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Research on the Innovation of Practice Teaching System in the Context of Industry-Education Integration

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Abstract: Practical teaching is a mode of intensive training with hands-on practical training as the basic means, which plays an important leading role in engineering education in higher schools. Practical teaching in the context of industry-education integration increases the full consideration of the actual needs of the industry and is a new type of training means to improve the competitiveness of students, oriented to the actual needs of society as the goal. This paper analyzes the problems encountered in the process of carrying out comprehensive practice courses for students in higher education institutions and explores the new path of industry-teaching integration in higher education from the starting point of students, employers, and schools to provide some new ideas and inspiration for building a high-quality and applied engineering talent cultivation system.

1. Introduction

Comprehensive practical teaching is a cooperative talent training mode oriented to the market and social needs and aimed at improving the strength of the school's professional operation and education quality and is an important initiative of the industry-teaching integration system in the context of the new engineering discipline [1]. At the school level, comprehensive practice teaching integrates social practice, internship training, and the second classroom, promotes collaborative education through the integration of industry and education, and guarantees the realization of the "three verticals and three integrations" education model in higher education institutions. At the student level, under the mechanism of "school-enterprise cooperation", students can integrate what they have learned and carry out technological innovation through the cultivation mode of industry-academia-research integration, which is conducive to the cultivation of complex and application-oriented talents with an innovative spirit, and truly achieves the goal of "people fit for their jobs" [2]. At the enterprise level, students in the process of comprehensive internship cultivate the ability, skills, and psychological attributes needed to complete the task, and truly achieve the "human-job match".

The General Office of the State Council of China on deepening the integration of industry and education pointed out that higher education should “guide colleges and universities to take the actual needs of enterprises on the front line of production as an important source of engineering and technology research topics”. However, at present, the professional skills of practical teaching instructors, the interests of students, and the needs of enterprises are not organically combined. This makes the instructors whose majors do not match the engineering background of the enterprises unable to effectively guide the students in the internship process, the students whose interests and majors do not match their own cannot get effective training, and the enterprises whose needs do not match the actual needs of the enterprises are unable to get the excellent talent reserve [3].

At present, the traditional comprehensive practice teaching mode is based on instructor counseling, and students complete the practice tasks independently. The participation of the instructor in the process of practice is low, and the communication and interaction links are few, so students are easily confused in the process of practice, lose interest and motivation to learn in practice, and it is difficult to achieve the desired effect of practice [4]. Therefore, how to change the concept of guidance, stimulate the motivation of students to learn independently, and change “passive learning” into “active learning” is a problem that needs attention. Comprehensive practice is closely integrated with engineering practice, and the guidance of teachers alone cannot help students solve the problems encountered in practice, which reduces the enthusiasm and participation of students in practice [5].

At this stage, the evaluation method of comprehensive practice mainly consists of three parts: logbook, report, and appraisal form, and the instructor evaluates each of the three parts separately, and finally gives a comprehensive assessment score. The problems are: firstly, the logbook and report lack accurate records and objective evaluation of students' practice effectiveness in content design; secondly, the logbook and report are only provided by the students unilaterally and are not effectively examined by the instructors, so there is no way to consider the authenticity of the content; finally, the report mode is relatively single, and is not adapted to the characteristics of the practice program itself [6]. To sum up, this paper carries out the research on the innovation path of practice teaching systems under the background of industry-education integration, analyzes the challenges faced by comprehensive practice, and gives feasible solutions.

2. Difficulties and challenges in integrated practice teaching

2.1. Resource and policy constraints

In undergraduate institutions, the lack of practical teaching resources is one of the major dilemmas facing student practice, where resources mainly include laboratory facilities, technical equipment, specialized software, and tools. On the one hand, laboratory facilities may be obsolete and lack applicability to new technologies. On the other hand, the number of equipment is small and insufficient to support students' practicing activities. In addition, certain specialized software and tools may be costly and difficult to obtain directly. This lack of resources affects students' ability to explore and innovate in practice and limits the development of practical skills.

School policies and institutional constraints are another major dilemma facing integrated practice. School policies and systems involve many aspects, including the project approval process and resource allocation mechanism. In some endeavors, school policies and systems are too cumbersome and the approval process is complicated, which leads to obstacles in the initiation and implementation of projects. Insufficient or unreasonable resource allocation is also a problem in the school system, and it leads to practice activities not being fully supported and guaranteed. In the face of the lack of resources and the constraints of school policies and systems, appropriate measures need to be taken to address these problems. These include increasing investment,

upgrading the level of laboratory facilities and technical equipment, streamlining the approval process, and optimizing the resource allocation mechanism.

