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Sensor Principle and Application Course Ideological and Political Teaching Reform

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Abstract. "Sensor Principle and Application" is a compulsory professional course for Internet of Things engineering, electronic information engineering, intelligent perception and other majors. In view of the pain points existing in the teaching of this course, a series of innovative measures are put forward: integrating and updating the teaching content, adopting mixed teaching mode and innovative experimental methods, digging deeply into the curriculum ideology and politics, and building a multiple assessment and evaluation system, so as to comprehensively improve the learning effect of students and enhance their practical innovation ability and comprehensive quality. In order to promote the ideological and political teaching reform of the sensor Principle and application course, the research group combined the training requirements of engineering certification for students and the characteristics of application-oriented undergraduate students, with education moral education as the fundamental goal and task, to cultivate students' sense of innovation and feelings of home and country as the starting point, clear teaching objectives, use a variety of teaching methods, fully tap the integration point of moral education in the course, and optimize the assessment method. The ideological and political construction of professional courses will stimulate young students' confidence in the system, theory, road and culture to a greater extent, and train students to become application-oriented technical talents who love the Party, love the country and dare to innovate.

Keywords: Sensor principle and application, Internet of Things, electronic information engineering.

1. Introduction

As a professional course with strong application and practice, sensor plays an important role in cultivating students' practical ability, innovative thinking and improving their overall quality. Traditional teaching materials of sensor technology are based on theory, without experiment or practical guidance, and traditional teaching is also based on theory, supplemented by confirmatory experiments, without real practical teaching links, resulting in vocational education students can not really understand the principle of sensor [1-3]. At this stage, the teaching focuses on the practical application of the sensor principle explanation, combined with practical projects, signal acquisition, processing and error analysis, students can intuitively understand the sensor. With the rapid development of Internet of Things technology, wireless sensor network technology, intelligent technology and computer technology, the requirements for sensor knowledge have also changed. In the past, the basic principle of the sensor, equivalent circuit, measurement circuit design, error analysis and sensitivity analysis were explained, and optical fiber sensors, gas sensors, humidity sensors and ultrasonic sensors were not involved, and they cannot meet the requirements of intelligent, wireless and networking of current sensors. According to the applicability of the course, the teaching content of sensor will be adjusted and reformed [4-6].

Under the background of "new engineering" construction, combined with the school's school-running orientation of "insisting on local, application-oriented and open, and building a high-level urban university with distinctive characteristics", the teaching of this course focuses on application. Aiming at some pain points in course teaching, this course integrates various teaching modes, innovates experimental methods, digs deeply into curriculum ideology and politics, and builds a diversified assessment and evaluation system to be comprehensive Enhance the learning effect of students [7,8].

2. Teaching Method Reform

2.1. Sensor Traditional Teaching Method Reform

Traditional teaching usually adopts the teaching mode of teachers' teaching and students' learning. Students' enthusiasm is not high, which can not meet the needs of higher vocational personnel training. The sensor course is

multi-disciplinary, with a wide range of involved areas, knowledge collection, a large number of devices and loose content, involving mechanics, thermodynamics, optics, electricity, physics and chemistry related knowledge, in the case of students with a relatively poor foundation, teachers are required to adopt a flexible way to demonstrate the class. Through the combination of computer technology, multimedia technology, the use of micro-lessons, videos and other ways to enrich students' access to knowledge, the classroom adopts practical skills and other means to inspire more discussion, enrich class life, according to the characteristics of vocational students, teaching students according to their aptitude, so that students have more opportunities for independent learning. At the same time, it is necessary to use project-based teaching method to combine theory and practice to achieve deep integration of production and teaching [9-11].

Since the sensor course is a course of perceptual understanding, it is necessary to make full use of the convenience of the laboratory, such as multimeter, oscilloscope and other tools, and use the existing sensors in the laboratory to show different sensors and signal changes. The photoresistor is subject to constant changes in light irradiation resistance, and the field uses a multimeter to show the resistance changing with the light intensity, so that the application of the sensor principle is more intuitive. The thermistor is in different temperature fields, and uses a multimeter to show the change process of the resistance, which makes the class lively, encourages students to think, makes the esoteric theory easy to understand, and lays a solid theoretical foundation for the subsequent design experiment courses [12-15].

