Application of handlungsorientierung teaching in IOT technology course

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ABSTRACT

Shandong University of Technology is one of first ten pilots of application-oriented universities in "A Plan for Educating and Training Outstanding Engineers". Universities have introduced policies to deepen the reform of course construction, teaching method and mode in pilots to guarantee the smooth process of this project. Improving teaching effect with handlungsorientierung teaching method was analyzed under the example of IOT (Internet of Things) teaching in this work. Handlungsorientierung theory, specific teaching method and current application situation, as well as its teaching process and effect on IOT, were discussed.

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KEYWORDS

Handlungsorientierung;
IOT technology course;
PETOE.

INTRODUCTION

A Plan for Educating and Training Outstanding Engineers (PETOE for short) is the strategy of implementing new industrialization path and construction of innovation-oriented and rich human resources nation proposed in the 17th CPC National Congress. Besides, it is a vital plan to implement National Medium and Long-term Education Reform and Development Plan (2010-2020). This plan aims to construct cultivation mode of innovative talents and new system of university-enterprise cultivation of practical talents, transforming enterprises from employers into joint-supervisions. Therefore, universities and enterprises can make training objective and plan together. Moreover, they can cultivate innovative and practical talents who can meet requirement of so-cial development through joint training[1-2].

On June, 25th, 2010, Ministry of Education published first ten pilot universities of "A Plan for Educating and Training Outstanding Engineers" (hereinafter, PETOE), which included Shandong University of Technology. To guarantee the smooth implementation of PETOE, Shandong University of Technology introduced Opinions about Implementing Excellent Engineer Education Training Project in Shandong University of Technology. The university has done following works to guarantee the work in different pilots. Firstly, engineering education specialized congress in Shandong University of Technology, led by principal Zhang Xinyi, was set up to approve and organize the cultivation criterion, plan and relevant measures of PETOE. Secondly, excellent engineering education training groups in pilot

colleges, led by relevant deans, should be formed to formulate and implement their own cultivation criterion, plan and teaching practice of pilot majors. Thirdly, construction team of different pilot majors, led by relevant department chairmen, should be formed to take charge of core curriculum construction and reform of teaching method, mode and content in pilot majors. Fourthly, university and enterprise cooperative group of PETOE ought to consist of vice-president, heads of pilot majors, heads of cooperative enterprises and senior engineers of relevant enterprises. The group should be in charge of implementing specific engineering practice and coordinating engineering practice teaching links of relevant enterprises. In addition, Shandong University of Technology has done abundant works in student selection and construction of double tutorial system.

School of Computer Science & Technology is one of four pilot majors of PETOE in Shandong University of Technology due to its cooperation and exploration work with Neusoft since 2007. To further close the gap between school knowledge and social requirements, measurement direction of computer science and technology major has been transformed into embedded system direction. Therefore, student's practical ability can be improved to adjust to work as soon as they graduate. Besides, courses are adjusted and upgraded, adding courses like Embedded System Theory, Embedded Operating System Design, Embedded Application Software Development and IOT Technology and Application.

SIGNIFICENCE OF HANDLUNGSORIENTIERUNG THEORY

Handlungsorientierung, also called as action-oriented or practice-oriented, is a popular teaching theory in world professional education theory after the 1980s. This teaching method is accepted and praised by experts in world professional education and labor, because it can efficiently cultivate people's comprehensive quality and ability[3].

In handlungsorientierung theory, people can constantly feedback, correct deviation and perfect in achieving expected goal due to their subjective initiative, self-responsibility, summarizing and perfect-ing ability[4]. In addition, according to this theory, study aims to perfect and enlarge individual's action mode and help them get relevant professional and action ability. In handlungsorientierung theory, basic cognition progress is combined with professional action while student's individual study is combined with outside requirement. With the expansion of student's action space, their action ability is enhanced, thus improving their innovation consciousness and problem solving ability[5].

There are several teaching methods developing followed by handlungsorientierung theory. Firstly, case study method means teachers providing cases for students to analyze and research, helping students get experience and knowledge. Secondly, project teaching, representative of handlungsorientierung theory, includes project creativity design, solving plan research, action progress confirmation and specific implementation. Thirdly, simulation, means students studying in a virtual environment as if they were personally on the scene. In addition, there are means like role playing and acting of which the teaching organization form can change flexibly according to the nature of study task[6]. Currently, many teaching methods following handlungsorientierung theory are transformed into basic education and regular higher education in China[7-11], which achieves great effect.

