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Research on Measures for the Construction of Computer Science in the Context of Big Data

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***Abstract*—*With the rapid development of big data, artificial intelligence, cloud computing, and large language model, new challenges have been posed to the education of computer majors. We explore the improvement on the educational competence of computer science major from five perspectives: curriculum system, teacher construction, practical innovation, second classroom, and school enterprise cooperation. It proposes to optimize the curriculum system through multiple channels, build "double-qualified" and "double-talented" teachers with two-way flow, innovate stereoscopic practical teaching, diversify the second classroom, and cooperate with schools and enterprises for talent cultivation, which plays a certain positive role in the construction and talent cultivation of computer major.*

***Keywords*—*Curriculum system; construction of teaching staff; practical innovation; second classroom; enterprise cooperation.*

I. Introduction

With the rapid development of artificial intelligence, big data, and large language model, traditional computer majors have faced new challenges, requiring full integration with new technologies, adapting to market demands, and continuously improving their educational capabilities. In 2019, the Ministry of Education issued the "Opinions on Deepening the Reform of Undergraduate Education and Teaching to comprehensively improve the quality of talent cultivation", requiring the construction of a professional design management system that integrates autonomy, flexibility, standardization, and stability, guided by the needs of economic and social development and student career development, and driven by the "Four New" construction to adjust and optimize the professional structure and enhance the connotation of universities[1]. The construction of a speciality requires the vitality of manager, teachers, and students - "people", as well as the optimization of teaching, practice, and school-enterprise - "things". Activating from multiple angles, advancing together, and creating synergy is vital to infuse more vitality into the development of the profession and effectively enhance students' comprehensive abilities.

II. The Problems in the Current Construction of Computing Majors

A. Systematization of the curriculum system needs further improvement

With the development of artificial intelligence, cloud computing, and large language model, further exploration and improvement are needed to explore how traditional course teaching content can be integrated with emerging technologies, which emerging technology courses need to be added to the curriculum system, how to adjust the structure and composition of the original curriculum system, how to better connect courses, and how to align with the market. "How to fit the curriculum system with professional needs and how to integrate emerging technologies in curriculum content" is facing huge challenges [2].

B. Teachers' ability to guide engineering practice is relatively low

At present, the theoretical teaching level of most teachers is generally higher than their engineering practical ability, because the teachers mainly come from doctoral or master's students who have graduated from universities, without experience working in companies, engaging in practical projects, and lacking engineering practical experience. After working in universities, there's a lack of in-depth cooperation between schools and businesses. Many teachers don't have the opportunity to immerse themselves in the actual workings of enterprises, understanding their real needs, and enhancing their own engineering practical abilities and instructional skills. Many teachers lack strong practical engineering skills, and the percentage of educators with hands-on experience in industry is relatively low. There's a shortage of applied instructors with actual work experience in enterprises, particularly in terms of innovation and entrepreneurship [3].

C. The overall hands-on ability and practical innovation awareness of students are weak.

Students tend to have lofty aspirations but struggle in practical application. They excel in grasping theoretical knowledge but often overlook hands-on practice. Once engaged in practical work, they frequently encounter various issues. This 'emphasis on theory, neglect of practice' mindset restricts their innovative consciousness and capability. It hinders them from sparking inspiration or generating creative ideas during practical application. Additionally, efforts toward nurturing engineering practice and fostering innovation primarily remain at the level of perceptual understanding, lacking sufficient emphasis on enhancing practical skills and innovative abilities [4].

Due to the abundance of online resources, many students have developed a sense of inertia. When faced with problem-solving tasks, they tend to search for readily available answers online. This reliance on existing solutions leads to a lack of innovative awareness, preventing them from approaching problems with new perspectives and methods. Over time, this pattern diminishes their drive and passion for innovation

D. Students' knowledge base is not sufficiently broad, and their perspective remains limited.

Due to our school's geographical location, which is not situated in a first-tier city, students have limited access to resources available in these cities. Consequently, their exposure to cutting-edge academic exchanges and discussions is minimal, and they lack opportunities for collaboration with major corporations in metropolitan areas. Students primarily focus on assimilating existing curriculum content, lacking the initiative to explore knowledge beyond the classroom. Consequently, their scope of knowledge remains relatively narrow, limiting their vision and hindering their ability to plan for future development directions and research avenues at a macro level.