Project teaching, as the main direction of reform in recent years, transforms traditional knowledge into teaching projects and combines theory with practice. However, the integration of production and education in China is not deep enough, the basis of project-based teaching is engineering practice, and the practical conditions of schools are still not mature enough. Therefore, electronic building blocks are selected to achieve simple project teaching. For example, the use of resistance strain sensors and electronic building blocks to achieve weighing, the use of ultrasonic sensors and other electronic building blocks to achieve ultrasonic ranging, height measurement and liquid level depth, the use of smoke sensors and other electronic building blocks to achieve indoor air detection, the use of various photoelectric sensors to achieve photoelectric detection, the use of various temperature sensors for temperature detection, the use of soil moisture sensors and soil moisture sensors Other electronic building blocks realize automatic watering system, etc., fully tap the innovative potential of students, achieve the ideal teaching effect, and achieve the purpose of cultivating students' practical operation ability.

LabVIEW is a graphical programming language developed by NI company, which is the best programming language for virtual instruments. The front panel of LabVIEW visualization is a human-computer interaction interface, and the program block diagram contains a large number of function boards. Different controls are connected through the connection to achieve different functions1. In the sensor experiment, data acquisition instrument and LabVIEW graphical language were used to build a human-machine interface. Real-time display and processing of data collection can realize the detection of pressure, light, temperature, humidity, smoke and other parameters. Students can also build circuits independently through multi-functional innovative experiment modules, accurately exercise students' hands-on ability and innovative practical ability, and better understand the technical principle, data processing and display of sensors through practice [16-19].

2.2. Experimental Method Reform of Sensors

Experimental teaching is an important part of engineering courses, and sensors are no exception. Most of the sensor experimental equipment used in the sensor experiment teaching in undergraduate colleges and most junior colleges is a combination of experimental platforms or experimental boxes, without application scenarios, can not be combined with practical applications for further analysis. This type of device can only train students to make simple connections according to the experimental instructions and verify the principle of the sensor, but it cannot make them understand how the sensor obtains signals. This kind of experiment is not conducive to stimulating students' interest in learning, and is not conducive to cultivating students' practical application ability and innovation ability [20].

The verification experiment increases the interaction through the teacher's demonstration in class. Students can directly observe the demonstration process and draw conclusions, so that students can truly understand the sensor principle and stimulate their learning interest. For example, when talking about photoresistor, use a multimeter to measure the photoresistor resistance value of different light sources; When it comes to piezoelectric sensors, the pressure to charge transformation can be achieved by the ignition device of a lighter; When it comes to thermocouples, the hot end is burned at a high temperature with a lighter, and then the change process of the cold end voltage is measured [21-24].

3. Ideological and Political Teaching Practice of Sensor Principle and Application Course

This course is an important professional basic compulsory course, which can lay an important foundation for the following courses, such as the principle and application of single chip microcomputer, the principle and application of intelligent instrument, graduation design and students' postgraduate entrance examination. This course adopts the mixed teaching mode of "online, one-line and off-line". On the one hand, the application of information platform, the establishment of online classroom, a large number of course ideological and political content, resources, moral education materials uploaded to the online classroom, for students to view at any time, repeated learning. On the other hand, in the teaching process, the student-centered and problem-oriented, the teaching method of inspiration and summary is adopted, and the teaching process of "raising questions, thinking about problems and solving problems" is used to stimulate students' interest in learning and fully mobilize students' subjective initiative in learning. In view of the problems existing in the class in the past, such as low active classroom atmosphere, students' inattention, insufficient ideological and political content in the class, and relatively inexperienced addition of ideological and political education content, we need to carry out teaching reform from four aspects to improve teaching quality.

