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Research on the Cultivation of Preservice Teachers' Computational Thinking Based on Case-driven Teaching Approach

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Abstract

Computational thinking, as the core thinking mode in the information age, is of vital importance in the cultivation of computer application abilities among teachers' students. Based on the background of Education Informatization 2.0, this paper explores the computer hardware cognition, application of educational technology tools, digital resource integration, and AI technology practice abilities that teachers' students need to possess. By analyzing the role of case-driven teaching in the "University Computer and Artificial Intelligence" course, the "problem scenario - technical analysis - solution implementation" path is used to promote the transformation from theory to practice. The ways of constructing a multi-dimensional case system, implementing student-centered phased task-driven, establishing a dynamic assessment and evaluation mechanism, and promoting the structured development of teachers' students' computational thinking are discussed.

Keywords

computational thinking, teachers' students, computer application, ability cultivation, Artificial Intelligence

Computational thinking is the core thinking mode in the information age, along with theoretical thinking and experimental thinking, forming the three major methodologies of modern scientific research. The core of computational thinking is based on computer science and network technology, and it is a thinking mode that solves complex problems through abstraction and algorithmic means. In the current cultivation of college students' computer skills, establishing a positive computational thinking and using modern computers and communication technologies to solve problems have become the core module of college students' skill cultivation. Even in daily life, computational thinking is also everywhere: the optimal path

planning of navigation systems is essentially the application of graph theory algorithms, the back-end of e-commerce recommendation systems is supported by collaborative filtering algorithms, and even the prioritization of daily affairs also implies the logic of task scheduling algorithms. Therefore, this article will, based on the discussion of the main requirements of current teacher students for computer application abilities, conduct an in-depth analysis of the position and role of case-driven teaching in the basic course teaching of "University Computer and Artificial Intelligence", and thereby explore the cultivation of teacher students' computational thinking through case-driven teaching.

1. The Main Requirements for Computer Application Skills of Current Teacher Candidates

Under the background of the in-depth implementation of the Education Informatization 2.0 Action Plan, teacher candidates, as the main force of the future teaching staff, their computer application skills directly affect the process of educational digital transformation. In light of the requirements of teacher professional certification, it is not difficult to find that teacher candidates should possess computer hardware cognition and familiarity, mastery of common computer software, information recognition and comprehensive processing, etc.

1.1 Overall Mastery and Systematic Control of Educational Technology Tools

Teacher candidates need to deeply master the operation of intelligent teaching platforms, be proficient in the basic requirements of computer technology and network usage, and be able to manage classes and design teaching through mixed teaching systems such as Yuelin Classroom. In terms of information technology and multimedia application, in addition to traditional courseware production, they also need to possess the ability to develop virtual simulation experiments, master AI and other artificial intelligence tools, and be able to generate the necessary teaching resources or materials using computers. For example, in the school where the author works, through "micro-lecture classrooms + AI recording systems", teacher candidates can automatically analyze their teaching situations and teacher quality data through big data, thereby effectively combining traditional training with intelligent technology, and significantly enhancing the depth of application of technology tools.

1.2 Ability to Integrate and Develop Digital Educational Resources

Digital resource creation has gone beyond the scope of traditional courseware production. If current teacher candidates fail to make full use of various online course resources and produce all teaching materials by themselves, it no longer meets the requirements of modern teaching models. Teacher candidates should master the entire process of micro-video production, including scriptwriting (Storyboard), video editing (Premiere), animation production (AE, FLASH), etc. At the same time, in some relatively specialized educational fields, teacher candidates should also possess the ability to develop and integrate various online teaching resources. For example, they should be able to use voice and automatic network synthesis technology to create audio-visual images to help students understand and master the content they have learned. The learning videos of various ancient poems and texts generated by AI at present well illustrate this core requirement.

