Practice of the Core Curriculum in General Education Based on the PAD Class Teaching Model

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The "PAD (Presentation-Assimilation-Discussion) class" teaching model divides the class into four sequential stages based on the concept of partitioned teaching: lecture, internalization, discussion, and teacher-student dialogue, emphasizing the students' central role in the learning process. This model establishes a division of responsibility and authority: the teacher manages the lecture and dialogue stages, while students take charge of internalization and discussion. This approach fosters a genuine learning community and maximizes the value of education. Taking the general education core curriculum Physics and Culture at Fudan University as an example, this study explores its implementation. By collecting and analyzing students' learning data, the findings indicate that this innovative teaching model effectively improves students' learning outcomes, enhances multiple comprehensive skills, and, to some extent, alleviates their learning pressure compared to traditional teaching models.

Keywords: PAD class, teaching model, internalization, higher education, qualitative and semi-quantitative research

Trends and Impacts of ICT-Assisted Experiments in Physics Education: A 15-Year Systematic Review and Meta-Analysis

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As the primary vehicle for inquiry-based learning, experimentation plays a crucial role in physics education. It helps students gain an intuitive understanding, consolidate physical knowledge, and develop exploration and practical skills. With the continuous advancement of information technology, an increasing number of Information and Communication Technologies (ICT) are being integrated into physics experiments. This integration addresses limitations inherent in traditional experiments, such as insufficient equipment, high costs, time constraints, and the challenge of recording fleeting occurrences. Over the past fifteen years, ICT-assisted physics experiments have undergone dramatic transformations, from the early reliance on computers to today's smartphone apps as platforms, and from simulation software to current virtual reality (VR), augmented reality (AR), and even AI technology. However, no comprehensive studies have yet systematically analyzed the evolving trends of ICT-assisted experiments or their roles and significance in physics education. Therefore, this study will conduct a systematic review of relevant research from the past 15 years, focusing on three key perspectives: technological, application-based, and impact. We will first systematically analyze the evolution of technologies used and their application scenarios, and then quantitatively evaluate the effect of ICT-assisted experiments on students' cognition, attitudes, and skills. By analyzing and comparing the impact of different technologies and different teaching strategies employed, this study aims to provide recommendations for future implementation and development of ICT-assisted experiments in physics education.

An AI Agent System Based on LLMs for Physics Experiment Report Generation and Q&A

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With the rapid development of artificial intelligence technologies, the potential of large language models (LLMs) in empowering physics experiments has become increasingly prominent. This paper presents a lightweight intelligent agent system based on the DeepSeek model series, designed for the "Steady-State Method for Measuring Thermal Conductivity" experiment. By integrating context engineering with a local knowledge base, the system enables automated data acquisition and processing, graphical plotting, personalized experimental report generation, and intelligent question-answering within a unified framework. Furthermore, we explore a "small-model-assist-large-model" collaborative reasoning algorithm, which significantly enhances the system's performance. The system is highly extensible and can be rapidly adapted to other physics experiments through secondary development. This work provides an efficient, flexible, and innovative approach toward the automation and intelligent augmentation of physics experiments, offering a practical reference for future educational applications of LLMs.

Reform and Practice of University Physics Laboratory Teaching under the New College System in Tsinghua University

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Under the New College education model, the Experimental Physics Teaching Center has implemented a systematic reform of university physics laboratory instruction, guided by the concept of Science – Engineering Integration. We established the “Threefold Integration” philosophy: Integration of Science and Engineering, Integration with the Times and Integration with Daily Life. Through customized college-specific experiments, AI-driven digital platforms, and a nationally leading electromagnetics laboratory, we built an inquiry-oriented teaching ecosystem that enhances students’ research competence and innovation ability. Reform outcomes include excellent teaching evaluations, national-level teaching awards, and a replicable reform model for experimental physics education.