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Research on the Empowerment of Artificial Intelligence in the Reform and Implementation of Blended Teaching in Computer Science Programs

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Abstract: Against the backdrop of the deep penetration of digital-intelligent technologies into education, traditional blended teaching for computer science programs has long suffered from common pain points, including separated teaching scenarios, insufficient adaptability, and single-dimensional evaluation, making it hard to meet talent-training demands brought by rapid disciplinary iteration. Taking artificial intelligence as the core empowering tool, this paper explores systematic reform paths for blended teaching in computer science programs. It puts forward implementable practical strategies from dimensions such as reconstruction of teaching paths, construction of resource systems, and connection of scenario links. It breaks the fixed pattern of separation between online and offline sessions, promoting a shift in teaching logic from unified output to personalized adaptation. It provides new reform ideas for cultivating compound technical talents majoring in computer science, as well as referable practical directions for digital-intelligent teaching upgrading of similar majors.

Keywords: Artificial intelligence empowerment; Computer science programs; Blended teaching reform; Digital-intelligent teaching; Personalized training

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1. Introduction

Computer science is a field with the fastest technological iteration. The adaptability of talent-training systems directly determines the core literacy of technical talents in the digital-intelligent era. In the past, most domestic colleges and universities carried out blended-teaching reform for computer science programs merely by migrating online resources and superimposing them onto offline classroom procedures, which remained at a shallow level. Core contents, including teaching logic, training frameworks, and evaluation systems, were not truly adjusted. Consequently, the reform has long fallen into the dilemma of “form over substance”. It fails to fully leverage the flexible strengths of blended teaching and keep pace with the dynamic updating

of industrial technical systems. With the deepening application of artificial-intelligence technologies in educational scenarios, attempts are being made to tackle deep-seated problems of traditional blended teaching via intelligent technologies and realize systematic upgrading of computer-science teaching systems, which constitutes a major exploration direction for current professional teaching reform [1]. Combined with the disciplinary attributes of computer science, this paper analyzes existing problems in blended teaching, explores feasible reform paths enabled by artificial intelligence, facilitates the implementation of relevant teaching reforms, and sorts out referable theoretical directions and replicable practical experience.

2. Significance of artificial-intelligence-empowered blended teaching reform for computer science programs

2.1. Break rigid supply and return to the student-oriented essence of education

Artificial intelligence can support blended-teaching reform for computer science programs. First of all, it can adjust traditional teaching logic and clarify its value orientation. In the past, computer-science teaching always followed unified schedules and provided fixed learning resources, failing to meet the differentiated growth demands of students with varied foundations and development orientations [2]. After the introduction of artificial-intelligence technologies, the separation between online and offline sessions in traditional blended teaching is broken. Both online resource provision and offline classroom organization can flexibly change according to students' real-time learning status. Such adjustment is not a simple addition of technologies to existing systems. The core of teaching shifts from "finishing content according to preset schedules" to "building growth paths in accordance with students' cognitive rhythms". The unique value of in-depth teacher-student communication and intellectual inspiration in offline classrooms is preserved, and the flexible features of online learning spaces can be fully exerted. Knowledge delivery in computer science is no longer confined by fixed time-space arrangements and schedules. It fundamentally improves the acceptance of teaching systems for students with different learning characteristics and makes teaching better align with the goals of education itself [3].

2.2. Adapt to disciplinary iteration and consolidate competency foundations for long-term development

The application of artificial intelligence in blended-teaching reform for computer science points to systematic upgrading and extended long-term value of professional talent-training logic. Computer science updates far faster than other fields. The content-updating rhythm and competency-training frameworks of traditional teaching modes can hardly fully keep up with dynamic changes in industrial technical systems [4]. With in-depth involvement of artificial intelligence, the whole training chain of blended teaching can be adjusted more rapidly. Without disrupting the basic framework of existing teaching systems, the connection between knowledge delivery and competency training can be continuously optimized, pushing students from passively receiving established knowledge to actively building knowledge systems adapted to the digital-intelligent era. This reform will not completely overturn existing teaching orders. As long as the bottom-line requirements of core professional training are maintained, the boundaries and possibilities of teaching can be broadened. It helps students gradually develop self-directed-learning awareness and comprehensive thinking capabilities adapted to rapid technological iteration. Thus, the talent-training process for computer science can better respond to the era's requirements for compound technical talents and equip students with underlying

competencies supporting long-term career development [5].

3. Existing problems in blended-teaching reform for computer science programs

There remain quite a few deep-seated problems in the ongoing blended-teaching reform for computer science programs. The first problem lies in the understanding of teaching philosophy. Many teaching practitioners simply regard blended teaching as uploading online resources and combining them with offline classrooms. They fail to truly comprehend the integration logic of the two teaching scenarios. Online and offline sessions stay separated and cannot work together to promote student growth. The second problem is the insufficient matching between existing online resources and teaching demands. Most existing online resources are developed following the logic of traditional content, without special adjustments for the practical-oriented features of computer-science majors. They cannot satisfy the personalized demands of students with varied learning paces or support offline teaching [6]. The third problem is poor connection between online and offline teaching. There is no design for a smooth transition between online learning and offline classroom activities. Teachers can hardly accurately identify problems exposed in students' self-directed online learning, and offline interactions fail to target students' real knowledge gaps. As a result, students end up with fragmented knowledge systems. The fourth problem is the misplaced orientation of competency cultivation [7]. In the reform process, excessive emphasis is often placed on the speed of knowledge delivery, while systematic cultivation of students' core thinking and comprehensive practical capabilities for computer science is neglected. Students are unable to build complete disciplinary cognitive frameworks. The fifth problem concerns incomplete coverage of existing evaluation systems. Current assessments are still trapped in the traditional result-oriented mindset. They fail to capture students' changes throughout blended-teaching procedures, offer objective and comprehensive judgments on students' comprehensive competencies, or provide effective feedback for continuous adjustment and optimization of teaching reforms.

