

Integrating Instrumental Motivation and Generative AI in Materials Design for Teacher Education

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This study investigates a teacher education course integrating instrumental motivation through TKT certification and generative AI-assisted materials design. Findings indicate significant gains in pedagogical knowledge, improved teaching materials quality, and increased engagement, demonstrating how goal-oriented learning and AI integration enhance both competence development and practical application in English teacher education.

This study aims to examine how instrumental motivation, operationalized through Cambridge Teaching Knowledge Test (TKT) Module 2 certification, combined with generative AI-assisted materials design, influences students' learning outcomes in an English teacher education course. Specifically, it explores how goal-oriented certification preparation enhances pedagogical knowledge, and how AI-supported design tasks facilitate the transfer of theoretical knowledge into practical teaching competence.

In addition, the study investigates how integrating flipped learning and collaborative learning environments supports student engagement, autonomy, and participation. By situating the course within a higher education context, this research also seeks to demonstrate how certification-oriented and technology-enhanced pedagogy can contribute to broader discussions on teacher education innovation.

Participants included 46 university students enrolled in an English Teaching Materials Design course at a university in Taiwan, and a mixed-methods approach was

adopted to evaluate students' learning outcomes and engagement. Quantitative data were collected through TKT Module 2 pre- and post-tests, consisting of an 80-item paper-based assessment. A paired-samples t-test was conducted to examine differences in students' performance before and after instructional intervention. Qualitative and performance-based data included students' AI-assisted teaching materials, lesson plans, participation records, peer feedback, and course evaluation surveys.

The instructional design followed a two-phase structure. In the first phase (Weeks 1 to 8), instruction focused on TKT Module 2 theoretical knowledge, including lesson planning, teaching aims, and instructional resources. Flipped learning was implemented, requiring students to preview content before class and engage in interactive activities, group discussions, and formative quizzes during class.

In the second phase (Weeks 9 to 16), students engaged in AI-assisted materials design tasks. Working in groups of three to four, students developed a complete 40-minute English lesson plan and corresponding teaching materials. They utilized generative AI tools such as ChatGPT for text generation, as well as multimedia tools (e.g., image-, audio-, and video-generation platforms) to create integrated teaching resources. The design process included three iterative stages (first draft, second draft, and final version), with continuous instructor and peer feedback.

The findings demonstrate that integrating instrumental motivation and generative AI significantly enhanced students' learning outcomes and engagement. First, quantitative results indicate a statistically significant improvement in students' pedagogical knowledge. Post-test scores ($M = 31.33$, $SD = 15.86$) were significantly higher than pre-test scores ($M = 21.37$, $SD = 7.38$), $t(45) = 5.34$, $p < .001$, with score ranges increasing from eight to 40 (pre-test) to 11 to 79 (post-test). These results suggest that the use of certification-oriented goals effectively strengthened students' motivation and learning performance.

Second, students demonstrated strong competence in AI-assisted materials design. Final project scores averaged 86.33 (SD = 7.82), with a range of 72 to 95, indicating high-quality outputs across groups. The structured iterative process (draft revisions and feedback cycles) contributed to improvements in instructional coherence, creativity, and integration of multimodal resources. Students successfully produced a series of 13 thematically connected teaching units, integrating AI-generated text, audio, and video materials.

Third, the incorporation of flipped learning and collaborative group work enhanced student engagement and participation. Students prepared course content prior to class and engaged in interactive activities, discussions, and quizzes during class time. Participation data indicate high engagement, with an average of 11 voluntary responses per group and only two students not participating orally throughout the semester. Course evaluation scores ($M = 4.50$) exceeded the institutional average (4.39), and the item measuring encouragement of active participation received a score of 4.73.

Qualitative feedback further supports these findings. Students reported that the integration of TKT certification made the course more challenging and meaningful, particularly in relation to future career goals. Many also highlighted AI-assisted materials design as a key innovative element, noting that it enhanced creativity, interactivity, and ownership of learning. Collaborative activities, peer feedback, and hands-on production tasks were frequently mentioned as contributing to deeper understanding and increased motivation.

Overall, the results suggest that instrumental motivation, when combined with generative AI and student-centered pedagogy, creates a powerful learning environment that bridges theoretical knowledge and practical application. This model demonstrates how to address common challenges such as low motivation, limited creativity, and lack of authentic output, while contributing to global trends in AI-enhanced and

competency-based education.

Keywords: Instrumental motivation; generative AI; materials design; teacher education; TKT certification