In the course preparation, teachers should take into account the preparation of teaching materials and students. Teachers should formulate a teaching plan acceptable to students, conduct in-depth research and analysis of the teaching content, focus on the design of teaching links, and integrate the course knowledge points with moral education cases to achieve the purpose of ideological and political education in the curriculum. In the teaching process, teachers should guide students to learn relevant scientific and technological literature, understand the cutting-edge technology of sensors from multiple angles, and fully mobilize the initiative and creativity of students [25-28]. Teachers should pay attention to cultivating students' academic integrity, truth-seeking and pragmatic spirit of scientific research; Cultivate students' ability to find and solve problems; Cultivate students' hard-working and persistent research spirit; Cultivate students' innovative thinking and innovative habits; While strengthening professional confidence, students' sense of social responsibility and feelings of home and country are cultivated. Teachers should follow the rules of the curriculum, focus on the curriculum construction goal of knowledge teaching, ability training and value shaping, and fully tap the moral education materials "integration points" related to socialist core values such as social responsibility, cultural confidence, professional confidence and family and country feelings. Through the use of various teaching materials, classroom interaction and after-class teaching effect evaluation, the moral education elements are fully integrated into the course teaching, and the correct values, ideals, beliefs and feelings of family and country are effectively transmitted to students in the way of "moisten things silently", which not only imparts knowledge, but also achieves the effect of cultivating morality and people, so that teaching and educating people are implemented into classroom teaching.

In the teaching process, if professional teachers only adopt a single, rigid and traditional preaching form to teach some major principles to college students, they can not achieve good teaching effect. When carrying out ideological and political education, it is necessary to fully tap the "integration point" of moral education materials related to socialist core values such as social responsibility, cultural confidence, professional confidence, family and country feelings, and fully integrate moral education elements into teaching through the use of various teaching materials.

When teaching the teaching content of "The working principle of strain sensor", the course is taught by asking questions: "Please combine the working principle of rheostat sensor learned above, and try to summarize the working principle and application of strain sensor according to the knowledge learned before class." Teachers first do not analyze and explain, let students preview the course knowledge, fully mobilize students' learning enthusiasm and subjective initiative, cultivate students' ability to find problems, and improve students' learning enthusiasm. When teachers teach the teaching focus of "The working principle of strain sensor" in the form of "raising questions, exploring questions, summarizing and concluding", they can combine students' answers and opinions expressed by students, introduce the various disciplines competitions and awards that students of this major have participated in in recent years, and combine teachers' own experience of leading students to participate in scientific research. Encourage students to be innovative and cultivate students' good scientific literacy of seeking truth, being pragmatic and thinking independently.

4. Innovative Ideas and Measures of Course Teaching

We adhere to the student-centered, problem-oriented and continuous improvement teaching philosophy, follow the new engineering teaching strategy of "learning, thinking, practicing and understanding", and adopt innovative measures such as updating and integrating teaching content, online and offline mixed teaching mode, innovative

experimental methods, in-depth exploration of curriculum ideology and politics, and construction of multiple assessment and evaluation systems, in order to solve the above pain points in teaching.

Integrate and update the teaching content, and continue to build the curriculum resources. The content of the course is sorted out and reconstructed, and new technologies are added. In the teaching process, teachers should pay attention to domestic scientific research trends in a timely manner, and introduce cutting-edge content in the field into the curriculum, such as integrating sleeveless blood pressure measurement methods, nanosensors and other technologies into the teaching of the ”New sensor” chapter. At the same time, pay attention to domestic hot issues, contact the sensor knowledge learned in the course, inspire students to think about the application of sensors, such as excessive rainfall caused by tunnel water, timely elimination of elevator buttons and other practical problems, let students think about the use of sensors to solve the above problems, in order to achieve the purpose of application [29,30].

In terms of course construction, nearly 40 key knowledge of ”Sensor Principle and Application” course are sorted out, and micro-class videos are recorded, guided learning plans are prepared (to clarify learning objectives and learning content), and online question banks are constructed. Students can complete the study of theoretical knowledge in an all-round way through video resources, after-class tests, discussions, examinations and other forms.