PETOE, oriented by professional practice, emphasizes on practice and application while handlungsorientierung teaching regards student's practice as subjects. Therefore, students are active participators in activities while teachers are consultants and instructors as well as knowledge initiators. Teachers transformed message teaching into method teaching, making student's activity the primary of teaching. In this way, students can not only learn indirect experience concluded by predecessors, but also get direct experience in their own practice[9].

Currently, Shandong University of Technology has pursed fund efforts on PETOE to further develop the reform of curriculum construction, teaching method and mode in pilots. Meanwhile, teacher training and research project are strongly supported. Therefore, handlungsorientierung teaching method is applied to courses like Principle and Application of Microcomputer and IOT Technology. In following

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work, IOT Technology course is analyzed as an example to explain the application of handlungsorientierung teaching in practical teaching.

INSTRUCTING IOT TECHNOLOGY TEACHING WITH HANDLUNGSORIENTIERUNG THEORY

IOT is the third development wave of information technology industry after computer and internet. According to protocol, it uses sensing equipments like RFID, sensor and GPS to achieve the connection between people, things as well as people and things at anytime and anywhere. Therefore, information exchange and communication can be processed to realize the network system with intelligent identification, location, track, monitor and management[12]. Generally, there are three important features of IOT: instrumented, interconnected and intelligent. Instrumented feature means using QR code, sensor and RFID which can get object's real-time correlation parameters anywhere. Interconnected feature means transferring object's message timely and correctly through integration of telecommunication network and internet. Intelligent feature means analyzing data with advanced computer method and technology like cloud computing and fuzzy recognition to realize the intelligent control of objects. Current IOT architecture in industry is shown in Figure 1.

Currently, the booming IOT is faced with many scarce development opportunities. Therefore, IOT curriculum emerges at the proper time. Besides, IOT Technology is a compulsory course in IOT direction of computer science and technology major. This course, in which the principle line is application technology, mainly introduces IOT architecture and key technology (RFID, WSN, location technique, embedded technique, wireless network, etc). Moreover, it can master and use key technology and application means of IOT to design IOT application system through case study and course experiment.

According to training program, IOT Technology includes forty credit hours. To guarantee the smooth course process, IOT Embedded Teaching and Research Platform II of Bejing Universal Pioneering Company has been bought with embedded IOT comprehensive innovation laboratory. The laboratory is open to students to provide a nice practice environment. The teaching content of IOT Technology should be designed under the principle of "form easy to difficult" and "from simple to profound", following handlungsorientierung theory. The course is divided into eight teaching tasks[13-15], including three presentation tasks (two credit hours per task), two case teaching (five credit hours per task: two for analysis, two credit hours for analysis and one for comment), and three project teaching (six credit hours per task: one for lecturing and task assigning, four for practice and one for comment). If students do not complete the task on time, they can make exchange and design in laboratory in spare time. Teachers should leave enough time for students to study on their own, and the self-study content should be decided before next task. The rest six credit hours consist of conclusion and flexible hour. TABLE 1 shows all the tasks of the course.

In demonstration teaching, teachers will show relevant experiment system for students to provide them with schematic circuit diagram and source code, guiding students to master relevant skills in spare time. In case study, teachers will give students the case in advance so that students can refer to necessary knowledge and come up with solutions after research, deepening the understanding of knowledge.
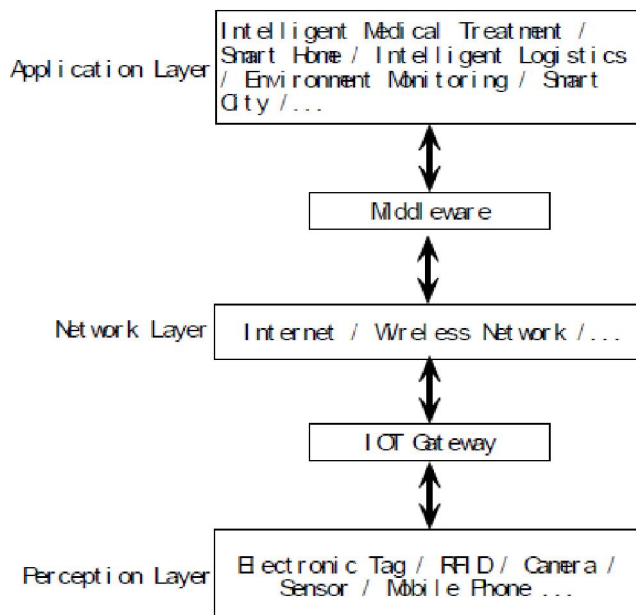

