
Exploring the Integration of Artificial Intelligence in the Flipped Classroom

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Abstract — This study explored the experiences of Second Year BSED English students at Ave Maria College with Artificial Intelligence (AI) integration in a flipped classroom, examining its influence on accessibility, comprehension, engagement, preparedness, collaboration, and emerging challenges. Using qualitative data from interviews, classroom observations, document analysis, and reflective activities, the research investigated how AI functions as a scaffold for self-directed and socially mediated learning while revealing cognitive, ethical, and affective dimensions of technology use.

Findings indicate that students perceive AI as an accessible, non-judgmental learning support that provides instant explanations and adaptive examples, fostering autonomy and self-paced knowledge construction. AI served as a teacher-like cognitive scaffold, simplifying complex concepts through stepwise explanations, analogies, and multimodal representations that supported deeper understanding and reflection. In the flipped classroom, AI encouraged active engagement by guiding reasoning, offering alternative solution paths, and linking new information to prior knowledge. AI-mediated pre-class preparation enhanced confidence, readiness, and participation, while structuring peer collaboration to promote inclusivity and balanced contribution.

However, challenges included over-reliance, ethical and privacy concerns, and varied engagement due to differences in digital literacy and confidence. These findings suggest that AI scaffolding is beneficial only when implemented thoughtfully. The study extends Sociocultural Theory by positioning AI as a mediational tool within the Zone of Proximal Development and refines constructivist perspectives by emphasizing learner agency, digital competence, and instructional design in shaping outcomes.

Keywords: *AI integration, flipped classroom, student experiences, personalized learning, active engagement*

I. INTRODUCTION

Education in the 21st century has shifted from traditional face-to-face instruction to technology-enhanced learning environments. Educators are increasingly challenged to deliver complex content within limited class time while maintaining student engagement. In response, the flipped classroom model has gained attention as an approach where students access instructional materials before class, allowing classroom time to focus on active learning, collaboration, and problem-solving. Research suggests that flipped learning can enhance students' preparedness, motivation, and academic performance while promoting critical thinking and technological competence (Jiang et al., 2022; Mortaza et al., 2023; Güler et al., 2023; Torío, 2019).

At the same time, rapid advancements in digital technologies such as virtual simulations, mobile applications, and artificial intelligence (AI) have further transformed educational practices. AI tools like ChatGPT can support personalized learning by providing immediate feedback, adaptive guidance, and cognitive scaffolding (Herrmann-Werner et al., 2024; Kamalov et al., 2023; Lin et al., 2023). However, their widespread use also raises concerns regarding academic integrity and ethical application in learning.

Despite increasing research on flipped learning and AI, limited studies explore their integration within a single learning framework. Guided by constructivist perspectives on knowledge construction (Huang et al., 2022; Vygotsky, 1978), this study examines the lived experiences of students in AI-enhanced flipped classrooms, focusing on how AI supports learning, engagement, and instructional processes while identifying potential challenges and ethical considerations.

Literature Review

Education is undergoing rapid transformation as artificial intelligence (AI) becomes increasingly integrated into teaching and learning. Supported by advances in digital technologies, AI is reshaping educational practices by enabling adaptive learning, personalized feedback, and data-informed instruction (Liu et al., 2023). Within this evolving environment, the flipped classroom has emerged as an innovative pedagogical model that restructures traditional instruction. Instead of delivering lectures during class, students engage with learning materials

before class, allowing classroom time to focus on interactive activities such as discussion, collaboration, and problem-solving (Güler et al., 2023; Huang et al., 2023; Li et al., 2023).

Research indicates that flipped learning enhances student engagement, promotes self-regulated learning, and strengthens collaboration through active participation and peer interaction (Jiang et al., 2022; Wright & Park, 2022). However, the model also presents challenges, particularly for students who struggle with independent pre-class preparation (Vitta & Al-Hoorie, 2020). In this context, AI offers potential support by functioning as a virtual mentor that provides adaptive guidance, monitors learning progress, and delivers immediate feedback tailored to students' needs (Nazaretsky et al., 2022; Owan et al., 2023).

Despite the growing adoption of both flipped learning and AI in education, research examining their combined integration remains limited. Existing studies often focus on technical outcomes rather than how AI-enhanced flipped classrooms influence engagement, collaboration, and self-regulated learning. Therefore, this study investigates how AI can be strategically integrated within the flipped classroom to enhance learning experiences while addressing pedagogical and ethical considerations in technology-enhanced education.

