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Exploration on the Reform Path of Course Content and Teaching Mode for Computer Science under the Background of "Internet Plus"

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Abstract: The advent of the "Internet Plus" era has brought unprecedented challenges to the cultivation of computer science talents. To cultivate computer science professionals who meet the demands of this new era, it is imperative to conduct in-depth reforms in the course content and teaching mode of computer science. Therefore, this paper systematically explores the reform path of course content and teaching mode for computer science under the background of "Internet Plus," aiming to provide a concrete and operable reference plan for the teaching reform of computer science and effectively enhance the quality of talent cultivation and its alignment with industry needs.

Keywords: Internet Plus; Computer science; Teaching reform; Curriculum system; Practical teaching

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1. Introduction

In recent years, the in-depth advancement of the "Internet Plus" initiative has reshaped the technological ecosystems of multiple industries, including finance, healthcare, and education. Today, next-generation information technologies such as big data and the Internet of Things are no longer distant concepts but have become everyday tools for industrial upgrading. This transformation undoubtedly places higher demands on computer science professionals, requiring them not only to possess a solid theoretical foundation but also practical skills and innovative thinking. However, computer science education in reality appears somewhat inadequate. This is specifically manifested in outdated course content that lags behind technological advancements and a single, rigid teaching approach. The design of practical sessions often contradicts real-world R&D processes and project scenarios in enterprises, resulting in graduates typically needing a prolonged period of relearning when they enter the workforce. Therefore, exploring an effective pathway for curriculum and teaching reform has become extremely urgent. This study is grounded in this practical contradiction, focusing on the two most critical dimensions—course content and teaching mode—and attempts to construct an executable reform framework.

2. Practical dilemmas of course content and teaching mode in computer science education in the context of "Internet Plus"

2.1. Disconnection between course content and technological development

Taking a broad view of the computer science textbooks currently used in some universities, there is a prominent issue: a significant portion of these textbooks still dedicates extensive space to explaining outdated or rarely-used technological frameworks in the industry, while only providing brief introductions to mainstream technologies such as cloud computing and deep learning, which are explicitly required by companies during recruitment, lacking systematic and in-depth explanations. This disconnect between teaching content and industry trends is extremely pronounced and arises from a combination of factors. For instance, the process of compiling and publishing textbooks is lengthy, and revisions to course syllabi often fail to keep pace with the rapid evolution of technology [1]. As a direct result, there is a notable disparity between what students learn in the classroom and what is required in the workplace, necessitating substantial retraining efforts by companies. This disconnect undoubtedly represents a major bottleneck in the current efficiency of talent cultivation.

2.2. Monolithic and rigid teaching modes and methods

In many computer science classrooms today, the one-way lecture mode of "teacher talks, students listen" remains predominant. Teachers meticulously derive complex algorithm formulas on the podium, while students passively receive the information below, leading to a lack of effective interaction and inspiration. This "spoon-feeding" approach yields suboptimal results for computer science, a discipline that demands a high degree of hands-on practice. It transforms the lively, interesting, and creative programming and system design into a pile of abstract concepts and examination priorities that require rote memorization. Even if some teachers attempt to change the teaching model, they often find it difficult to implement thoroughly due to students' long-established learning habits, overcrowded class sizes, or lack of support from the teaching evaluation system. Ultimately, this rigid teaching model stifles students' initiative to explore, leaving them proficient at taking exams but at a loss when faced with a brand-new, real-world problem that requires the comprehensive application of knowledge to solve [2].

3. Core directions for the reform of computer science curriculum content and teaching models in the context of "Internet Plus"

3.1. From knowledge transmission to competency building

In the "Internet Plus" environment, the primary transformation in computer science teaching should be a reorientation of educational objectives. The goal of overly emphasizing students' mastery of fixed knowledge points must be changed, shifting the focus from "teaching students knowledge" to "cultivating students' abilities." Specifically, this involves focusing on developing students' thinking, enabling them to think about problems, break them down, and design solutions during the learning process. Meanwhile, it is essential to enhance their self-directed learning abilities. After all, technology evolves at an incredibly rapid pace, and the skills learned today may become outdated in the near future. Only by possessing the ability to self-update their knowledge can individuals maintain competitiveness and avoid obsolescence. The capacity for innovative problem-solving in complex engineering scenarios is of paramount importance. Students should not only be proficient in coding but also understand design, optimization, and collaboration, ultimately developing a comprehensive professional skill set [3]. This shift implies that the criteria for evaluating students should no longer be solely based on their scores on final exams but should focus more on what they can accomplish and what practical problems they can solve using their acquired knowledge and skills.

3.2. Building a dynamic, modular curriculum system

Given the extremely rapid pace of technological iteration in today's society, the existing fixed, linear curriculum system is clearly inadequate. Many foundational courses taken in the first or second year may already be outdated by the fourth year, and this scenario is not uncommon. The organization of course content must become more flexible and adaptable. Therefore, it is necessary to construct a "dynamic + modular" curriculum structure. Here, "dynamic" refers to establishing a mechanism that can swiftly respond to industry technology trends, promptly incorporating newly validated technologies and tools from the market into teaching content, rather than waiting for the next round of curriculum revision. As for modularization, it involves breaking down the entire curriculum system into a series of relatively independent yet interconnected knowledge modules, such as establishing modules like "Web Development Technology Stack" and "Mobile Application Development" [4]. The advantage of this approach is that students can make menu-style selections based on their interests and career plans, thereby creating personalized learning paths. Additionally, for the college, updating a single module is much easier than overhauling the entire curriculum system, which helps enhance the adaptability and forward-looking nature of teaching.

