Research on the Application of Intelligent Computer Equipment in Higher Vocational Physics Experiment Teaching

Miao Yan1,*

1Shangrao Preschool Education College, Jiangxi, China, 334000

*Corresponding author e-mail: yuyu111@srygz.edu.com

Abstract. With the rapid development of computer, intelligent computer equipment has been gradually applied to the field of teaching, which not only strengthens the authenticity of teaching, but also improves the students' interest in learning. At present, intelligent computer equipment management applied to higher vocational physics experiment teaching, which has begun to replace the traditional physical experimental instruments, such as simple pointer type, electromagnetic instrument. With the intelligent experimental teaching instruments, the teaching methods, teaching means and teaching quality of physical experiment in higher vocational colleges have been greatly improved. Through the introduction of intelligent experimental platform, higher vocational colleges have realized real-time measurement technology, which is based on computer, sensor and traditional instrument. Through the measurement, processing, storage and output of physical experiments, students can observe and learn physical phenomena more clearly, which also provides a practical and effective teaching environment for experimental teaching. First of all, this paper analyzes the importance of introducing intelligent computer equipment. Then, this paper analyzes the implementation principle of the intelligent experimental platform. Finally, some examples are given.

Keywords: Intelligent, Computer Equipment, Physics Experiment Teaching

1. Introduction

With the continuous improvement of microprocessor technology, single chip microcomputer and microcomputer have been gradually used to measure physical quantities in higher vocational physics experiments. Through the computer software program settings, we can directly carry out data analysis and processing, and finally we can get the final data1. With the introduction of intelligent computer equipment, physical experiment education can carry out intelligent teaching, which is inseparable from the measurement digitization of traditional basic physical quantities, such as time, length, current, temperature, light intensity and so on, which can be directly measured by electronic meter, digital caliper with vernier, digital multimeter, digital thermometer, digital light intensity meter and so on, and then exported to the computer. In this way, we can get the real-time data of the experiment.
Based on computer equipment, physical experiment teaching results in the whole process will avoid many operations, from data acquisition, data processing, data analysis, results output, etc. Although, therefore, computer equipment improves the means and accuracy of physical measurement. However, the introduction of computer equipment also brings some problems, such as weakening the training of hands-on ability and reducing the subjective initiative. However, with the deepening of intelligence, the introduction of computer equipment has become an important course of physical experiment teaching in higher vocational colleges, which requires colleges to improve the old measuring instruments.

2. The importance of introducing intelligent physical experiment instruments

It is very important to use computer equipment in physics experiment teaching, as shown in Figure 1.

![Figure 1](image.png)

**Figure 1.** The importance of introducing intelligent physical experiment instruments.

2.1. Improve measurement accuracy

As a control center, computer has many functions, such as high computing power, effective control mode, huge storage capacity and strong identification ability, which will enhance the accuracy of the verification experiment. At the same time, by digging deep laws, we can increase the progressiveness of research experiments, which will help students master advanced scientific knowledge. Therefore, the introduction of intelligent computer equipment can improve the quality of teaching content, which will strengthen the hierarchical curriculum. At the same time, experimental teaching can ensure that students master the basic knowledge, which can also improve the measurement accuracy. For example, in the intelligent single slit diffraction experimental device, through the improvement of single chip microcomputer, we can realize the automatic output of measurement data and experimental results, which will eliminate the error caused by multiple sampling in the traditional experimental instrument. By means of automatic output, we can improve the measurement accuracy.

2.2. Expand the experimental content

College physics experiment is a practical course, which can help students master the theoretical knowledge of physics. By clarifying the logical relationship between theoretical knowledge, students can increase the comprehensive mastery of multi-disciplinary knowledge, which will ensure the wide development of knowledge system. Through the introduction of intelligent computer equipment, we can build a virtual experimental system, which will lead to students' ideas of software and hardware combination, modularization and hierarchical design. By dividing the teaching system into software function module, virtual instrument module and experiment project module, students can expand the experiment content times. Through the combination of computer equipment and traditional experimental methods, higher vocational colleges can increase the correlation of experimental principles and interdisciplinary between experimental projects, which will promote students to master
the internal relationship of the knowledge system of the discipline\textsuperscript{[5]}. By understanding the logic of knowledge system, higher vocational colleges can strengthen the comprehensiveness of multi-disciplinary knowledge, which will promote the development of students' knowledge system structure. For example, the traditional pendulum experiment can only observe the movement of the pendulum. Through the introduction of computer-aided simple pendulum experimental instrument, students can not only study the physical phenomena and laws of simple pendulum, but also collect and process the data of nonlinear simple pendulum, damped pendulum and rigid pendulum. At the same time, through the computer experimental results, students can get a variety of simple pendulum experiment comparison curve\textsuperscript{[6]}.