1.3 Practice and Innovation Ability of Modern AI Intelligent Education Technology

Against the backdrop of a digital power nation, the application ability of modern AI intelligent technology has become one of the core competitiveness. Teachers-in-training need to understand the principles of educational data collection and master the basic methods of learning analysis technology (LA). In the field of artificial intelligence education, they should have basic cognitive abilities in natural language processing and be able to operate intelligent grading systems for homework evaluation. How to utilize the basic grammatical requirements of various large data models and solve the teaching problems that need to be achieved through generative algorithms has become a major issue that current teachers-in-training have to face. This frontier ability cultivation requires the establishment of a "laboratory + teaching case task-driven + computer core ability cultivation" collaborative mechanism. Thus, through the establishment of modular course groups, multi-mentor guidance mechanisms, and collective lesson preparation mechanisms, the digital teaching competence, practical development and innovation ability of teachers-in-training can be systematically enhanced.

2. The Position and Role of Case-Based Teaching in the Basic Course of "University Computer and Artificial Intelligence"

In the context of the rapid development of artificial intelligence technology, big data technology, and modern network communication technology, the teaching model of the basic course "University Computer and Artificial Intelligence" urgently needs innovation and change. The case-based teaching method, by reconfiguring the knowledge transmission path, demonstrates unique value in enhancing students' practical abilities and innovative thinking. Its position and role are mainly reflected in the following three aspects.

2.1 Achieve the Transformation from Theoretical Knowledge to Practical Ability

Under the traditional teaching model, the principles of artificial intelligence algorithms and the fundamentals of computer technology are often imparted in fragmented knowledge points. The most common method is for teachers to impart knowledge in a rote manner, which makes it difficult for students to develop a strong interest in learning. The cultivation of computer application skills thus becomes dull and uninteresting. However, case teaching, through the multi-dimensional path of "problem scenario - technical analysis - solution implementation", constructs thinking patterns, collects and processes data, and solves problems concretely. For example, in "WORD Graphic and Text Mixed Layout", after the teacher sets the target task, students can quickly utilize the relevant computer knowledge they have learned and combine their own aesthetics to create innovative compositions and arrangements of colors, graphics, and text. This task-driven mode based on real scenarios effectively breaks through the barrier between theory and practice.

2.2 Reflect the Fun of Multi-dimensional Exploration and Team Creation

The teaching task is not only to solve the so-called knowledge problems, but also to enable students to learn in a joyful manner. Case-based teaching reshapes the classroom teaching ecosystem through an

iterative mechanism of "case presentation - group discussion - outcome presentation and update". For example, in the practical teaching of "Comprehensive Application of EXCEL Functions", the teacher first demonstrates the powerful functions of the intelligent application, then organizes students to debate and think about different functions to solve different functional sections, and finally submits the best solutions through teams. This three-dimensional teaching model significantly improves learning efficiency. This case-based problem-solving teaching method also cultivates students' collaboration and innovation abilities.

2.3 Achieve Career Planning and Establish an Important Channel for Lifelong Learning

Teachers are a profession that requires lifelong learning, especially in the era of rapid development of information technology. According to the demand for compound talents in the artificial intelligence industry, the construction of the teaching case library should incorporate real industry projects. Taking the cultivation of image processing ability of college teachers as an example, current teachers not only need to master traditional PS and CorelDRAW, but also should master the common AI generative software nowadays, especially by combining smart classrooms with related big data recording and management systems, to review their teaching process and continuously dynamically correct their teaching design and implementation plans. Thus, the vocational core abilities of teachers can be improved in the practical process. Teachers can also enhance their abilities such as Mandarin proficiency, classroom questioning, and case teaching design through practical training. They can also obtain vocational training in aspects such as demand analysis, technology selection, and project management by simulating real working scenarios, effectively shortening the adaptation period from the classroom to the workplace, and laying a foundation for teachers to establish the concept of lifelong learning.

