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The Transformation of Computer Fundamentals Education Driven by "DeepSeek"

-- Taking the Course "Principles of Computer Composition" as an Example

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Abstract: In the current teaching process of computer fundamentals courses, challenges such as numerous and complex knowledge points, abstract and obscure concepts, a disconnect between theoretical instruction and practical training, as well as a lack of systematization and relevance in practical exercises have emerged. These issues have impacted the teaching of computer fundamentals courses. With the rapid advancement of artificial intelligence technology, how can we leverage deep learning techniques and the Deepseek model to overcome the limitations inherent in traditional classroom teaching? This approach aims to revitalize courses like "Principles of Computer Composition" by integrating dynamic elements into both theoretical instruction and practical training. We propose introducing the Deepseek Model and Artificial Intelligence Technology" reform framework into foundational computer education. This initiative seeks to better harness cutting-edge technologies to serve core curricula, guiding students toward proactive theoretical learning and active participation in the learning process. Ultimately, it cultivates students' ability to integrate theoretical knowledge with practical application.

Keywords: Artificial Intelligence; Deepseek Model; Teaching Reform; Principles of Computer Composition.

1. Introduction

The Computer Fundamentals course is designed to cultivate student mastery of computer software and hardware, as well as foundational knowledge, methodologies, and skills in their applications [1]. Students Proficient in utilizing modern computer hardware and software environments and tools, gain insight into cutting-edge developments within the computer science discipline, and develop into versatile professionals equipped with solid theoretical foundations, broad specialized knowledge, strong character, innovative thinking, and robust capabilities in computer application system analysis, design, and engineering practice [2]. As the core of foundational computer courses, "Principles of Computer Composition" serves as a bridge between past and future knowledge, forming an enduring knowledge system that constitutes the core competitiveness of computer science [3]. It provides the essential foundation and guarantee for learning applied computer knowledge. Through the study of Computer Organization Principles, students will develop a systematic perspective on computer architecture. They will grasp the composition and operational principles of the five core hardware components the controller, arithmetic logic unit, memory, and input/output systems and deepen their understanding of the coordination process between computer hardware and software instructions, further cultivate students' ability to solve complex engineering problems [4].

Due to the abstract and obscure nature of foundational computer science concepts, numerous challenges arise in actual teaching and practical implementation. For instance: theoretical instruction and hands-on training often operate as two separate entities. Concepts in computer architecture are highly abstract, with numerous complex knowledge points. Practical experiments may be scattered across different chapters, lacking systematic organization and targeted focus. This results in insufficient depth in theoretical teaching and experiments failing to align with theoretical instruction, leading to a "triple disconnect" between theory and practice [5][6]. Other pressing issues include students' lack of proactive engagement, ineffective integration of ideological and political education elements, and scarcity of vivid teaching cases. These challenges represent the most urgent problems requiring resolution in foundational computer courses like Computer Organization Principles at the current stage.

In January 2025, China's Deepseek released its Deepseek model, marking a new breakthrough in generative AI technology [7]. As one of the most transformative technologies of the 21st century, artificial intelligence is reshaping our world at an unprecedented pace. From voice assistants in smartphones to self-driving cars, from medical diagnostics to financial analysis, it has permeated every facet of human life. As a breakthrough AI technology, the Deepseek model achieves efficient reasoning capabilities by optimizing the inference process, significantly reducing computational resource consumption. Utilizing the Deepseek model in computer fundamentals education to drive pedagogical transformation across multiple dimensions "teaching", "learning" and "nurturing", Promoting the transformation of foundational computer education is a novel challenge worthy of deep consideration by every educator.

2. Transformation Pathways for Computer Fundamentals Education Driven by the "DeepSeek Model"

2.1. Integrating Mobile Internet and Classroom Teaching Activities to Innovate Teaching Models

In contemporary university teaching, computer multimedia is widely employed to support instructional activities. By integrating text, audio, video, animation, and other media formats, it offers significant convenience for teaching [8]. Therefore, computer-based multimedia teaching systems have gained widespread popularity among both teachers and students, leading to their rapid adoption and promotion. With the continuous advancement of hardware and software technologies, multimedia-assisted teaching activities are also undergoing constant evolution. With the advancement of the Internet of Things, cloud computing, 5G, and smart technologies, we are reimagining the classroom environment to create a new learning space that supports both student learning and teacher instruction. This involves fully leveraging sensor technology, IoT technology, multimedia technology, and cloud computing technology.