Adopt mixed teaching mode, use a variety of teaching methods, organize a variety of teaching activities, and enhance students' learning interest and curriculum participation. Through resources such as pre-class guidance plans, micro-class videos and pre-class homework preview, students can learn micro-class videos in advance, complete pre-class homework, summarize the problems they encounter, and walk into offline classroom learning with problems. In class, we pay attention to cultivating thinking and practical innovation ability, and adopt a variety of teaching methods to organize teaching activities, such as CBL, PBL, TBL, student-guided performance, heuristic, practice-based teaching methods, etc., to make students ”move”, improve their learning interest, actively participate in class, interact with teachers and students, and solve the problem of students' low participation and lack of learning interest. After class, students are asked to complete various forms of work (exercises and extended group reports) at different levels [31,32].

In terms of practical teaching, adhere to the ”application-oriented”, add comprehensive and designed experiments, and adopt the experimental method of ”virtual and real combination” to enhance students' practical innovation ability and post competence. Application-oriented, implement the ”multi-mixed” form of school-enterprise cooperation to educate people, put the relevant sensor technology cases in the enterprise on the ”wisdom tree” platform for students to learn, and increase comprehensive and designed experiments in combination with the actual cases of the company's sensor applications. Using the ”virtual-real combination” experimental method, sensor virtual software in the field of Internet of Things is used to simulate sensor applications in smart home, smart agriculture, intelligent transportation and other industries, and specific sensor application experiments are carried out in the Internet of Things application comprehensive laboratory. In addition, it can also be combined with teachers' scientific research, college students' innovation and entrepreneurship competition, discipline competition, etc., to add design experiment content to improve students' practical ability in an all-round way.

Dig deeply into the ideological and political cases of the course. Combining with the content and characteristics of the ”Sensor Principle and application” course, we dig deeply into the course thinking and politics, introduce ideological and political cases, and attach equal importance to the course education and ideological and political education. As an important sensor equipment in the Internet of things, sensors are the basis for the implementation of major national strategies in the direction of the industrial Internet and ”Internet +”, so the state pays attention to the localization of sensor products, which is of great significance for improving the level of science and technology in China and ensuring the national basic information security. Therefore, in the course of teaching, we should introduce the ideological and political content of the course, cultivate students' sense of mission and professional pride, and make students become responsible socialist builders.

A diversified assessment system has been established, and students' final scores are composed of online, offline and written scores. Among them, online scores accounted for 22%, offline classroom scores accounted for 18%, and final exam scores accounted for 60%. Adhering to the student-centered principle, it constructs a process assessment system based on knowledge goals, ability goals and value goals, takes the achievement of curriculum goals and students' graduation requirements as the main basis of assessment, and comprehensively evaluates students' ability to analyze and solve problems. Students are comprehensively assessed from online, offline and final exams respectively. At the same time, according to the implementation effect of the process assessment, the problems and shortcomings exposed by students in the learning process are summarized and improved in a timely manner, so as to continuously improve the teaching effect and help achieve the course objectives. Among them, online comprehensive evaluation mainly includes video learning progress, homework test, online discussion, communication, Posting and so on. The online platform records the students' behavior data in real time, sets the weights of each project activity, and automatically calculates and gives the results. Offline evaluation mainly

includes class attendance, discussion and communication, speech and experiment report, network program, and achievement display. Final exam results are closed-book written test results [33-35].

5. Conclusion

The practice has proved that the application of PDCA cycle has a good effect on improving the teaching quality and ideological and political teaching of the course. Teachers should continue to use this method in the future teaching process, find new problems in each cycle, and timely solve these problems in the next cycle, while recording in detail in the document. Practice has proved that every PDCA cycle, teachers' teaching level has been greatly improved, and schools, teachers and students can benefit from it, forming a virtuous cycle. The exploration of ideological and political teaching reform in this course has realized the organic integration of knowledge impartation and ideological and political education. Application-oriented colleges and universities insist on ideological and political education is the fundamental guarantee to train the socialist builders and successors with all-round development of morality, intelligence, physical fitness, the United States and labor, which meets the needs of application-oriented colleges and universities to serve the local economy.

