Exploration and Practice of “3+3” IT Talent Training Mode

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Abstract. On the basis of in-depth study of 40 items of the "Opinions on Accelerating the Construction of High-level Undergraduate Education and Comprehensively Enhancing the Ability of Personnel Training" issued by the Ministry of Education, and in response to the new requirements of new technologies, new industries, new formats, and new models for talent training in the new era, this paper tries to build a student-centered "3+3" high-quality applied IT talent training mode, with adhering to the "student-centered" teaching concept, focusing on the construction of connotation, relying on "school-enterprise cooperation, integration of production and education". The School of Computer and Information Engineering carries out the practice and active reform and exploration in teaching theory and teaching methods. This mode has a good effect on practice and has certain reference value and reference for similar majors in applied undergraduate colleges.

Introduction

In recent years, with the advent of cloud computing, artificial intelligence, big data, Internet of Things, mobile Internet, etc., new technologies, new industries, new formats, and new models have challenged new talents in the new era[1]. The times require traditional engineering majors to transform into new engineering talents with strong practical ability, innovative spirit, entrepreneurial awareness and innovative entrepreneurship, and the ability of cross-disciplinary and cross-border integration. Faced with the call of the times and the historical opportunities of school development, the School of Computer and Information Engineering (SCIE) closely focused on the training objectives of "high-quality applied IT talents", relying on the college project of The National Level Makerspace and the school projects of The Strategic Emerging (pillar) Industry Talent Training Program of Hubei Provincial Higher Education and The Software Outsourcing Base of Hubei Province, actively explored and practiced the teaching reform and has achieved good results by building a student-centered project—the "3+3" high-quality applied IT talent training mode.

The Construction of “3+3” Talent Training Mode

“Cultivating people is the primary objective of education”, Adhering to the education and teaching philosophy of “taking students’ learning as the center”, “taking students’ development as the center” and “taking students’ ability as the center”, SCIE aims to cultivate high-qualified applied IT talents, and has broken the situation that traditional engineering education emphasizes much more on the transferring of theoretical knowledge than the application ability training.

The Basis for the Formation of the “3+3” Talent Training System

Targeting at the current situation that the application of undergraduate colleges and universities is out of line with the demand for talents, that the curriculum is set outdated, that the application of the curriculum is not strong, and the lack of dual-teachers[2], and that it is not compatible with the rapid development of the computer industry, SCIE has established a professional construction
steering committee and jointly develops a school-enterprise cooperation talent training program with professional leaders, corporate executives, industry experts, senior engineers, key teachers, and outstanding alumni as members. It actively explores the three-level mode of cooperation between the school and the enterprise, the school and the association, the school and the administration. Investigating the related majors of 8 colleges and universities such as Wuhan Wenhua College, 2 associations such as Wuhan Digital Creative and Game Industry Association and Wuhan Software Association, 2 government departments such as Hongshan District Recruitment Bureau and Kunshan Municipal People’s Bureau, etc, it is clear that we must adhere to “three aspects”, which are the market-oriented needs, position-oriented needs, and skills-oriented modules, implement and interface professional settings with local information industry, talent training objectives/specifications with enterprise industry standards, curriculum setting with enterprises’ demand for talent knowledge ability, teacher training with enterprise technology innovation, teaching process with enterprise project design and development management, academic certificate with professional qualification certificate. According to industry needs and job standards, the talent training program has been revised from the aspects of training objectives, curriculum design, teaching method reform, and professional position ability to optimize the talent training process.

The Connotation of “3+3” Talent Training Mode

The “3+3” talent training mode is based on the premise and goal of comprehensive development of morality, intelligence, art and work. It is guided by employment and changes the traditional “teacher-centered”, “classroom-centered” and “examination-centered” teaching theory in the past. We have established talent training mode for three centers of “taking students’ learning as the center”, “taking students’ development as the center” and “taking students’ ability as the center” to cultivate students’ “general professional competence”, “high-level innovation ability” and “career-oriented entrepreneurship”.

“Taking students’ learning as the center” means that teachers are encouraged to have a deep understanding of students, to stimulate students’ interest in learning, to use modern methods of intelligent classrooms to carry out teaching, and to improve students’ ability of independent learning, cooperative learning, and lifelong learning; “taking students’ ability as the center” means that cultivating students’ engineering practice ability, ability to analyze problems, ability to use professional knowledge to solve problems, and comprehensive ability of communication, expression, coordination, organization, etc.; “taking students’ development as the center” means that through series of lectures, academic reports and participation in the practices of corporate project, students can do the career planning, and determine the goals for life and development.

