilience and equitable access in contemporary higher education.

Methodology

This study employs a conceptual research methodology to bridge a procrastination decision model (Temporal Decision Model, TDM) and a self-regulation intervention method (Mental Contrasting with Implementation Intentions, MCII) with technological applications in smart education. The framework targets two drivers of procrastination: task aversiveness and low outcome utility. MCII interventions are operationalized through AI tools like behavioral analytics and NLP, enabling real-time, personalized support. This approach aligns with SDG 9's emphasis on leveraging technology for inclusive education.

The first methodological step involves synthesizing an established model and a specific strategy to develop a novel dual-pathway framework. The Temporal Decision Model (TDM) serves as the foundational theoretical lens, conceptualizing procrastination as a temporally dynamic self-regulation failure influenced by two decision utilities: engagement utility (task aversiveness) and outcome utility. TDM explains that students tend to delay academic tasks when the emotional cost of task initiation outweighs the discounted value of future rewards (Zhang et al., 2020). To intervene in this decision imbalance, the study integrates Mental Contrasting with Implementation Intentions (MCII) into the TDM framework. MCII is a self-regulation technique that combines positive goal visualization (mental contrasting) with structured planning ("if-then" intentions), making it well-suited for targeting both the emotional and motivational roots of procrastination. The integration of TDM and MCII leads to a dual-pathway model whereby MCII reduces task aversiveness and improves outcome utility, thereby increasing the likelihood of task initiation and completion.

As illustrated in Figure 1, the proposed framework integrates MCII into the TDM model to address two key psychological drivers of academic procrastination: low engagement utility (via task aversiveness) and low outcome utility (via future discounting). MCII not only targets the emotional roots of procrastination, but also provides the structural tools needed for action. The dual-path mechanism supports both the initiation and maintenance of goal-directed behavior. This theory-based model lays the groundwork for future empirical studies and practical implementations in digital education environments, where MCII can be embedded into intelligent learning systems to support personalized, emotionally-responsive interventions.

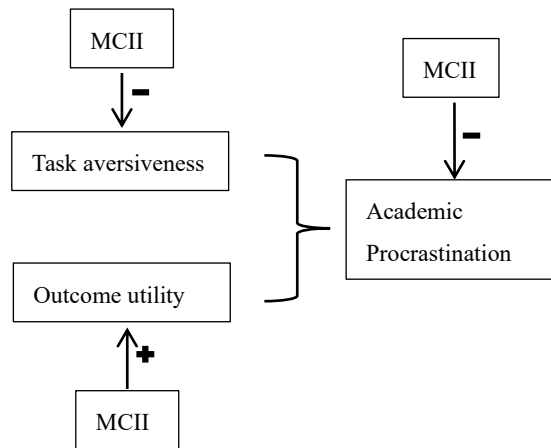


Figure 1. Conceptual Model of MCII's Dual-Pathway Effects on Academic Procrastination

Having established the dual-pathway framework by integrating MCII into the Temporal Decision Model, the next step involves exploring its practical deployment within technology-mediated educational contexts. Specifically, this study investigates how the TDM-MCII model can be operationalized through AI-powered smart education platforms to deliver timely, personalized, and scalable interventions. These platforms offer a promising foundation for transforming psychological insights into practical applications that support self-regulated learning and address academic procrastination in a sustainable and context-aware manner.

To implement this framework, three core mechanisms are proposed. First, behavioral analytics can be used to detect early signs of procrastination by monitoring indicators such as delayed logins, incomplete assignments, and reduced platform engagement. When such patterns are observed, just-in-time MCII-based prompts can be triggered to help students regain focus and motivation. Second, Natural Language Processing techniques facilitate content personalization by analyzing students' written responses related to MCII, including goal descriptions, identified obstacles, and planned actions. This analysis helps to detect emotional states and motivational tendencies that inform the design of tailored interventions. Tools like ChatGPT and DeepSeek can then generate tailored MCII interventions that resonate with individual learners' emotional and cognitive needs. Third, a feedback-driven mechanism ensures that the system continuously adapts by analyzing learner interactions, including task completion rates and responsiveness to prompts, in order to refine message delivery in real time. Together, these AI-enhanced mechanisms, including risk detection, personalized content generation, and adaptive feedback, compose a closed-loop system that translates psychological theory into educational practice and offers a scalable solution to academic procrastination in digital learning environments.