2.2. Teacher experience and practical program management difficulties

Teachers' lack of hands-on experience is one of the challenges facing integrated practical courses. Teachers may have profound attainments in subject knowledge, but their lack of hands-on skills may affect their guidance and teaching quality in practical courses. In integrated practice courses, students need to acquire practical skills, solve real-world problems participate in practical projects, etc. This requires teachers to have rich practical experience to guide and support students. For example, some teachers may lack knowledge of the latest development trends and technical requirements of the industry and are unable to guide students to choose suitable practical projects or master practical skills promptly. In addition, teachers who lack practical experience may not be able to effectively guide students to solve problems encountered in practice or give timely practical guidance and advice to students, which may make it difficult for students to cope with difficulties encountered in the process of practice.

Practical project management difficulties also exist in integrated practical courses. Practical project management involves issues such as project schedule control, task allocation, and teamwork. In comprehensive practice courses, students need to participate in a variety of practice projects, which often involve multiple links and multiple participants and require effective management and coordination. If the project progress is not controlled in a timely and precise enough manner, it will lead to the project being delayed or not completed on time. If the task allocation is not reasonable, it will lead to some students being overburdened or part of the task being left unattended. Further, if there is miscommunication and disharmony in teamwork, it will directly affect the smooth progress of the project.

In the face of the above problems, undergraduate institutions can strengthen the training of teachers to improve their practical ability and guidance level. In addition, it is necessary to establish a sound practical project management mechanism, including clear project objectives and task allocation, effective project progress control, and teamwork.

2.3. Lack of independent learning skills among students

There is a wide variation in the ability levels of students, for example, some students may already have some practical experience and skills and may specialize in certain areas, while others may have no relevant experience at all or even lack basic practical skills. This difference in ability can lead to frustration for some students and also increase the difficulty for teachers in the course design and teaching process. For example, for some students with practical experience, the course design may be too simple to meet their needs and challenge their abilities, while for students who lack practical experience, the course may be too complex to cope with. Such differences may also affect teamwork among students, as some students may need to take on more responsibilities and tasks, while others may not be able to keep up with the team, leading to inefficient teamwork and affecting the progress and outcomes of the practicum program.

Autonomous learning ability refers to the ability of students to take the initiative to learn consciously, to think and solve problems independently, and to have the ability of self-management and self-regulation. In the integrated practice course, students need to constantly engage in independent learning and exploration, and they need to have a certain degree of independent learning ability to complete practical projects and tasks. However, some students have long been accustomed to passive acceptance of teaching and lack the sense of active exploration and practice. This will lead to poor performance of students in the process of practice, unable to give full play to

their potential, and affecting the cultivation of practical ability.

In the face of the above problems, teachers can carry out individualized instruction and tutoring according to the different ability levels and learning needs of students through differentiated teaching, to meet the learning needs of different students. They can also help students to improve their independent learning ability and practical ability by carrying out learning ability training and practical ability training, and cultivating students' awareness and ability of independent learning.

2.4. Lack of interdisciplinary collaboration in the program and linkages to industry

Integrated practice courses require students to acquire knowledge and skills in a wide range of disciplines and to be able to engage in interdisciplinary cooperation and communication. However, due to the influence of factors such as a clear division of disciplines and a high degree of specialization, students are unable to effectively carry out interdisciplinary cooperation, which limits the depth and breadth of practical activities. Most institutions of higher education also have the problem of insufficient contact with the industry and are unable to keep abreast of the latest development trends and needs of the industry, and are unable to provide students with industry-related practical resources, which leads to insufficient understanding and awareness of the practical activities, and the inability of students to truly apply the knowledge they have learned to their practical work. At the same time, the lack of connection with the industry may also affect the student's ability to develop their careers, making it impossible for them to find employment or adapt to changes in the development of the industry after graduation.

Higher education institutions need to establish an interdisciplinary cooperation mechanism to promote exchanges and cooperation among different disciplines, break down disciplinary barriers, and promote the interdisciplinary development of comprehensive practice courses. They can also strengthen cooperation and communication with the industry, establish a platform for school-enterprise cooperation, provide industry practice opportunities and resource support, and provide students with industry-related practical experience and career development guidance. On the one hand, institutions of higher education need to establish a long-term contact mechanism with enterprises to ensure that they can get more support from enterprises. On the other hand, institutions of higher education should actively link with the actual needs of local governments and seek common development with local governments.

3. Innovative Path of Comprehensive Practice Teaching in Higher Education

3.1. A new instructional model aiming to enhance students' motivation and participation

Utilizing autonomous, interactive, exploratory, and motivational guidance methods to enhance teachers' guidance level and students' enthusiasm for learning. Case teaching can improve students' ability to analyze and solve problems. Project teaching can implement the internship environment that combines competition and cooperation, teaching and practical training. Experimental platform teaching can exercise students' practical hands-on ability. Informatization platform practice teaching can help students find the "professional role" and form a seamless link with the needs of enterprises. Through multimedia and other means, the efficiency of guidance is improved. The above methods get rid of the drawbacks of the traditional single guidance mode, integrate and optimize the practice resources, and form a new information-based practice guidance concept that is effective, reasonable, open, and shared. Figure 1 gives the framework of this guidance model.