4. Strategies for artificial-intelligence-empowered blended-teaching reform for computer science programs

4.1. Reconstruct hierarchical teaching paths with intelligent adaptation logic

With in-depth involvement of artificial intelligence, rigid teaching progress logic can be broken. Teaching stages will no longer be divided by unified time points. Instead, content arrangement and progress rhythm will be dynamically adjusted according to students' real-time learning status. Such reconstruction goes beyond simple splitting and recombination of content. The whole teaching chain is divided into multiple flexibly connectable modules to build differentiated growth paths for students with varied learning characteristics [8]. Students with weak foundations will not suffer knowledge gaps caused by fast progress, while high-ability students will not get fatigued by repetitive content. The whole process fully follows students' cognitive rules. In blended teaching, online self-directed learning is no longer a supplementary attachment to offline content. It becomes an independent supporting system adapted to diverse student needs. It solves the common problem that traditional blended teaching cannot take individual differences into account. Every student can build a complete computer-science knowledge system step by step along paths matching their own learning rhythms [9].

4.2. Build dynamic resource systems relying on intelligent collaboration mechanisms

With the integration of artificial intelligence, resource systems shift from closed static storage to open, dynamically evolving modes. There is no need for manual completion of the whole process of resource collection, classification, and updating. Intelligent-collaboration mechanisms connect content producers of different dimensions to continuously expand resource coverage scope and content depth. Such dynamic resource systems are not limited to fixed courseware and supporting exercises. Centering on the knowledge threads of computer science, they build continuously extendable content networks. They can automatically complete correlation and matching of various types of content according to actual teaching needs, realizing organic connection among theoretical explanations, thinking expansion, and competency-extension content. Meanwhile, following the latest disciplinary developments, the system can automatically filter and adapt relevant contents. It maintains the timeliness of resources without heavy manual input, thoroughly solving long-standing drawbacks of outdated and poorly-adapted resources in traditional resource construction, and delivering stable content support for the whole blended-teaching process [10].

4.3. Establish scenario-based connection links via intelligent interaction modes

With in-depth involvement of artificial intelligence, full-time intelligent interaction channels can be built between two teaching scenarios. Instead of waiting for students' active feedback to collect learning problems, multi-dimensional information generated in the learning process is analyzed to automatically extract common cognitive blind spots and personalized comprehension biases arising in students' self-directed learning [11]. Such information is directly synchronized to offline-teaching preparation procedures, helping teachers adjust content arrangement and organizational forms of classroom interactions in advance. Offline sessions such as group discussions and intellectual collisions are no longer pre-set procedures divorced from students' real conditions. All activities are developed around real problems generated in students' online learning. After the connection of the two scenarios, gains from online sessions support more in-depth offline exploration, and extended offline activities in turn consolidate online learning outcomes. Common disconnection problems in traditional blended teaching are thoroughly resolved, and a complete closed-loop full-process teaching system is finally formed [12].

4.4. Improve competency-oriented training frames guided by intelligent thinking

After artificial intelligence is integrated into teaching, the logic of intelligent thinking can be naturally embedded in every link of blended teaching. Competency cultivation need not be split into isolated skill-training sessions. Instead, progressive competency-growth paths can be built following the underlying thinking rules of computer science. The whole training framework does not take proficiency in knowledge memorization as its major evaluation criterion. It guides students to gradually develop capabilities for decomposing and analyzing complex problems, integrating and applying interdisciplinary knowledge, and conducting self-directed exploration of unknown technical fields. Such a competency-centered training framework fits well with the feature of rapid updates in computer science. Training is not confined to the operation of certain specific existing technologies. It helps students lay foundations for long-term growth at the level of underlying thinking. When facing continuously-updated technical systems in the future, students can realize rapid knowledge transfer relying on their built-up core literacy and ultimately grow into compound professionals required in the digital-intelligent era [13].

4.5. Construct process-oriented evaluation systems through intelligent multi-dimensional analysis

With in-depth involvement of artificial intelligence, the limitation of single-dimensional evaluation can be broken. Evaluation is no longer confined to final output results. Multi-dimensional information throughout blended-teaching procedures is analyzed to build a process-oriented evaluation system covering students' whole growth process [14]. Instead of standardized scores as the sole evaluation yardstick, this system captures students' thinking changes, exploratory attempts, and competency advancement in different learning stages. It can accurately identify students' personalized strengths and potential weaknesses, and fully present differentiated growth paths of different learners. Multi-dimensional feedback generated by this evaluation system can in turn drive dynamic adjustment of the whole teaching workflow. Teachers can continuously optimize the design and arrangement of teaching links, forming a positive cycle of "teaching implementation — multi-dimensional evaluation — dynamic optimization", and supporting the long-term advancement of blended-teaching reform for computer science programs [15].

5. Conclusion

Artificial-intelligence-empowered blended-teaching reform for computer science programs is not a simple superposition of technical tools, but a systematic reshaping of the underlying logic of traditional teaching. Its core value does not lie in replacing traditional teaching links with technologies, but in using intelligent technologies as a bond to establish collaborative links between online and offline teaching scenarios and truly return teaching to the educational essence centered on student growth. In the future, as the integration of digital-intelligent technologies and educational scenarios keeps deepening, the reform boundaries of blended teaching for computer science programs will keep expanding. Relevant practical paths will be continuously iterated and optimized in implementation. Eventually, a new-type teaching system adapted to talent-training demands in the digital-intelligent era will be constructed, laying solid underlying support for the long-term growth of compound technical talents in the computer-science field.

Disclosure statement

The author declares no conflict of interest.

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