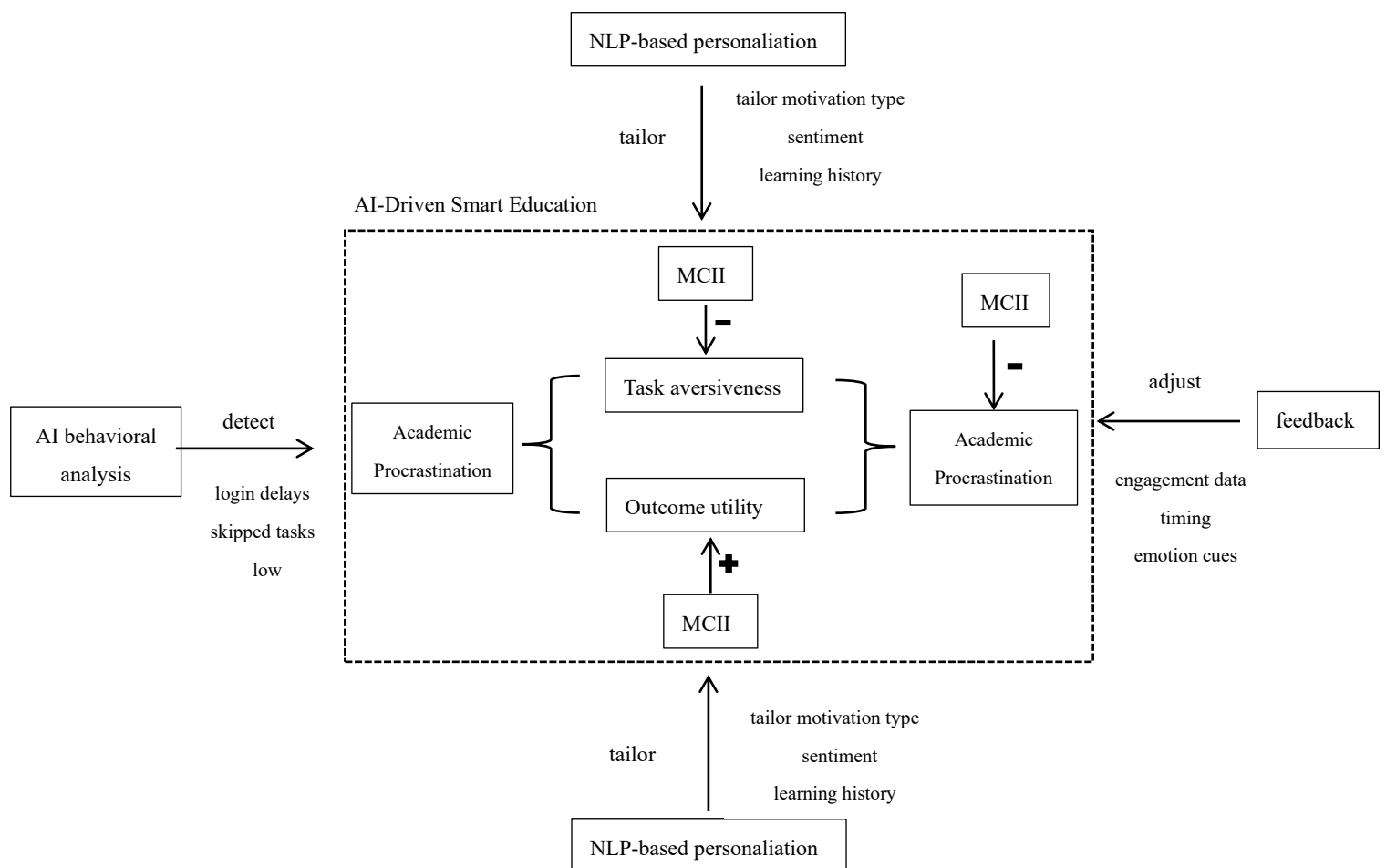


Figure 2. Application of the TDM-MCII Framework within AI-Driven Smart Education Systems

Discussion

Integrating the Temporal Decision Model (TDM) with Mental Contrasting and Implementation Intentions (MCII) into AI-driven smart education systems offers both theoretical innovation and practical potential for addressing academic procrastination.