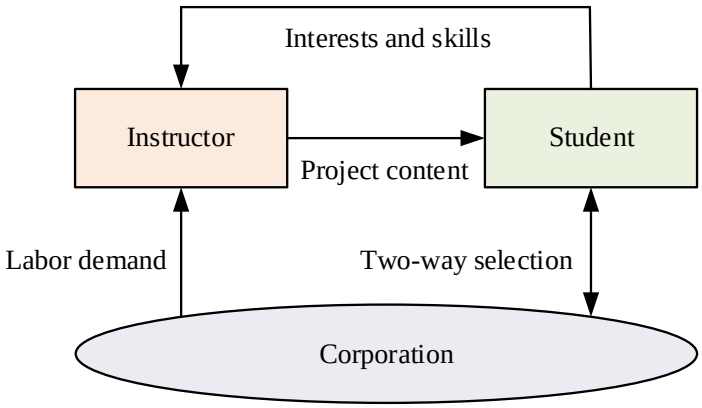

Figure 1: Informatization practice teaching architecture

3.2. Accurate assessment mechanisms to recognize student performance

We need to pay full attention to the process evaluation and refine the process evaluation. This model focuses on quantifying students' performance in the internship process and developing report contents and templates for different types of projects that meet the characteristics of the project and accurately record the effectiveness of the internship. The new model can avoid the situation where students do not understand, are not clear about, and have no way to start the project tasks, break down the project tasks, guide students to develop their thinking, and increase their interest. For different practice tasks, the template is appropriately modified to make it more in line with the actual situation; for special cases, flexible and variable assessment indicators are set to achieve real, effective, and multi-dimensional assessment, and in this way, reverse motivation of students' practice is stimulated. The assessment content includes daily sign-in, weekly records, project reports, achievement appraisals, and so on. Table 1 gives an example of the composition of practice assessment.

Table 1: Example of integrated practice scenario creation for IT companies

Item	Assessment	Percentage	Description
Check-ins Participation	Percentage system, no practical grade for more than 3 absences or more than 6 poor classroom performances.	10%	Examining the seriousness of students' participation in practical projects.
Weekly Log	Four levels of scoring, categorized as excellent, good, moderate, and passing.	20%	Examining the effectiveness of students' learning in stages.
Competency Assessment	Percentage system, comprehensive evaluation of students' hands-on skills, with points awarded according to the practicing process.	10%	Examining the overall performance of students in all stages of the practical tasks.
Creative Thinking	Four levels of scoring, categorized as excellent, good, moderate, and passing.	10%	Examination of students' ability to raise questions and solve problems in practice.
Project Reports	Four levels of scoring, categorized as excellent, good, moderate, and passing.	50%	Examination of students' final practical results.

3.3. Three-way selection mechanism by instructors, students, and employers

At present, students' graduation choices show personalized and diversified trends, some students choose to go to graduate school for further study, some students choose to try the current popular fields, and some students are not interested in their majors but do not have their ideas, and a single centralized mode of practice can not meet the diversified needs of students.

To carry out the centralized and self-selected two forms of practice, students can apply for exemption from practice at a certain stage, which does not delay the acquisition of credits and can ensure that the examination review time is sufficient. Students who want to engage in other fields in the future, can apply for self-selected practice and choose the type of practice they are interested in. For students who want to engage in this field and do not have an internship unit, as well as students who have no idea about the future and are confused, the school provides centralized practical training places and assigns professional teachers to provide career counseling and planning to help students gradually clarify their plans.

For students, they can independently choose the direction of practice and instructors, so that their interests match the professional backgrounds of employers and instructors, realizing the unity of interests and professional backgrounds. In the stage of instructor allocation, qualified professional teachers or enterprise instructors are screened, so that the professional background of instructors is in line with the job requirements of employers, the training, hiring, and assessment standards of instructors are standardized, and the instructors provide students with practical suggestions that are in line with their interests and professional backgrounds; in the stage of practical training, the content of the practical training is in line with the interests of students, so that the students are given more space to choose, and finally a benign closed loop is formed. A benign closed loop is formed.

4. Conclusions

This paper analyzes and summarizes the practical problems encountered in the implementation of comprehensive practical teaching in institutions of higher education, and proposes an innovative path for the practical teaching system of industry-teaching integration from the three perspectives of colleges and universities, students, and employers. The study provides new ideas and new parenting modes for higher education institutions to cultivate high-quality applied talents. It is undeniable that the research on industry-teaching integration based on comprehensive practical teaching will certainly inject new impetus into the construction of new engineering disciplines and will put forward new initiatives to further deepen teaching reform and improve the quality of talent cultivation.

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