Figure 1 : Schematic of IOT architecture

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TABLE 1 : IOT technology teaching tasks

Task Number	Task Content	Teaching Technique
1	RFID Read-write System	Demonstration
2	USB Camera Data Acquisition	Demonstration
3	Sensor Data Acquisition	Demonstration
4	Zigbee Data Transmission	Case Study
5	Wireless Communication	Case Study
6	Simple Embedded Web Server	Project Teaching
7	Mobile Software Development	Project Teaching
8	IOT Comprehensive Application	Project Teaching

Moreover, teachers can complete the task together with students in teaching and help students to further master knowledge. In project teaching, students are encouraged to learn IOT application situation of their major and find problems and research emphasis. Therefore, they can use their skills to solve the problem or propose technology implementation means.

Students can master basic IOT skills and its application in a short term through the explanation and practice of above eight tasks under handlungsorientierung teaching. Moreover, students can study and practice with each other in spare time, thus they can complete tasks while master new skills, inspiring their study and research interest.

In addition, the assessment of this course has been reformed. In the assessment, the first seven tasks occupy 50% scores while the eighth task occupies 50%. Besides, the eighth task is the main criterion for the selection of students in Shandong/National College Students Embedded IOT Design Competition.

In Shandong area of 2014 "Universal Pioneering Cup" National College Students Embedded IOT Design Competition, Shandong University of Technology
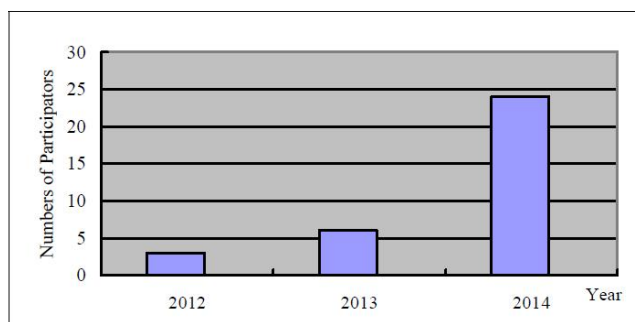

Figure 2 : Numbers of students in shandong university of technology participating in "universal pioneering cup" competition

get two first prizes and five second prizes, ranking front among universities in Shandong. In addition, advisors, students participated in Universal Pioneering Cup, and school of life sciences, Shandong University of Technology developed a laboratory instrument monitoring system based on the Internet of things. The system is composed of multiple data acquisition nodes and one coordinator node. The former acquire temperature, current, noise, vibration and other parameter and laboratory temperature, humidity, smoke and other parameter. The Latter collects all the data collected by the former and passes them to the network soft, which judge whether the instrument work normally through the analysis of the data above.

In conclusion, the effect of traditional teaching can only be confirmed by final test because traditional teaching method means teachers lecturing and students listening while students mainly learns theoretical knowledge. Handlungsorientierung-oriented teaching mode of IOT Technology can make students clear with learning tasks and inspire their learning interest to help them study and practice positively. Therefore, students can study and design the eighth task on the basis of completing the first seven to show their achievement. Besides, the interests in study can help student master course content in a short term, realizing better teaching effect.

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CONCLUSION

With the instruction and support of policies in Shandong University of Technology, handlungsorientierung teaching, funded by Foundation for Outstanding Young Scientists in Shandong Province, Elite School and Doctor Foundation in Shandong University of Technology, is preliminarily used in IOT Technology teaching of 2013-2014 academic years. It achieves quite a good effect while student's operation ability and design level are improved greatly. The number of students who took part in "Universal Pioneering Cup" National College Students Embedded IOT Design Competition is greatly larger than last year. The comparison of number of students in Shandong University of Technology taking part in this competition in 2012-2014 is shown in Figure 2.

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