3. A Teaching Path for Cultivating Calculative Thinking in Preservice Teachers Based on Case-driven Approach

"University Computer and Artificial Intelligence" is a compulsory course for preservice teachers in various universities and is also a core course for cultivating their comprehensive application and analytical abilities in modern information technology. In the teaching of this course, by using case-driven methods, we aim to cultivate preservice teachers' calculative thinking and computer application skills. This is of great significance for enhancing the overall professional literacy and information technology capabilities of preservice teachers.

3.1 Establish a Multi-dimensional Case System and Highlight the Initiative of Learning through Cases

In the case design of computer basics, we follow the three-dimensional principles of "contextuality, hierarchy, and transferability". As the instructor of the computer course, we usually adopt cases from real teaching scenarios, such as "modular development of student performance statistics system", "campus garbage classification data analysis", or "company cost and profit analysis", which are concrete projects. Students involved in the teaching process, through visual means such as flowchart drawing, computer code writing, or tool application, guide preservice teachers to transform the abstract calculative thinking

process into observable cognitive operations. For example, in the "WORD Electronic Handwritten Newspaper" case, preservice teachers are required to decompose problem elements using tree diagrams, and use graphic sketches for text and image mixing and spatial layout, achieving the external manifestation of spatial abstraction and logical reasoning thinking, thereby strengthening preservice teachers' practical cognition and ability to solve real problems using computers and calculative thinking.

3.2 Implement Student-centered Phased Task-driven Approach to Promote the Structured Development of Teachers' Computational Thinking

In the actual case teaching process, taking "design and implementation of the textbook cover" as an example, a four-stage teaching method of "problem introduction - task section decomposition - group implementation - iterative optimization of results" can be adopted. In the problem introduction stage, a group of students can propose multiple condition descriptions for the actual needs of the textbook cover design and discuss the core requirements, thereby laying the foundation for the next step of task decomposition. As a teacher of computer or information technology courses, in the second stage, which is the task decomposition stage, one should fully understand the students' ability composition, especially the current situation of computer application technology, and conduct targeted task decomposition. In the group implementation 环节, the subjective initiative of the student team should be fully exerted. Especially in the final stage of scheme optimization and iterative upgrade, teachers should provide guidance on the concretization of computational thinking. This step-by-step training strengthens the structured thinking of problem decomposition, pattern abstraction and algorithm design, and also cultivates students' cooperative awareness and innovation ability in practice.

3.3 Integrate the Characteristics of Teacher Education and Establish a Dynamic Assessment and Evaluation Mechanism to Promote the Transfer Application of Computational Thinking

As teachers-in-training, how to integrate the cultivation of computational thinking with teaching design ability should become an important part of their information technology courses and also an important content for improving their teacher education in practice. For example, interdisciplinary cases such as "algorithm design for solving mathematical problems in primary school" can be trained through micro-teaching practice, requiring teachers-in-training to design teaching plans containing computational thinking elements and simulate the implementation in primary and secondary school classrooms. This dual training not only enhances computational thinking ability but also cultivates their future ability to design and implement computational thinking teaching, forming a virtuous cycle of "acquisition of ability - transformation of ability". It is known that the current assessment of computer-related courses in various universities mainly relies on the final "exam", with a relatively small proportion of the average score. To truly achieve the daily application of computer skills and the cultivation of computational thinking, it is necessary to vigorously advocate diversified teaching effect evaluation methods such as peer evaluation, teacher evaluation, and third-party evaluation. For example, in the case of "my hometown multimedia display PPT design", teachers-in-training are required to complete the stages of requirement analysis, material collection, architecture design, animation design, and code

implementation in groups, and conduct a “developer - teacher” dual perspective defense through role-playing, forming a “design - implementation - reflection” thinking loop, thereby guiding students to achieve the transfer of true computational thinking awareness and ability. This dynamic feedback mechanism uses diversified assessment methods to promote the transfer application of thinking, and at the same time integrates the characteristics of teacher education to achieve the dual improvement of computational thinking and teaching design ability. Through the author’s teaching practice, this model has effectively improved the problem abstraction, algorithm design, and teaching transformation abilities of teachers-in-training.

About the author

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