II. METHODOLOGY

Research Design

This study employed a qualitative single-case study design guided by Sharan B. Merriam's interpretive framework. Grounded in constructivist and interpretivist paradigms, the design enabled an in-depth examination of how artificial intelligence (AI) was integrated into a flipped classroom. The bounded case focused on a single cohort of second-year Bachelor of Secondary Education (BSED) English students at Ave Maria College, allowing for context-specific analysis of participants' experiences and meaning-making processes.

Settings and Participants

The study was conducted at Ave Maria College, a higher education institution implementing technology-enhanced instruction, including the flipped classroom model. Participants included 12 second-year BSED English students and two English teachers involved in AI-supported flipped instruction.

Purposive sampling was used. Student participants were enrolled in the program, had completed at least one academic term in a flipped classroom, and had regular exposure to AI-based tools in pre-class and in-class activities. Variation in academic performance and learning preferences was considered to capture diverse perspectives. Teachers were included to triangulate student accounts. Sampling continued until data saturation was achieved.

Data Collection

Data were collected from three sources: semi-structured interviews, classroom observations, and document analysis. Semi-structured interviews served as the primary data source and were guided by questions grounded in Sociocultural Theory, focusing on personalized learning, engagement, collaboration, and knowledge construction in AI-supported flipped instruction. Interviews lasted 30-45 minutes, were audio-recorded with consent, and transcribed verbatim. Classroom observations documented instructional practices, student interactions, and AI tool usage. Relevant instructional documents were analyzed to contextualize implementation and support triangulation.

Data Analysis

Data analysis was conducted iteratively and concurrently with data collection, following an inductive thematic approach consistent with Merriam's framework. Transcripts, field notes, and documents were coded to identify meaningful units, which were grouped into categories and refined into themes. A constant comparative method was applied across data sources to identify patterns and variations.

Categories were validated through triangulation and supervisory consultation, and interpreted through the lens of Sociocultural Theory to explain how AI-mediated interactions shaped learning processes within the flipped classroom.

III. RESULTS AND DISCUSSION

Thematic analysis of interview data, teacher observations, classroom observations, and syllabus documents identified eight interrelated categories describing students' experiences with AI integration in the flipped classroom at Ave Maria College. Trustworthiness was established through member checking and peer debriefing, with findings showing convergence across data sources while revealing variation in engagement, digital literacy, and learner readiness.

Students commonly described AI as a scaffold that supported pre-class preparation by providing simplified explanations, examples, outlines, and stepwise guidance. These AI-mediated supports helped students organize ideas, initiate tasks, and monitor progress independently, consistent with research highlighting AI's role in cognitive scaffolding (Güler et al., 2023; Huang et al., 2023; Li et al., 2023). Classroom observations confirmed that students used AI to clarify literary concepts, summarize readings, and structure written responses. Teachers noted that AI served as a bridge during pre-class learning, particularly in large classes where individualized guidance was limited.

AI-generated feedback also promoted self-regulated learning. Students valued the immediacy of AI responses, which allowed them to revise reasoning, correct errors, and refine understanding before seeking teacher support. These processes encouraged iterative reflection and critical engagement, aligning with sociocultural perspectives on mediated learning and the Zone of Proximal Development (Vygotsky, 1978).

AI further supported collaborative learning by providing shared prompts that stimulated discussion, peer evaluation, and collective knowledge construction. However, challenges such as overreliance, academic integrity concerns, and uneven digital literacy were also observed. Overall, AI functioned as a cognitive, metacognitive, and social scaffold that enhanced engagement, preparation, and collaboration, though its effectiveness depended on learner readiness and thoughtful pedagogical integration.

IV. CONCLUSION

This study examined the experiences of second-year BSED English students using AI in a flipped classroom at Ave Maria College. Findings show that students used AI not merely to obtain answers but as a scaffold for initiating tasks, clarifying complex concepts, monitoring progress, and reflecting on learning. AI also supported collaboration by encouraging participation during group discussions. These results challenge assumptions that AI primarily threatens academic integrity, demonstrating that when integrated thoughtfully into instruction, it can promote self-regulated learning, critical thinking, and learner agency.

The findings extend sociocultural theory by illustrating how AI can function as a mediational tool within the Zone of Proximal Development, providing responsive scaffolding for learning. Overall, the study highlights the potential of AI to enhance engagement, collaboration, and self-directed learning in flipped classrooms, particularly within resource-limited contexts in Philippine higher education.

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