Theoretically, this dual-pathway framework systematically captures the interplay between emotional avoidance (task aversiveness) and motivational delay (discounted outcomes), reframing procrastination as a self-regulation failure. By embedding emotional and motivational factors into one model, it fills a critical gap in existing research and provides a solid foundation for intervention design within smart learning environments, thereby supporting the achievement of Sustainable Development Goals.

Practically, the model enables low-cost, scalable interventions through AI-powered platforms like Chaoxing Platform. These platforms can monitor behavioral data, deliver personalized MCII prompts, and continuously optimize interventions via NLP and feedback

loops. This makes psychological support more accessible, adaptive, and emotionally responsive within everyday learning environments.

The TDM-MCII model advances SDG 4 by promoting self-regulation and reducing dropout risks. Its integration into AI platforms (e.g., Chaoxing) exemplifies SDG 9's innovation goals. In addition, the implementation process involves collaboration among educators, data scientists, platform developers, and institutional stakeholders. Such cross-sector cooperation aligns with SDG 17's emphasis on multi-stakeholder partnerships to deliver quality education at scale. Future research should explore cross-cultural adaptations to ensure global relevance and assess long-term impacts on educational equity.

Conclusion

Academic procrastination remains a major barrier to student success in increasingly autonomous and digital learning settings. This paper presents a novel TDM-MCII framework that addresses both emotional resistance and motivational disconnection. When embedded into smart education systems, this model enables real-time, personalized interventions through behavioral analytics and NLP, offering a scalable and psychologically grounded solution.

By addressing procrastination through a sustainability lens, this framework not only enhances individual learning outcomes but also contributes to systemic educational resilience. Aligning psychological interventions with SDGs ensures that efforts to combat procrastination resonate with broader global priorities, fostering a generation of learners equipped to tackle 21st-century challenges.

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References

- Alexander Govicar, D. Y., Purwaningrum, E. K., & Umaroh, S. K. (2024). The Influence of Academic Burnout on Academic Procrastination Among Students. *KnE Social Sciences*, 9(30), 369–378. <https://doi.org/10.18502/kss.v9i30.17513>
- Brahma, B., & Saikia, P. (2023). Influence of self-regulated learning on the academic procrastination of college students. *Journal of Education and Health Promotion*, 12, 182. https://doi.org/10.4103/jehp.jehp_1106_22
- Bu, X., Wu, L., & Wang, H. (2021). Impact of college students' academic procrastination on subjective well-being. *Social Behavior and Personality: an international journal*, 49(7), 1-13. <https://doi.org/10.2224/sbp.9858>
- Castro, G. P. B., Chiappe, A., Rodríguez, D. F. B., & Sepulveda, F. G. (2024). Harnessing AI for Education 4.0: Drivers of Personalized Learning. *Electronic Journal of e-Learning*, 22(5), 1-14. <https://doi.org/10.34190/ejel.22.5.3467>
- Cheng, S.-L., & Xie, K. (2021). Why college students procrastinate in online courses: A self-regulated learning perspective. *Internet and Higher Education*, 50, 100807. <https://doi.org/10.1016/j.iheduc.2021.100807>