2.3. Improve measurement efficiency
Intelligent computer equipment is inseparable from the application of various sensors, which is the main method of data acquisition. In the characterization of variables, all kinds of sensors reflect the changes of various variables by the change of voltage. For example, the temperature sensor obtains the change of temperature according to the characteristics of resistance changing with temperature. Resistance can be converted into voltage. The voltage can be measured by Voltmeter and output to the computer, which will facilitate the computer to analyze and process the data. For example, in the experiment of measuring the characteristics of microwave reflection klystron, the traditional experiments usually use oscilloscope for qualitative observation, sensitive galvanometer or power meter for quantitative measurement, and obtain a two-dimensional curve respectively. Through the introduction of computer-aided measurement of microwave reflection klystron, colleges and universities can convert the microwave analog signal into digital signal, which will facilitate computer data processing. Through hardware and software processing to get the required data, students can obtain three-dimensional graphics\textsuperscript{[7]}.

3. Physical experiment principle based on intelligent computer equipment

3.1. Realization principle of intelligent experimental platform
Traditional instruments, sensors, interface circuits and computer structures will be used in the construction of intelligent physical experiment platform. Therefore, the intelligent experimental platform can be divided into five parts: traditional instrument, sensor module, input interface module, control interface module and computer. According to the platform structure, the computer and the traditional instrument can be divided into three modules: sensor, input interface circuit and control interface circuit.

The traditional instruments are mainly force, heat, electricity, light and so on, which can send the physical quantity to the sensor. The sensor can accept the measured physical quantity and convert it into output signal. By inputting the measured physical quantity, the sensor can convert the non-electric quantity into the electrical signal output, which requires different sensors to measure different types of measured physical quantity. The input interface circuit mainly converts analog electrical signal into digital signal. When collecting multi-channel signals, we need to use multi-channel parallel data acquisition technology, which will realize multi-channel selection, such as a / D converter, signal amplifier and so on. The control interface should be realized by different components, such as D / a converter, silicon controlled rectifier, photoelectric isolation device, etc. Single chip microcomputer or microcomputer is the core of intelligent experimental platform, which can realize data acquisition, storage, processing and output of results. According to the function of each module, we can install some common basic devices, which will obtain the basic test platform. According to the experimental requirements, we can choose different module functions, which will be applied to a variety of experiments. The implementation principle of the intelligent experimental platform is shown in Figure 2.
3.2. Virtual experiment

Virtual experiment is to use software technology to build the logical structure model of the system. Combined with related hardware to form a virtual system, we can use network technology to realize network virtual system, as shown in Figure 3. It is the schematic diagram of design pattern of virtual experiment system. According to the experimental object and research content, we can use software to form the overall logical structure model, which will form the overall structure of the virtual system. Through the network virtual system, we can expand the scope of the experiment, which will realize the distributed construction of the system and the multi-party collaborative processing of the experimental process. In the whole experiment process, we can make full use of the control, processing and coordination functions of the computer. At the same time, the software program in the computer can reverse control the signal output of the experimental object and the experimental instrument, which will increase the clarity of the understanding of the experimental object.

3.3. Intelligent test control process

The computer control process in the experimental system is a closed-loop control and feedback system, including multiple feedback and regulation, which will form a complete control system. Through feedback control, the overall performance of the experimental system will have a qualitative leap. The intelligent test control process is shown in Figure 4.

4. Temperature sensor characteristics

The principle of "temperature sensor characteristics" experimental project is based on the characteristics of temperature sensor resistance value changing with temperature, which requires to master the temperature and resistance variation characteristics of resistance, semiconductor thermistor,
PN junction temperature sensor and integrated temperature sensor, including heating system, oil bath system, power supply, sensor, thermometer and voltmeter. By adding a data acquisition card to the experimental system, we can analyze, process, display and store the data and release it on the network. Through the data acquisition card, we can control the output of the command to the heating system, which will control the environmental temperature to change with the experimental requirements. The temperature sensor characteristic test based on intelligent computer equipment is shown in Figure 5.

5. Conclusion
Higher vocational colleges must introduce intelligent physical experiment instruments, which is in line with the teaching idea and system of modern technology and the needs of teaching development in the 21st century. Through the introduction of intelligent physical experiment instruments, vocational colleges can adjust, modify and design the traditional physical experiment teaching content and teaching methods, which will be better applied to experimental teaching.

References
[1] Bian dunxin. Computer control technology experimental platform based on windows [J]. Laboratory research and exploration, 2015, 24 (11): 52-54.
[2] Chen Hongyu. Design of university physics experiment teaching management website based on Interner [J]. Laboratory research and exploration, 2016, 25 (2): 194-197.
[3] Gao Hongbo, Wang Fengxian. Architecture design of virtual experiment system based on Web [J]. Journal of Hebei Academy of Sciences, 2018 (6): 72-73.
[4] Lu Zhanhong. Analysis of the application of single chip microcomputer in designing physical experiment [J].College physics experiment, 2011, 14 (4): 34-36.
[5] Yin Yongtian. Design and implementation of online course selection system based on ASP. Net [J]. China educational technology equipment, 2016 (12): 60-62.
[6] Zhang Li, fan bingduo, Cao Lesong. Design and practice of dynamic website based on ASP. Net [J]. Information technology, 2017 (1): 68-71
[7] Zhao Shenghui, Liu Ping, Shi Baohua, et al. Computer control experimental system based on virtual instrument [J]. Microcomputer information, 2016, 7(10): 59-63.