E. The collaboration between the school and enterprises lacks depth, resulting in a significant gap between students' abilities and market demands.

Most of the abilities students possess are general skills, creating a notable gap between their skill set and the specific demands within the computer industry. Students often lack the corresponding job skills required for specialized positions, leading to longer adaptation periods within these roles. The insufficient depth of collaboration between the academic institution and enterprises fails to address the needs of both parties, hindering the achievement of mutual benefits. This lack of substantial collaboration hampers the creation of inherent motivation for industries and businesses to actively engage in the development of university talents[5].

III. RESEARCH ON MEASURES FOR IMPROVING THE CONSTRUCTION OF COMPUTER MAJORS

The corresponding measures have been proposed to address issues such as an incomplete curriculum system, teachers' lower proficiency in engineering practical guidance, students' overall lack of hands-on skills and weak innovation awareness, narrow knowledge scope, limited depth in school-enterprise cooperation, among others.

A. Utilizing a 'multi-pathway' approach to optimize curriculum design, expanding the scope of curriculum reform, conducting restructuring of the curriculum system, elevating the standards and quality of professional education, and establishing top-notch major and courses to enhance professional development.

The "multi-pathway" approach involves restructuring the curriculum system by considering various aspects such as the inherent connections between courses, market demands, and advancements in the computer field. This restructuring emphasizes not only intra-course discussions but also strengthens communication and exchange between courses. Particularly for courses with sequential relationships, emphasis is placed on the continuity and coherence of the curriculum.

Furthermore, it involves deepening the integration of industry and education by conducting in-depth corporate research to understand actual enterprise needs. This includes introducing new professional technologies and theories, expanding existing teaching content, ensuring seamless integration, and collectively building a curriculum system to establish top-tier courses.

Simultaneously, keeping abreast of cutting-edge developments in the computer field involves integrating new technologies and theories into the teaching content. This approach ensures the curriculum not only establishes a solid foundation but also aligns with market demands and emerging trends.

The selection of elective courses prioritizes students' wide-ranging employment prospects and prepares theoretical prerequisites for further academic pursuits. Regarding curriculum design, the focus remains on highlighting the distinctive features of the university's programs while strengthening communication and collaboration with peer institutions in terms of course structure, teaching methods, and other elements. This collaborative effort aims to enhance inter-school cooperation, integrate high-quality resources, foster mutual learning, and further elevate the quality of computer science education.

In summary, adhering to the principles of "strengthening foundations, expanding specialization, emphasizing practice, keeping abreast of advancements, and enhancing quality," the aim is to enhance the scientific nature of curriculum design and optimize the curriculum system.

B. Strengthen the construction of the teaching staff, strengthen the "double-qualified and double-talented" teaching staff, and adopt diversified models to enhance teachers' professional and engineering practical abilities.

Quality teaching necessitates a skilled faculty. In China, the 'Engineering Education Accreditation Standards'[6] require teachers to possess ample engineering experience and the ability to engage in practical engineering research. The encouragement of universities to actively engage industry or sector experts as part-time instructors underscores the need for educators to cater to industrial requirements with practical expertise. To enhance teachers' capabilities, diverse approaches such as self-study, corporate training, on-site industrial experiences, and further education domestically or internationally are employed.

For instance, grouping teachers into discussion units based on the interrelatedness or category of courses allows for periodic exchanges and discussions. These sessions focus on expanding course content, integrating research with teaching, and planning practical teaching activities. Through self-study and peer learning, this approach uplifts teachers' theoretical and professional standards.

Promoting a reciprocal exchange between academia and industry involves teachers delving into enterprises to understand their status, needs, and actively conducting applied research. This practice enhances their practical skills and innovation abilities. Simultaneously, inviting industry experts as adjunct faculty to undertake teaching responsibilities and organizing industry-led seminars or skill-based training sessions on campus uplifts the overall quality and nurturing capabilities of the faculty.

C. Establishing a 'multi-channel, open, and stereoscopic' practical teaching system aims to enhance students' practical innovation capabilities.

The term 'multiple channels' refers to employing various forms of practical teaching such as 'course experiments, off-campus internships, and academic competitions' to provide multifaceted and multi-level practical experiences. This approach widens pathways and methods for practical learning. With an outcome-oriented educational philosophy, it necessitates the redesign of experimental content within courses, emphasizing real-life scenarios and practical applications. Additional modules like curriculum design or specialized internship modules tailored to the unique aspects of the field, for example, introducing computer assembly internships or hardware internships, can be integrated.