- Dardara, E. A., & AL-Makhalid, K. A. (2021). Investigating the relationship between bedtime procrastination, psychological stress, and mental health among Saudi undergraduates. *Review of International Geographical Education Online*, 11(8). <https://rigeo.org/menu-script/index.php/rigeo/article/view/2403>
- Derakhshan, A., & Gao, X. (2025). "I Am Excessively Pressed by Classroom Tasks": A Cross-Cultural Study on the Sources and Solutions of Chinese and Iranian EFL Students' Academic Disengagement in Online Classes. *Psychology in the Schools*. <https://doi.org/10.1002/pits.23374>
- Glick, D. M., & Orsillo, S. M. (2015). An investigation of the efficacy of acceptance-based behavioral therapy for academic procrastination. *Journal of Experimental Psychology: General*, 144(2), 400. <https://doi.org/10.1037/xge0000050>
- Grunschel, C., Patrzek, J., Klingsieck, K. B., & Fries, S. (2018). "I'll stop procrastinating now!" Fostering specific processes of self-regulated learning to reduce academic procrastination. *Journal of Prevention & Intervention in the Community*, 46(2), 143 – 157. <https://doi.org/10.1080/10852352.2016.1198166>
- Kim, K. R., & Seo, E. H. (2015). The relationship between procrastination and academic performance: A meta-analysis. *Personality and Individual Differences*, 82, 26 – 33. <https://doi.org/10.1016/j.paid.2015.02.038>
- Kizilcec, R. F., Reich, J., Yeomans, M., Dann, C., Brunskill, E., Lopez, G., Turkay, S., Williams, J., & Tingley, D. (2020). Scaling up behavioral science interventions in online education. *Proceedings of the National Academy of Sciences*, 117(26), 14900 – 14905. <https://doi.org/10.1073/pnas.1921417117>
- Loeffler, S. N., Stumpp, J., Grund, S., Limberger, M., & Ebner-Priemer, U. (2019). Fostering self-regulation to overcome academic procrastination using interactive ambulatory assessment. *Learning and Individual Differences*, 72, 43 – 52. <https://doi.org/10.1016/j.lindif.2019.101760>
- Maypa, A. L. Z., Marcial, D. E., & Montemayor, J. O. (2023). Student engagement, challenges, and coping mechanisms in high school online distance learning during COVID-19 pandemic. *Information Technologies and Learning Tools*, 93(1), 1-13. <https://doi.org/10.33407/itlt.v93i1.5148>
- Miyake, A., & Kane, M. J. (2022). Toward a holistic approach to reducing academic procrastination with classroom interventions. *Current Directions in Psychological Science*, 31(4), 291 – 304. <https://doi.org/10.1177/09637214211070814>
- Oettingen, G. (2014). *Rethinking positive thinking: Inside the new science of motivation*. New York, NY: Penguin Random House. ISBN: 978-1591846871 / 1591846870
- O' Driscoll, C., Singh, A., Chichua, I., Clodic, J., Desai, A., Nikolova, D., Yap, A. J., Zhou, I., & Pilling, S. (2024). An ecological mobile momentary intervention to support dynamic goal pursuit: Feasibility and acceptability study. *JMIR Formative Research*, 8. <https://doi.org/10.2196/49857>
- Pereira, J., & Díaz, Ó. (2021). Struggling to keep tabs on capstone projects: a chatbot to tackle student procrastination. *ACM Transactions on Computing Education (TOCE)*, 22(1), 1-22. <https://doi.org/10.1145/3469127>
- Rozental, A., Forsström, D., Lindner, P., Nilsson, S., Mårtensson, L., Rizzo, A., Andersson, G., & Carlbring, P. (2017). Treating procrastination using cognitive behavior therapy: A pragmatic randomized controlled trial comparing treatment delivered via the internet or in groups. *Behavior Therapy*, 49(2), 180 – 197. <https://doi.org/10.1016/j.beth.2017.08.002>

- Salguero-Pazos, M. R., & Reyes-de-Cózar, S. (2023). Interventions to reduce academic procrastination: A systematic review. *International Journal of Educational Research*, 121, 102228. <https://doi.org/10.1016/j.ijer.2023.102228>
- Svartdal, F., & Nemtcan, E. (2022). Past negative consequences of unnecessary delay as a marker of procrastination. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.787337>
- United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. <https://sdgs.un.org/2030agenda>
- Wang, S., Zhou, Y., Yu, S., Ran, L.-W., Liu, X., & Chen, Y.-F. (2017). Acceptance and commitment therapy and cognitive - behavioral therapy as treatments for academic procrastination. *Research on Social Work Practice*, 27(1), 48 - 58. <https://doi.org/10.1177/1049731515577890>
- Zhang, S. M., & Feng, T. Y. (2020). Modeling Procrastination: Asymmetric Decisions to Act between the Present and the Future. *Journal of Experimental Psychology: General*, 149 (2): 311–322. <https://doi.org/10.1037/xge0000643>