6. Conflict of Interest

The authors declare that there are no conflict of interests, we do not have any possible conflicts of interest.

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References

1. Yu S, Zhu H, Hu K, et al. The Ideological and Political Reform and Practice of the Course" Sensitive Materials and Sensing Technology."[J]. Adult and Higher Education, 2022, 4(6).
2. Feng L, Wang X. The Teaching Reform of" Sensor Principle and Application" Course Based on OBE Education Concept[J]. IJLAI Transactions on Science and Engineering, 2024, 2(1): 1-7.
3. Yu J, Lu Z, Yin S, et al. News recommendation model based on encoder graph neural network and bat optimization in online social multimedia art education[J]. Computer Science and Information Systems, 2024, 21(3): 989-1012.
4. S. Yin, H. Li, Y. Sun, M. Ibrar, and L. Teng. Data Visualization Analysis Based on Explainable Artificial Intelligence: A Survey[J]. IJLAI Transactions on Science and Engineering, vol. 2, no. 2, pp. 13-20, 2024.
5. Zheng W, Wu L. Construction of Ideological and Political Education of Professional Curriculum under the Background of Chinese Modernization[C]//SHS Web of Conferences. EDP Sciences, 2024, 190: 01027.
6. Zheng Z, Zhang Z, Chen X, et al. Teaching Reform and Research of "Microcontroller Application Technology" Course Based on" Ideology and Politics leading and practice running through"[J]. Journal of Education and Educational Research, 2022, 1(2): 70-72.
7. Jin W. Information Fusion Technology-based Approach to Mining Civic Political Elements in College Curriculum[J]. Applied Mathematics and Nonlinear Sciences, 2024.
8. Yin S, Li H, Laghari A A, et al. An anomaly detection model based on deep auto-encoder and capsule graph convolution via sparrow search algorithm in 6G internet-of-everything[J]. IEEE Internet of Things Journal, 2024, 11(18): 29402-29411.
9. Yin S, Li H, Teng L, et al. Attribute-based multiparty searchable encryption model for privacy protection of text data[J]. Multimedia Tools and Applications, 2024, 83(15): 45881-45902.
10. Wang J, Gu S, Zhang S, et al. Teaching Reform in The Demonstration Professional Construction Site of "Curriculum Ideology and Politics"[J]. Journal of Education and Educational Research, 2023, 4(1): 111-113.
11. Song Z, Shao X, Chen H, et al. Reform of the Experimental Teaching Mode of the Course "Sensor and Detection Technology" Under the Background of Engineering Education[C]//Proceedings of the 4th International Conference on Education, Knowledge and Information Management, ICEKIM 2023, May 26C28, 2023, Nanjing, China. 2023.
12. Liu W. Channel Reorganization for Few-Shot Segmentation[J]. Journal of Artificial Intelligence Research, 2024, 1(1): 73-82.
13. Zhang M, Qin C, Qiang F. Leveraging Artificial Intelligence to Assess Physicians' Willingness to Share Electronic Medical Records in a Hierarchical Diagnostic Ecosystem[J]. Journal of Artificial Intelligence Research, 2024, 1(1): 55-72.
14. Wang Z, Wang Y. Digital Library Book Recommendation System Based on Tag Mining[J]. Journal of Artificial Intelligence Research, 2024, 1(1): 19-32.
15. Teng L, Wang J. A Novel Gesture Recognition Network based on LSTM[J]. Journal of Science and Engineering, 2024, 1(1): 1-6.
16. Li H, Zhao C. Fusion Cycle GAN: A Multiple Feature Fusion based Cycle-consistent Generative Adversarial Network for Person Re-Identification[J]. Journal of Science and Engineering, 2024, 1(1): 7-12.

