Teaching Team Building for Internet of Things Hardware and Software Integration Courses in the Context of Science, Education and Industry Integration

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Abstract. Integration of science, education and industry has become a necessary path for the construction and development of first-class computer science majors. In this paper, combining with the characteristics of computer-based majors, this team takes the teaching team construction of the Internet of Things engineering major of Qilu University of Technology (Shandong Academy of Sciences) as an example, focusing on the undergraduate teaching tasks in the field of intelligent Internet of Things-related majors, and discussing the construction work carried out in various aspects of the Internet of Things hardware and software fusion teaching team in the light of the issues of unclear team objectives, uneven team structure, inadequate team synergy, and inconspicuous team characteristics.

Keywords: Internet of Things Engineering Program; Teaching Team Building; Integration of science, education and industry; Undergraduate teaching

1   Introduction

Internet of Things engineering is a general higher education undergraduate major, belongs to the computer class, the major requires the mastery of mathematics and other related basic knowledge of natural sciences as well as and the Internet of Things related to the basic theory of computers, communications and sensing, basic knowledge, basic skills and basic methods, to cultivate senior engineering talents who can systematically master the Internet of Things related to theories, methods and skills, and have the broad professional knowledge in the field of information, such as communication technology, network technology, sensing technology, and other information areas[1][2].

The curriculum of Internet of Things engineering includes courses in computer, communication, electronics and other disciplines, which can be divided into three categories: software, hardware and comprehensive, and it is a great challenge for students

and teachers to achieve better teaching effect due to its combination of hardware and software [3]. On the other hand, the Internet of Things industry always separates software and hardware into software engineers and hardware engineers. Although Internet of Things is a combination of hardware and software technology, pure software or pure hardware can not say that they are complete Internet of Things industry, but the perfect combination of hardware and software can be said to be a major pursuit in the minds of all software and hardware developers [4]. So the combination of hardware and software is a skill that Internet of Things practitioners must have.

As an intelligent system connecting things, people and information resources, Internet of Things realizes the processing of information in the physical and virtual worlds. Along with the maturity of 5G technology, Internet of Things is developing rapidly and penetrating into all aspects of our food, clothing, housing and transport, bringing intelligence and convenience to our lives [5][6]. The rapid development of intelligent Internet of Things requires more professionals with scientific research capabilities and hardware and software skills.

At present, the talent cultivation mode of intelligent Internet of Things-related professions is mostly the separation mode of science and education or industry and education, and it is difficult to realize the integration of science, education and industry [7].

With this background, this paper discusses the teaching team construction of the soft-hard integration course of Internet of Things engineering in a local university as an example, and discusses various aspects of the training system, teaching platform, management and assessment system, and so on.

2   Construction Route

2.1   Constructing an Innovative and Entrepreneurial Talent Cultivation System under the Integration of Science, Education and Industry.

Adopting the science and education integration model of project-driven and scientific research results feedback to enhance students' innovation ability.

Make full use of the resources of research institutes and scientific research centers to guide teachers to combine scientific research with teaching, internalize scientific research results into teaching content and solidify through teaching materials and other forms. Develop an incentive mechanism that requires high-level professors to teach undergraduates and encourages teachers to lead students in research and training activities to enhance students' innovative and practical abilities.

Adopting various modes of industry-teaching integration, such as collaborative R&D and industry-teaching co-construction, to cultivate students' practical abilities.

Strengthen the dealings with famous enterprises, dig deeper into the mode of school-enterprise co-operation, combine enterprise-level project research and development with teaching, adopt course experiments, course design, the second classroom, discipli-

nary competitions, internship training, graduation design and other methods to consti-tute an integrated practice system, and cultivate students' ability to solve complex en-gineering problems.

Teaching-centered, collaborative education between research and industry.

Taking the integration of industry and education and the integration of science and education as the engine, proactively adapting to the new mode of social collaborative innovation, vigorously promoting the comprehensive cooperation between industrial enterprises and Shandong Academy of Sciences, and making full use of the advantages of funds, equipment, teachers, technology and practice places required for talent culti-vation to carry out collaborative education in various ways.

2. 2   Establishment of a Sharing Platform for Integration of Science, Education and Industry in Computer Science.

Make full use of the scientific research resources of the Institute and the R&D resources of famous enterprises to build a resource-sharing platform for the integration of science, education and production. The resource platform contains teaching resources, R&D platform, scientific research data, high-performance computing and other resources, which buttresses the demands of enterprise projects to the course design and graduation design, and also moves the classroom to the project reality, buttresses the cutting-edge knowledge of scientific research projects to the theoretical teaching, and applies the scientific research data to the experiments and competitions.

2.3   Deepen the awareness of reform, focus on the cultivation of results, and establish a management and assessment system for teaching teams.

As a grassroots teaching organization with a public interest nature, the ability to effec-tively balance collective and individual interests is the key to motivating team members to actively cooperate and compete in a healthy manner [8]. Improve the assessment, reward and punishment mechanism of the teaching team, reasonably distribute the ben-efits of team building, and effectively stimulate the enthusiasm of the teachers of the teaching team[9]. Establish a diversified assessment mechanism for teaching teams, ob-jectively evaluating team members' actual work inputs and contributions to outputs in terms of teaching performance, effectiveness in educating people, creation of special features, and development of teachers. Implementing asymmetrical benefit distribution mechanisms, strengthening incentives for teachers' individual characteristic innovative achievements and reform practice activities, and avoiding the phenomenon of teachers' passive wait-and-see and insufficient team competition. Focusing on the cultivation of teaching achievements, strengthening the guidance of innovation and entrepreneurship, and actively participating in the selection of various kinds of teaching achievement awards at all levels, teaching reform projects, teaching material projects, teaching re-search papers, and first-class courses.