Relying on “C++ Language Programming”, “Mobile Development”, “Computer Assembly and Maintenance” and other courses, and opening up barriers between programming courses, students are cultivated with “general professional ability”; relying on “Chinese University Students Computer Design Competition”, “The Blue Bridge Cup of National Software and Information Technology Professionals Competition”, “National University Computer Application Ability Competition”, “National University Students Big Data Skills Competition” and other professional skills competitions, students are trained with “high-level innovation ability”; relying on “Yangchun Cup Entrepreneurship Competition”, “Jinqiu Cup Entrepreneurship Competition”, “Internet +Entrepreneurship Competition”, some extracurricular activities, and corporate projects, etc., with moving the project to the National Level Makerspace to incubate, students are cultivated with “career-oriented entrepreneurship”, achieving a leap from homework to work to goods and production.

The Course Group of “3+3” Talent Training Mode

According to the revised talent training program, the course group of “3+3” talent training mode is set up according to the needs of the post. Taking the key major--computer science and technology of our school--as an example, it achieves seamless integration between teaching process and job requirements.

1. General professional ability and high-level innovation ability

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The programming is divided into three directions and developed in parallel, paying attention to the versatility of programming.

Table 1. Professional Position Capability Matrix.

<table>
<thead>
<tr>
<th>No</th>
<th>Professional direction</th>
<th>Course group</th>
<th>Professional job skills</th>
<th>Subject competition and qualification certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Mobile development</td>
<td>1.Android/Java language programming 2. Software Engineering 3. Data structure 4. Operating system</td>
<td>Master a programming language, technology and mainstream development, debugging and testing tools, with capabilities of customization, design and management and maintenance of mobile Internet application on mobile operating system (android)</td>
<td>Qualification Certificate 1. Software Engineer 2. Computer Programming Engineer 3. Database Engineer</td>
</tr>
</tbody>
</table>

2. In the process of implementing the above-mentioned teaching, all the teachers and enterprise engineers in the school are taught together, and they are carried out in the form of project design, curriculum design, production internship, graduation design, etc., aiming at cultivating students’ ability to adapt to positions according to enterprise standards.

3. In the third semester and the fourth year, the Entrepreneurship College of our school has set up an entrepreneurial elite class to enroll students with entrepreneurial projects. The specific credits are calculated according to the time of school.
Table 2. Enterprise Training Standards.

<table>
<thead>
<tr>
<th>No</th>
<th>Abstract</th>
<th>Content</th>
<th>Knowledge, ability and quality training objectives</th>
<th>Implementation unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Job ability</td>
<td>Understand the operations and technology of the company, using the skills and methods of computer science and technology.</td>
<td>Software component application technology, application system development process</td>
<td>Wuhan Soft Emperor Information Technology Co., Ltd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wuhan Zhongruan Excellence Technology Co., Ltd.</td>
</tr>
<tr>
<td>2</td>
<td>Professional attitude</td>
<td>With the awareness and enthusiasm of serving others, obey the law and abide by the company’s rules and regulations and staff rules.</td>
<td>Programming skills, software development specifications and standards</td>
<td>Wuhan Dana Software Co., Ltd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shanghai Science and Technology Information Technology Co., Ltd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wuhan Branch</td>
</tr>
<tr>
<td></td>
<td>Unity and cooperation, interpersonal communication skills</td>
<td>Theories and methods related to the planning and management of product development projects, and the ability to organize, control, manage, and promote projects.</td>
<td>Unity and cooperation, interpersonal communication skills</td>
<td>Wuhan Shanghangyou Technology Co., Ltd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yunchuang Power (Wuhan) Co., Ltd.</td>
</tr>
</tbody>
</table>

Table 3. Career-oriented Entrepreneurship.

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Course Credits</th>
<th>Total Class Hours</th>
<th>Total Class Hours allocation</th>
<th>Nature</th>
<th>Teaching form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project consultation</td>
<td>1</td>
<td>16</td>
<td>8 8</td>
<td>Elective</td>
<td>Teaching + practice</td>
</tr>
<tr>
<td>Business negotiation</td>
<td>0.5</td>
<td>8</td>
<td>4 4</td>
<td>Elective</td>
<td>Teaching + practice</td>
</tr>
<tr>
<td>Business salon</td>
<td>0.5</td>
<td>8</td>
<td>8</td>
<td>Compulsory</td>
<td>Practice</td>
</tr>
<tr>
<td>On-campus entrepreneurial experience project Management and management</td>
<td>2-4</td>
<td>2-4 week</td>
<td>2-4 week</td>
<td>Compulsory</td>
<td>Practice</td>
</tr>
<tr>
<td>Courses in entrepreneurship offered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile development</td>
<td>4</td>
<td>64</td>
<td>32 32</td>
<td>Elective</td>
<td>Teaching + practice</td>
</tr>
<tr>
<td>Big data technology</td>
<td>4</td>
<td>64</td>
<td>48 16</td>
<td>Elective</td>
<td>Teaching + practice</td>
</tr>
</tbody>
</table>

