Enhancing Physics Education with AI: A Personalized Case Study of the PHY001 Module

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1. Background

In today’s educational landscape, technology integration is crucial for enhancing teaching and learning. Artificial intelligence offers a powerful tool that can transform traditional education models. This study examines XIPU AI’s application in PHY001 "Classical Physics for Engineering" at Xian Jiaotong-Liverpool University, focusing on first-year students. The module enrolls over 100 students, presenting significant challenges in maintaining engagement and interaction within limited class hours. As module leader, I initiated AI-integrated teaching practices to boost interactivity and make learning more engaging.

Traditional methods often fail to sustain student interest, especially in large classes with limited teacher-student interaction. Research shows students are more interested in slides with "images and text" [1]. This "multimedia learning modality effect" [2] inspired using AI-generated images in slides to maintain attention and participation. While physics

explainer videos offer a new platform for declarative knowledge, passive viewing may create an "illusion of understanding"—apparent but not genuine comprehension [3]. To address this, we adopted active learning: students create educational videos with AI assistance. This aims to deepen conceptual understanding and provide practical AI tool experience.

2. Solutions

1. XIPU AI-Generated Images for Teaching Materials

To address engagement challenges, we used XIPU AI to create visually appealing, relatable illustrations that attract attention and aid abstract theory comprehension. For example, to teach "heat as energy transfer," we designed a problem: "If you recklessly eat ~500 calories of ice cream and cake, how high must you climb to burn equivalent heat?" Instead of dry formulas, we prepared multiple AI-generated illustrations: confused students doing homework, overeating scenes, exercising figures. Students voted for the most fitting image, then we discussed solutions. This attracted distracted students, boosted engagement without consuming much class time, and served as a discussion catalyst.

2. Assignment Design Integrating XIPU AI

We designed an "AI Physics Video Competition" as optional extra-credit homework. Students selected any PHY001 topic, formed groups (max 3), and created videos demonstrating physics concept understanding and application. They read and signed safety guidelines first.

XIPU AI applications included: generating competition title options, writing safety guidelines, drafting assignment notices, and creating video rubrics covering "core knowledge understanding, experimental verification, concept application, mathematical representation, scientific method use" (20% each). AI performed excellently, adding notes on clarity, creativity, and technical quality. With departmental support, we held an award ceremony where winners showcased videos and shared AI tool experiences. I also used XIPU AI to generate opening/closing ceremony slides.

3. Outcomes and Benefits

Student Engagement and Learning Outcomes:

Students actively participated, demonstrating creativity and physics knowledge through engaging videos and innovative AI tool use. Post-competition surveys on Learning Mall Core showed most students

agreed video production deepened physics understanding and desired more such activities.

Award-Winning Video Quality:

Three winning videos exceeded expectations:

- First Prize: Explained thermodynamics second law, using AI-generated fun images to explain everyday phenomena and physics applications.
- Second Prize: Explained Faraday’s law of electromagnetic induction with AI images and narration.
- Third Prize: Explained mechanical energy and work problems, ending with AI’s role in video creation.

Key Insights:

- **Personalized Learning**: AI-generated images/videos can be customized to preferences, making learning more engaging. Encouraging students to use AI tools for content creation deepens understanding and gives ownership of learning.
- **Active Learning Strategies**: Content creation promotes active learning. The competition provided opportunities to apply physics knowledge creatively, developing collaboration, problem-solving, and digital literacy.

- **Technology-Pedagogy Integration:** XIPU AI generated images, rubrics, and notices, demonstrating versatility and saving educators time for meaningful learning design.
- **Safety Considerations:** Ensuring student safety in AI-assisted activities is crucial. Clear guidance and safety instructions must be provided before AI-driven projects, requiring vigilant monitoring.

4. Replicability and Promotion Value

Continuous Professional Development: To fully harness AI's potential, educators need ongoing professional development. Many remain unaware of latest AI tools and pedagogical applications. Training workshops, seminars, and resource access can help educators use AI effectively. This development should cover both technical aspects and pedagogical applications, enabling informed decisions about AI integration.

Promotion Recommendations:

- Educators should embrace AI tools to create personalized, interactive learning experiences meeting modern student needs.
- AI can deepen student-centered education and research-oriented learning models.

- Creating communities of practice allows educators to share experiences, challenges, and successes, fostering collaborative innovation.

This case provides valuable insights and a practical model for AI integration in STEM education, actively promoting student creativity and engagement.