Establishment of reasonable work planning, periodic statistics on output results, timely summarization of experience, rewarding high-level results, identifying short-comings, and providing timely financial support for the team's teaching shortcomings.

2.4   Dovetailing with industrial development and the frontiers of science and technology, building a high-level application-oriented faculty.

Optimize the environment for the integration of science, education and industry, bal-ance the burden of teaching and scientific research, and target the planning proposed for teaching and scientific research to release the enthusiasm of teachers in teaching and scientific research. Encourage teachers to go out of the school door, in-depth to the first line of related enterprises and institutions; according to the teaching task needs of the teaching team of the integration of hardware and software of Internet of Things, the existing horizontal projects will be organically combined, and take the initiative to dock with the industrial chain, so as to transform the latest industry dynamics into the content of knowledge taught in the classroom, and at the same time, the enterprises will send their excellent engineering technology and management personnel to participate in the school's talent cultivation work, and to implement the integration of teaching and cross-platform collaborative cultivation of students.

Establishing teamwork mechanisms, improving teachers' educational and teaching abilities and overall teaching level, and creating conditions and support for teachers to carry out collaborative education and industry-university-research cooperation activi-ties. Improve the practical teaching guidance system, encourage teachers inside and outside the university to jointly guide students' practice, innovation and entrepreneur-ship; build a platform for industry-university-research cooperation, and improve teach-ers' scientific research and social service ability.

Strengthen project exchanges with industrial enterprises and research institutes, and enhance the construction of teaching teams relying on platforms such as science-teach-ing fusion, industry-teaching fusion, and collaborative education between industry, ac-ademia and research.

Strengthen internal communication and collaboration to build a synergistic teaching team. According to the needs of the courses taught by the team, the teaching resource network is gradually constructed from the core resources of the courses, and the auxil-iary resources of the relevant professions or enterprises upstream and downstream of the industrial chain in various dimensions, so as to effectively centralize the human resources, material resources, financial resources, knowledge, information and technol-ogy required for the operation of the teaching team, and to enhance the efficiency of the utilization of the team's resources.

Reasonable division of labor and collaboration is the key to support the effective operation of teaching teams. According to the concept of teaching team management, the teaching organization network is constructed according to the principles of deepen-ing division of labor, open cooperation and real-time collaboration to enhance the effi-ciency of teamwork. Deepening the division of labor refers to decomposing the tasks of teaching team construction such as education and teaching, curriculum construction, teaching conditions construction, teaching reform and scientific research in accordance

with the requirements of the goal of cultivating composite and applied talents, and distributing them to the member teachers in a reasonable way. Open cooperation refers to the establishment of a cooperation platform with the government, industry and scientific research institutions on the basis of the division of labor within the team, and the promotion of key projects and technology development cooperation between teachers and outsiders. Real-time collaboration refers to making full use of Internet technology and cloud platforms to realize real-time online interaction and task collaboration among members of the teaching team, achieving the goals of decentralized tasks, centralized management and timely collaboration.

Improve the information exchange mechanism and promote teamwork and learning. Improve the information exchange mechanism of the teaching team, encourage communication between teachers of related specialties inside and outside the team, and promote effective team cooperation and learning. First, enrich the communication methods, use the mentor system, group system, project consulting system and other forms to realize multi-dimensional and deep-level information exchange. The second is to build an information platform, utilizing online collaborative office software, online meeting software, online sharing platform and other tools to support team task arrangement and member interaction and communication, and to improve the real-time nature of information exchange. Third, improve the exchange system, encourage team members to regularly carry out project discussions, collective learning, group reporting and individual reporting and other exchange activities, and promote the effective externalization and migration of the team's tacit knowledge.

2.5   Strengthen the core leadership, strengthen the core backbone training, and create a characteristic innovation team.

According to the construction idea of teaching team, combined with the needs of science and technology frontier, industrial development and the school's own orientation, strengthen the close docking with the local strategic emerging industries, and gradually form the professional characteristics of intelligent Internet of Things and big data, and give play to its leading role as a demonstration. At the same time, it attaches great importance to the cultivation of core teachers, cultivates the disciplinary and professional construction and social service ability of team leaders from the perspective of disciplines, scientific research and industry, exercises the teaching reform and scientific research ability of backbone teachers, and strongly supports the core teachers of the teaching team to participate in the disciplinary and professional construction projects, key teaching and research and scientific research projects, on-the-job training in enterprises, and domestic and overseas study visits and exchanges, so that the excellent teachers' role of demonstrating leadership and innovation can be promoted and the overall level of the team can be improved.

3   Conclusions

After several years of construction, this team has now formed a reasonable knowledge structure, specialized and complementary advantages, deep integration of science, education and industry, and obvious advantages in the level of teachers. The practical ability of professional students has been greatly improved, and the level and number of awards won in professional competitions, the overall rate of advancement and employment rate have increased year by year.

At present, the main problem is that the technology is updated relatively quickly, the professional requirements of the team are very high, it is difficult to dock the demand of enterprises in time, there is a certain lag, and it is necessary to make continuous investment in faculty training. In view of the above problems, in the future team building, it is proposed to increase the docking with enterprises, focus on the core technology, and enhance the competitiveness of the profession.

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