The Realization Path of "3+3" Talent Training Mode

Pushing the Reform of “Student-centered” Teaching Methods

Relying on the wisdom classroom to implement "Internet + education", "smart + education", 643
SCIE effectively uses information technology to promote curriculum reform, actively promotes the combination of online and offline blended teaching, flipped classroom, and explores "student-centered, teacher-led" cooperative learning, self-learning teaching methods with CDIO, PBL, case studies, seminars, etc., and builds a networked teaching platform with combining micro-video, MOOC thinking and other modern educational methods, and carries out teaching reform by adopting case teaching method, game teaching method, contrast teaching method, analog teaching method, and using advanced teaching methods such as inquiry, discussion and situation combination. For example, when teaching “Software Engineering” course, the teacher adopts “Flipping Classroom + Blended teaching” to teach, and when teaching "Data Structure" course, the teacher adopts "Internet + Case Teaching" teaching method. Both courses are relied on the newly built wisdom classroom. The method of classroom teaching should be chosen based on the curriculum. Teachers actively guide students to do self-management, active learning, and stimulate students’ desire for knowledge, improve their learning efficiency, and enhance their self-learning ability.

SCIE also strengthens the practice teaching process, paying attention to the cultivation of students’ innovative spirit and teamwork ability, and effectively improves students’ practical ability to adapt to diversified market demands, thus ensuring students’ employment advantage.

Innovating “Student-centered” Talent Training Evaluation System
Combining in-class and extra-curricular teaching, paying equal attention to both theoretical teaching and practical teaching, and integrating internal and external resources at multiple levels and in multiple dimensions, SCIE builds an advanced high-quality applied talent training process which means students in the first year do the professional cognitive learning, students in the second year do the professional practice learning, students in the third year participate in enterprise project implementation, students of the fourth grade do the enterprise internship.

SCIE establishes a diversified evaluation system, and achieves full coverage of the practical program-oriented courses. The process evaluation is divided into the overall evaluation of the group, the individual evaluation of the students, the evaluation of the group leader, the self-evaluation of the students, and the evaluation of the completion of the project. It is necessary to complete the code writing, the project results display, the core link and the video recording of the test link, as well as the overall concept planning and implementation of the project. We also reform the curriculum examination method, increasing the forms of course papers, curriculum design or social practice, and assessing the students’ ability of applying the knowledge they have learned to practice, so that students can understand the close relationship between profession and society.

We vigorously promote the evaluation methods of “teacher's main evaluation, student self-evaluation, peer-to-peer evaluation, and enterprise participation”. 20% of the professional optional courses adopt the Quartet evaluation method, paying attention to the assessment of students’ knowledge, ability and quality, and promoting the transformation of talent cultivation from “teaching well” to “learning well”.

We reform the teaching evaluation system by adopting the teaching evaluation system of “both incentives and constraints, skills and skills are equally important”, establishing and improving the system of teachers and students’ symposiums, discovering teaching problems timely, summarizing teaching experience, studying improvement suggestions and solutions, rectifying within a time limit, and encouraging and guiding all teachers to improve teaching quality. At the same time, we perfect daily monitoring of teaching, cover the whole process of teaching with monitoring points, forming a management loop with inspections, and feedback. There are procedures for the review of teaching documents, supervision of the implementation of the teaching process, and assessment of the results.

Training Students’ Innovative Ability with Close Combination of Professional
In the cultivation of applied talents, SCIE has always grasped the core concept of “capability-based” education, and highlighted the students’ learning ability, application ability and innovation and entrepreneurship ability.
Through a series of initiatives, our school has strengthened its professional construction. In order to better develop students’ practical ability and innovative entrepreneurial ability, we have launched a series of innovative experimental courses. For example, “Sensor Principles and Applications”, “Mobile Development”, “Online Shop Operations and Management”, “Online Shop Decoration”, “Networking Technology” and other courses, directly link the coursework to the entrepreneurship project. The AIDS prevention platform developed by the students is currently earning 100,000 credits, and the VR Home Improvement project has an annual income of 300,000.