In the internet era, the purpose of learning is no longer merely to pass down knowledge from predecessors; innovation is the key. Cultivating innovative talent is the paramount priority of education. The development of innovative talent must help learners establish a unique, personalized knowledge system. Memorization is no longer the most important skill or goal; learning to think innovatively is crucial. In the “teaching” process, a new classroom model aligned with the principle of “student-centered learning with teacher-guided instruction” must be created. approaching it through elements like learning objectives, content, classroom ideological guidance, teaching methods, learning activities, and outcomes. By leveraging mobile internet technology in instruction, we achieve shifts from: Teaching-centered to learning-centered classrooms, Monolithic to integrated classrooms Lecture-based to discussion-based classrooms Closed to open classrooms Summative to formative evaluations Homogeneous education to differentiated cultivation.

Mobile internet enters the classroom, breaking traditional teaching models by permitting students to bring phones and laptops to class and allowing unrestricted internet access during lessons. This guides students to utilize mobile internet for collaborative learning activities that “coexist peacefully and complement each other's strengths”, gradually shifting from traditional teaching's emphasis on “lower-order cognitive” objectives like recall, comprehension, and application toward cultivating “higher-order innovation” skills such as independent analysis and exploratory creativity. Since the 16th National Congress of the Communist Party of China, cultivating “a large number of top-tier innovative talents” has been established as a key objective in education. The goal of building an innovative nation has created a historic opportunity for the growth of such elite innovators. The importance of high-quality innovative talent to the development of the nation and the people cannot be overstated. University education serves as fertile ground for cultivating innovative talent, with university classrooms at the forefront of this endeavor. Teaching activities within these classrooms must strike a balance: while respecting textbook knowledge to form a “teacher + textbook” model, students should also leverage the vast amount of data and information available on the internet to broaden their horizons, achieve mutual corroboration and mutual reinforcement.

In today's era marked by the rapid advancement of generative AI technologies epitomized by the “Deepseek Model”, educators teaching foundational computer science courses like “Principles of Computer Composition” can leverage mobile internet and the “Deepseek Model” to simplify complex theoretical concepts, visualize digital logic circuits and hardware design, animate memory and I/O system operations, and make bus data flow tangible. Students can also use mobile internet and the Deepseek Model to follow the instructor's reasoning and complete classroom tasks, avoiding learning difficulties caused by weak foundational knowledge or limited thinking. Thus, the “teaching” phase gradually shifts from being “textbook-centered, teacher-centered, classroom-centered” to being “student development-centered, student learning-centered, learning outcomes-centered”. This promotes students' transition from passive learning to active exploration and innovation, realizing the Party's 20th National Congress report's integrated approach to education, science and technology, and talent development. It achieves the goal of “enhancing independent talent cultivation and fostering innovative talents”.

2.2. Project-based Learning Promotes Deep Learning and Knowledge System Establishment among Students

In the theoretical instruction of foundational computer courses, exemplified by “Principles of Computer Composition”, Students encounter issues in the “learning” phase, including inconsistent depth of comprehension, incomplete knowledge frameworks, incomplete mastery of key concepts during post-class review, and insufficient coverage in knowledge reinforcement. These shortcomings negatively impact students' motivation and erode their confidence in learning. Addressing students' learning challenges is an urgent priority. We must help them shed the psychological burden associated with learning, fully unleash their motivation and potential, and foster a spirit of diligent study.

In instructional design, leveraging mobile internet and the “Deepseek Model”, we transform teaching into project-based learning. This approach centers on projects as the vehicle, students as the focus, and problems as the guide. Learning revolves around a complete, authentic project, integrating and applying acquired knowledge and skills throughout the process to solve real-world problems. This cultivates comprehensive competencies, promotes deep learning, and facilitates the construction of knowledge frameworks.

Using the memory chapter content from the “Principles of Computer Composition” course as an example for project-based learning, using 1K*8bit 2114 memory chips to configure a 2K*8bit memory module, students will study the memory chapter content. Before project commencement, establish key elements of real-world work scenarios, including project timelines, knowledge requirements analysis, task decomposition, team allocation, and a multidimensional project evaluation system. Specifically:

1) Duration: 2 class periods

2) Knowledge Requirements: Memory concepts, memory hierarchy, memory classification, memory-CPU connections, memory expansion types, etc

3) Task Breakdown: Knowledge point summarization, diagram presentation, group sharing, group evaluation, etc

4) Resource Utilization: Textbooks, mobile internet, and the “Deepseek Model”

5) Grouping: 6 students per group (total 36 students)

6) Evaluation System: Each group elects one representative to form the judging panel and two members to serve as audience judges. (Including the instructor to ensure an odd

number of judges).

The project requires full participation from both teachers and students. During implementation, students take the lead while teachers transition into guiding roles, enhancing students' interest and motivation. In knowledge acquisition, students proactively utilize textbooks, mobile internet, and the “Deepseek Model” for learning, thereby avoiding the issue of students solely using smartphones to browse short videos or play games in class. Task allocation and teamwork among members are crucial for project success. Instruction should help students integrate team resources and apply acquired knowledge and skills to solve real-world problems. Project outcomes are evaluated across multiple dimensions during the presentation phase, including speech content, delivery techniques, personal demeanor, impact, and time management. Undertaking a project inspires students both intellectually and practically, comprehensively developing their self-directed learning and collaborative abilities. This approach promotes students' holistic development in moral, intellectual, physical, aesthetic, and labor education, focusing on cultivating general competencies, professional expertise, practical application skills, applied innovation capabilities, and cross-cultural competence.