17. Yin S, Laghari A A. Multi-branch Collaboration Based Person Re-identification[J]. Journal of Science and Engineering, 2024, 1(1): 19-24.
18. Ibrar M, Sun Y. SEIR Model Based Epidemic Transmission Risk Deep Prediction[J]. Journal of Science and Engineering, 2024, 1(1): 25-31.
19. Wang F. Exploration of Cultural Teaching Mechanisms of Ideology and Politics Courses under the Background of "Internet Plus"[J]. Applied Mathematics and Nonlinear Sciences, 2023.
20. Yang H. Exploration of Intelligent Teaching Means of Ideological and Political Education in Colleges and Universities Under the Background of "Mass Entrepreneurship"[J]. International Journal of Information and Communication Technology Education (IJICTE), 2024, 20(1): 1-17.
21. Li D. Research on an early warning model of effectiveness evaluation in ideological and political teaching based on big data[J]. Applied Mathematics and Nonlinear Sciences, 2023.
22. Cantoni D, Chen Y, Yang D Y, et al. Curriculum and ideology[J]. Journal of political economy, 2017, 125(2): 338-392.
23. Si Y. Optimization of the innovation path of practical teaching of college Civics based on VR technology under information fusion technology[J]. Applied Mathematics and Nonlinear Sciences, 2023.
24. Cai M. Research on teaching reform of C language course under the engineering education certification[J]. Open Journal of Social Sciences, 2022, 10(6): 120-126.
25. Shen Z, Huang J. Reform of Craftsmanship Spirit Cultivation Integrated in Automation Major Curriculums:–A Case of Automatic Detection Technology Curriculum[J]. Journal of Education and Educational Research, 2022, 1(3): 69-72.
26. Pan X, Li Y, Li J. Reform of the Major Project Experiment in Mechanical Engineering Measurement Technology for Cultivating Excellent Engineers[C]//2023 IEEE 12th International Conference on Engineering Education (ICEED). IEEE, 2023: 112-116.
27. Yang H. Research and Exploration on the Teaching Practice System in Application Oriented UniversitiesłCResearch and Exploration on the Teaching Reform of Circuit Principle Course of Jilin Agricultural Science and Technology College[C]//2021 4th International Conference on Information Systems and Computer Aided Education. 2021: 1176-1179.
28. Zhang L, Xia Y Q, Zhou G. Exploration and Practice of Ideological and Political Education: Taking Engineering Majors as an Example[C]//2024 5th International Conference on Mental Health, Education and Human Development (MHEHD 2024). Atlantis Press, 2024: 234-242.
29. Zhang L, Yu H, Xu T M. Simulation of interaction E-learning mode in political courses based on virtual reality and digital entertainment environment[J]. Entertainment Computing, 2025, 52: 100857.
30. Xu T, Bai F, Liu Y. Instructional Design of Electronic Information Courses Led by Subject Competition[C]//2024 13th International Conference on Educational and Information Technology (ICEIT). IEEE, 2024: 1-5.
31. Liu H. Research and Practice on Blended Teaching Model of "Sensing and Detection Technology"[C]//2020 39th Chinese Control Conference (CCC). IEEE, 2020: 7722-7726.
32. Xuehua L, Yongmei L. Research on online and offline mixed teaching modełTaking the teaching of single chip microcomputer course of Internet of things engineering as an example[C]//2021 2nd International Conference on Big Data and Informatization Education (ICBDIE). IEEE, 2021: 9-12.
33. Liu Y, Ni L. Research on Curriculum Civic Education and Innovation and Entrepreneurship Education Reform in Undergraduate Universities under the Web-based Teaching Collaboration Platform[J]. Applied Mathematics and Nonlinear Sciences, 2024.
34. Guo L, Wang Y. Real time voice system design for college political teaching based on virtual SDN network[J]. International Journal of System Assurance Engineering and Management, 2023: 1-11.
35. Jiang Y, Yin S. Heterogenous-view occluded expression data recognition based on cycle-consistent adversarial network and K-SVD dictionary learning under intelligent cooperative robot environment[J]. Computer Science and Information Systems, 2023, 20(4): 1869-1883.

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