3.3. Deepening blended and inquiry-based teaching

The innovation of teaching methods serves as the foundational guarantee for achieving the aforementioned goals and content reforms. The traditional one-way lecture-style classroom is hardly capable of cultivating the advanced abilities expected, as mentioned above. The protagonist of the classroom must shift from the teacher to the students, allowing them to truly "come alive." Blended teaching provides an effective framework here, reshaping the teaching process through an organic division of labor between online and offline components. Basic knowledge transmission is placed online, allowing students to control their own learning progress. The precious offline classroom time is then dedicated to in-depth discussions, vigorous debates, and collaborative project practices, thereby maximizing teaching effectiveness. Schools should also vigorously promote inquiry-based teaching methods, adopting project-driven learning and case-based teaching approaches as much as possible. Teachers should also learn to pose open, authentic questions without predetermined standard answers, guiding students to personally experience, in group settings, the complete process from needs analysis, technology selection, and solution design to code implementation, as well as testing and deployment [5]. In this process, students will learn not only the technology itself but also valuable experiences in how to learn, collaborate, and innovate.

4. Reform paths for computer science curriculum content and teaching models in the "Internet Plus" environment

4.1. Dynamically update curriculum content

Schools can actively encourage their colleges to establish a "Curriculum Development Committee" in collaboration with representative enterprises in specific technological fields. This committee can invite frontline architects or technical directors from these enterprises, along with professional faculty members from the school, to review and refine the syllabi of core professional courses every semester or even more frequently. Outdated knowledge points can be reduced or moved to elective courses, while emerging technologies or technological trends can be promptly and systematically incorporated into the teaching content. Merely adjusting at the outline level is far from sufficient; synchronously updating teaching resources is also extremely crucial. The teaching and research office can take the lead in establishing a dynamic "online resource repository" for each core course. Teachers can selectively and systematically integrate high-quality, relevant content into it. Through this combination of a "stable syllabus + dynamic resources," it is possible to maintain the stability of the core curriculum while endowing teaching content with unprecedented flexibility and timeliness. This enables students to be exposed to the ongoing stories in the industry during their school years, rather than just learning about past technologies [6].

4.2. Hybrid and innovative teaching model

The computer science major can implement a model that combines "online self-directed learning with in-depth offline discussions." In the online segment, teachers carefully select and integrate existing high-quality MOOC resources, technical documents, and thematic micro-lectures. Students simply need to follow the guidance to complete the learning of relevant content before class and demonstrate their mastery of knowledge and skills through online tests and exercises. In the offline segment, the classroom primarily focuses on in-depth analysis of common difficulties exposed online, organizing debates among students on controversial technical solutions, or guiding them to tackle a comprehensive small project as a team. Hybrid innovation should also extend to experimental sessions. Virtual simulation experiment platforms can be introduced, leveraging container technologies like Docker to swiftly establish consistent and isolated development and testing environments for students. Students can conduct experiments and submit reports online anytime, anywhere. Meanwhile, offline experimental classes can focus on addressing personalized issues and undertaking performance optimization challenges. This combination of "virtual simulation + in-person guidance" effectively overcomes the limitations imposed by laboratory hardware conditions and time and space constraints. More crucially, it simulates the real-world remote collaboration scenarios of modern software engineering, playing a pivotal role in nurturing students' vocational capabilities [7].

4.3. Collaborative cultivation of practical skills

Schools should drive the transformation of school-enterprise cooperation from loose connections to close integration, jointly establishing high-level physical training bases. Mechanisms such as the on-campus presence of industry mentors and a dual-mentor system for projects can be introduced, enabling corporate engineers to bring real-world problems, adapted for educational purposes from their actual development work, into the classroom. For instance, by collaborating with domestic cloud service providers or software companies, the technical challenges they encounter can be transformed into course designs or graduation projects for students. This allows students to experience the complete process from requirements analysis and proposal review to iterative deployment while still on campus. Such immersive project training helps students grasp the entire lifecycle of software engineering and cultivate professional qualities. Meanwhile, by leveraging the incentive approach of "promoting learning through competitions and replacing exams with certifications," we can integrate academic competitions and industry certifications into the training system. Supporting students to participate in high-level competitions such as the "China Collegiate Computing Contest" not only stimulates innovation awareness but also allows award-winning achievements to be converted into credits for corresponding practical courses. More directly, widely recognized professional qualifications in the industry, such as Huawei's HCIP certification or Alibaba Cloud's ACP certification, can be set as alternatives or bonus points for relevant course assessments. This approach provides an objective third-party evaluation of learning outcomes, enhances learning motivation, and aligns students' skill standards more closely with industry requirements, truly cultivating practical talents needed by the industry [8].

5. Conclusion

In summary, amid the profound transformations of the "Internet Plus" era, the reform of computer science curriculum teaching has become an essential task. The proposed reform strategies aim to organically connect the real needs of the industry, the latest technological trends, and the growth of students' abilities, forming a closed loop in the talent cultivation ecosystem. Undoubtedly, reform is not something that can be achieved overnight; it requires educators to embrace it in concept and persist in action. It is hoped that the strategies proposed in this article can provide frontline teaching practitioners with a concrete and actionable reference framework, jointly promoting a substantial improvement in the quality of computer science talent cultivation and better empowering the development of the digital economy. For future research, further attention can be paid to how to utilize artificial intelligence technology to recommend more personalized teaching paths, which may be the next worthwhile direction to explore.

Disclosure statement

The authors declare no conflict of interest.

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