**Improve the Service Ability of Serving Local Enterprises**

Through teaching reform, our school combines entrepreneurship and professionalism to implement “three integration”—integrating the entrepreneurship education into the classroom, using classroom teaching to explore a large number of students with innovative spirit; integrating innovative thinking into the profession, cultivating a large number of students who have obtained patent authorization; integrating entrepreneurship into practice, and integrating the “entrepreneurship +” into the talent training. The process has formed a feature of the combination of professional construction and innovation and entrepreneurship, and has achieved remarkable results.

Through teaching reform, our school has strengthened the process management in the classroom teaching, course assessment, training internship and other links, and has strengthened the hands-on ability, so that students have improved their basic skills such as computer hardware maintenance, data application and programming.

**Improving the Teacher’s “Double-type” Ability**

This year, our school explored issues on the deep integration of production and education such as supply and demand docking, resource transformation and benefit sharing. In the process of school-administration-enterprise cooperation, a mechanism for the exchange and mutual development of bilateral talents between colleges and enterprises was formulated. We arrange teachers to practice in the enterprise participating in scientific research and product development to enhance their professional skills and ability of guiding students, thus improving “double-type” quality of professional teachers. At the same time, enterprise engineering and technical personnel and management personnel are transformed into the teaching resources of the college.

This year, a large number of excellent teachers went to Huawei ICT Academy and “Qianfeng Internet Technology” to participate in training in technology and equipment, and obtained the skills certificate of big data assistant engineer, cloud service computing assistant engineer, and IoT assistant engineer by Huawei, and 12 certificates of honor and honorary titles. At the same time, more than 30 software company executives and senior engineers were hired as industry lecturers to teach students big data technology, cloud computing, artificial intelligence and other courses. Through mutual recruitment and other means of integration of production and education, we firstly solve the problem of the shortage of teachers, and secondly enable teachers and students to gain more practical knowledge and ability.

**The Reform Effect of "3+3" Talent Training Mode**

**Students’ Professional Skills Being Improved**

Through the teaching reform, SCIE has strengthened the process management in the classroom teaching, course assessment, training and internships, and strengthened the hands-on ability, so that students have improved their basic skills such as computer hardware maintenance, data application and programming. In the past year, students have won 32 awards in the “China Software Design Competition”, “Blue Bridge Cup National Software and Information Technology Professionals Competition”, “National University Students Big Data Skills Competition” and other professional skills competitions, including 5 national competitions, 4 provincial competitions, and 23 municipal competitions.
Students’ Innovative and Entrepreneurial Practice Ability Being Enhanced

Through teaching reform, our school combines entrepreneurship and professionalism, and implements “three integration”—integrating the entrepreneurship education into the classroom, using classroom teaching to explore a large number of students with innovative spirit; integrating innovative thinking into the profession, cultivating a large number of students who have obtained patent authorization; integrating entrepreneurship into practice, and integrating the “entrepreneurship +” into the talent training. The process has formed a feature of the combination of professional construction and innovation and entrepreneurship, and has achieved remarkable results. More than 20 physical projects have been hatched, especially in this year's Jinqiu Cup Innovation and Entrepreneurship Competition. Our School has won the historical achievements of one gold, one silver and two bronzes.

The Ability of Teachers to Teach and Research Being Significantly Improved

Through teaching reform, the enthusiasm and initiative of teachers to participate in teaching and research have been improved. In the past year, our teachers have won the third prize of provincial teaching achievements, and have been approved by the Ministry of Education for 2 projects, 2 school-level key courses, 2 school-level teaching and research projects, and have applied for 1 teaching reform fund project of the Ministry of Education. The new major “Big Data Management and Application” published 2 textbooks with the school-enterprise cooperation; In the school-level wonderful lesson contest we won the third prize. In the school-level young teacher's teaching competition, we won the third prize. We have published 2 EI papers, 4 journal articles, 3 utility model patents, and two utility model patents were declared.

Conclusion

Realizing the connotative development of higher education is not a one-step thing. It requires the education workers to take the initiative, overcome difficulties, continue to struggle, and work hard for a long time. Follow-up, we will work together to continue the teaching reform and focus on strengthening professional construction and curriculum construction, construction of faculty, base construction and construction of production, education and research. We will form a company-based, professional multi-directional parallel training mode, further strengthen the “student-centered” teaching concept, further highlight the “capability-based” training concept, strengthen the pertinence and practicality of teaching, and achieve seamless integration of talent training and regional economic needs, and make efforts to contribute to the steady improvement of the quality of personnel training.

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Teaching and research project of wuhan municipal colleges and universities: Research on innovative teaching mode of application-oriented undergraduate program design course (No. 2014218)
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