2.3. Diversified Experimental and Practical Training to Teach Students in Accordance with Their Aptitude

The theoretical instruction and practical training in foundational computer courses, exemplified by “Principles of Computer Composition”, suffer from a disconnect between theory and practice. Practical experiments are scattered across different chapters, lacking systematic organization and targeted focus, resulting in insufficient depth in theoretical teaching and experiments that fail to keep pace with theoretical instruction. This creates a threefold disconnect between theory and practice. Diversifying experimental training and implementing tailored instruction for students with varying foundational knowledge are urgent measures that must be implemented.

As early as over 2,500 years ago, The Fourth Plenary Session of the 19th Central Committee of the Communist Party of China pointed out that we should " Leverage the strengths of online education and artificial intelligence, innovate educational and learning methods, accelerate the development of an open and flexible education system that serves everyone and is tailored to individual needs, and build a learning society."

With the rapid advancement of information technology, it has become feasible to leverage mobile internet and the Deepseek Model in university practical training to tailor instruction to students with varying foundational knowledge. This approach breaks down the boundaries between virtual and physical learning environments, expands effective educational offerings, integrates learning resources, and enhances teaching outcomes.

(1) Comprehensive Analysis of Students

Before developing practical training manuals, Teacher must observe student performance during theoretical lectures to evaluate their mastery of theoretical knowledge. Simultaneously, they should conduct class-wide surveys and individual interviews with most students to understand their expectations for training methods. This comprehensive assessment should account for individual differences, including intellectual capacity, practical skills, personality traits, and values to ensure a fair and reasonable evaluation.

(2) Develop targeted practical training manuals

At present, in university teaching, practical training manuals remain fixed in both content and methodology. This leads to some students finding the training overly challenging and struggling to comprehend the manuals, causing them to rely on peers to “Skipping class” and fail to meet training requirements. When developing these manuals, leveraging AI technology like the Deepseek model enables comprehensive student analysis to create three tiers A, B, and C tailored to diverse needs. Category A targets students with strong foundational knowledge, featuring appropriately increased training difficulty to enhance their critical thinking and innovation skills. Category B caters to students with average foundational knowledge, emphasizing the consolidation of core concepts to improve their learning capabilities. Category C addresses students with relatively weaker foundational knowledge, focusing on the acquisition of basic concepts and boosting their learning motivation. The highest achievable score in each tier serves as the upper limit for assessment: Tier A caps at 100 points, Tier B at 85 points, and Tier C at 75 points.

Using the memory chapter content from “Principles of Computer Composition” course as an example for developing a practical training manual, this guide demonstrates how to configure a 2K*8-bit memory using 1K*8-bit 2114 memory chips.

1) Class A Practical Training Manual Specifications:

- Calculate the number of 1K*8 bit memory chips required, including computational process and principle analysis;
- Determine the number of data and address lines for the memory, including computational process and principle analysis;
- Explain the operating principle and representation method of the chip select signal line;
- Explain the operating principle and representation method of the read/write signal line;
- Explain the operating principle and representation method of the NAND gate;
- Produce precise diagrams.

2) Class B Practical Training Manual Specifications:

- Determine the number of 1K*8 memory chips required and justify the decision;
- Specify the number of data and address lines for the memory and justify the decision;
- Representation method for the chip select signal line;
- Representation method for the read/write signal line;
- Representation method for the NAND gate;
- Complete the schematic diagram;

3) Class C Practical Training Manual Specifications:

- Determine the number of 1K*8 memory chips required;
- Quantify the data and address lines of the memory;
- Representation method for chip select signal lines;
- Representation method for read/write signal lines;
- Diagramming.

3. Conclusion

The rapid advancement of artificial intelligence technology has brought the reform of computer fundamentals education to a critical juncture. The rapid advancement of artificial intelligence technology has brought the reform of computer fundamentals education to a critical juncture. The essence of curriculum reform integrating mobile internet with the Deepseek model lies in fully leveraging internet and artificial intelligence technologies to address challenges in education. This approach transforms traditional “teaching”, “learning”, and “nurturing paradigms”, delivering a fresh experience for both educators and students. It ensures teaching practices keep pace with contemporary developments and technological advancements, catering to both the needs of the majority and personalized learning requirements. This enables truly tailored instruction, thereby enhancing teaching efficiency. Guided by the spirit of the 20th CPC National Congress, we are exploring innovative models for educational leadership to serve the “free and comprehensive development” of every student.

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