'Open-style' refers to utilizing open platforms such as the 'EduCoder' platform to introduce comprehensive design-oriented experimental projects to students. Moreover, instructors can align their own research projects and open specific topics for student selection based on their interests.

The term ' stereoscopic' implies leveraging the advantages of school-enterprise cooperation by engaging experienced industry professionals as off-campus instructors. These professionals guide students through the practical teaching process, thereby designing a systematic approach that seamlessly integrates students' course internships, societal practices, and graduation internships. This integration further expands the scope of practical teaching.

By constructing a 'multi-channel, open, and stereoscopic' practical teaching system, it aims to enhance students' abilities in algorithm design, hands-on programming, and fostering innovation within practical settings.

D. Build a rich and diverse second classroom, break through the limitations of classroom teaching, and broaden students' horizons.

Through avenues such as study exchanges, video lectures, practical teaching, academic competitions, internships, and hands-on training, a diversified extracurricular program is established. This exposes students to cutting-edge technology and specific professional skills beyond theoretical knowledge, broadening their horizons, enhancing their skill set, and nurturing versatile talents adaptable to market demands.

For instance, regular student study exchange meetings encourage students to share recent academic achievements, fostering independent research and resource exploration. Periodic viewing of high-quality, expert-led lectures on frontier technologies or attending live expert presentations broadens students' understanding. Each year, numerous teachers participate in major specialized conferences like machine learning, data mining, big data, etc. The valuable resources gained by teachers from these conferences are promptly organized and disseminated to students, compensating for potential academic constraints in non-first-tier cities or non-top-tier schools. This keeps students abreast of the latest developments in the field of computer science.

Tailored extracurricular activities or lecture series are introduced for students aiming for immediate employment or further academic pursuits after graduation. For those planning immediate employment, leveraging platforms like 'LeetCode' enhances their practical skills. 'LeetCode' provides a wealth of high-quality learning resources, question banks, virtual competition questions from various companies, and interview questions, offering students targeted learning opportunities.

Moreover, there's a reinforced focus on training for computer science competitions including 'Internet+' projects, the Blue Bridge Cup, computer design competitions, big data and artificial intelligence challenges, computer game tournaments, and intelligent robotics. Participation in these competitions serves as a learning catalyst, significantly boosting students' skills. Notably, competitions sponsored by companies are closely related to real-world industry needs, offering students a more practical and eye-opening experience.

E. Actively expand practical internship bases and establish a good educational ecological environment for collaborative education between schools and enterprises, fostering 'joint construction of specialties and shared talent cultivation'

Actively tapping into interpersonal resources and expanding the industry scope of school-enterprise cooperation involves gaining deeper insights into the demands for computer technology across various sectors. This facilitates the establishment of a favorable 'professional+' collaboration framework between academia and industry. The integration of computer technology with industries like agriculture, renewable energy, and intelligent control in transportation allows for understanding the practical requirements of these fields. This targeted approach in talent cultivation ensures better alignment with market demands.

Both academia and industry should adhere to the principles of 'resource sharing, mutually beneficial cooperation, and joint development' to deepen their collaboration. Schools engage in deep cooperative efforts with enterprises in segments like social practice and graduation projects, establishing practical training grounds where students actively participate in enterprise-level projects. Engaging students in 'real-world' scenarios during their graduation projects enables them to acquire tangible technical skills. Additionally, enterprises benefit by absorbing outstanding students cultivated through these collaborations, reducing recruitment costs. These new hires swiftly integrate into the company, saving training time and expenses.

This mutual benefit fosters a win-win situation between academia and industry, creating an environment conducive to collaborative talent development.

IV. CONCLUSION

Adhering to the principles of 'solid foundation, broad expertise, strong skills, staying updated with advancements, and emphasizing practical applications,' we aim to develop a scientifically guided curriculum structure and practical teaching system that's competency-driven. This includes a diverse array of extracurricular activities aimed at keeping pace with cutting-edge technologies and expanding students' horizons.

We also establish an enduring collaborative education mechanism between academia and industry that's market-oriented. Additionally, we ensure the presence of a high-quality teaching team proficient in theoretical instruction and engineering practice. Our objective is to nurture innovative, multi-skilled talents capable of meeting market demands.

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