

Reform of University Physics Experiment Course under the Combination of Big Data and Industrial Internet

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Abstract. This paper puts forward the combination of big data and university physics experiment teaching based on the combination of big data and industrial internet, and tries to get rid of the traditional teaching mode of university physics experiment and develop innovative experiment teaching, focusing on the application of computer data acquisition and data analysis in the process of university physics experiment teaching. Let our students, like scientists and engineers, open up the relevant concepts in reality in their study, reduce the chance of gross errors in the experiment process, use cloud computing to achieve real-time data feedback, improve the understanding of concepts, increase students' interaction, and promote students' thinking, thus becoming active participants, allowing students to spend more time in analysis and development. High-level thinking skills.

1. Introduction

Physics plays an important role in the cultivation of human scientific quality. Experiments are the basis of physics. It reflects the commonness and universality of science and engineering experiments, and plays an irreplaceable important role in the cultivation of talents' scientific quality. In recent years, the new scientific and technological revolution represented by computer information science and technology, life science, space science and material science has greatly accelerated the development of science and technology and the intersection and infiltration of various disciplines. The new trend of integration has become the mainstream of scientific development. Therefore, physical experiment curriculum system, teaching content, teaching methods and means must be changed from closed to open.

This paper mainly studies the methods and significance of College Physics Experiment Teaching Reform under the combination of big data and industrial internet. The practical significance of the Reformed College Physics Experiment to the experimental classroom is as follows:

- Large amount of data, you can see more details;
- Obtain multi-node experimental data in university physics experiment through remote internet.
- The gross error in the experiment is reduced, and the relative uncertainty of the experiment is lower.
- The focus of students shifts from observation and recording data to thinking about the differences between experimental phenomena and theories.
- We can really try to obtain data with different possibilities in time and conditions.
- There is no way for students to copy experimental data from each other in class.



2. Analysis of Research Status at Home and Abroad

2.1. Overseas Research Status

As we all know, outstanding physicists in Europe and the United States emerge in large numbers. On the one hand, physicists' endless thirst for knowledge is indispensable, on the other hand, they also benefit from the clear educational principles of European and American countries: cultivating innovative talents as the basic starting point. Based on this open teaching environment, some outstanding physicists, such as Newton and Bohr, and Nobel laureates, have emerged. In the compilation of textbooks, they will give students a space for independent design and thinking, and let them design feasible experimental schemes and operate them independently according to the experimental principles. At the same time, they will pay close attention to the advanced scientific research achievements and constantly update the experimental projects, so as to provide more possibilities for the discovery of new physical phenomena. In terms of instrument configuration, with the continuous progress of science and technology every year, Instruments are also updated, with the characteristics of short replacement cycle and high utilization rate. On the teaching object, strictly abide by the status of student subject and teacher object, give the initiative to students, through active exploration, grasp the essence of physical laws.

The teaching of experimental data processing in physics laboratories of famous universities in the United States and Canada has the following characteristics:

- Computer technology is widely used in data processing. In physical experiments, computer has been widely used to collect and process data, and various data analysis software has also been widely used in the processing of experimental results.
- Data processing theory is closely integrated with experimental courses. The theory and
- Method of data processing that students have learned before the experiment class should also be fully used in the experiment.
- Teachers pay attention to the training of students' data processing skills. The experimental
- Technicians of these schools attach great importance to improving the data processing ability of students in the experimental operation. Teachers encourage students to carry out experimental evaluation in the experiment.

It can be seen that the data processing of physical experiments abroad is much more advanced than that of our country. Therefore, we need to study the experimental data processing methods, study various kinds of computing software, and find suitable software and teaching methods for our college physics experiment data processing, in order to improve the teaching level of experimental data processing in our country.

2.2. Domestic Research Status

In our country, university physics experiment courses are offered in Universities of science and technology. Traditional teaching methods are generally adopted, which can be roughly divided into several steps: telling experiment principles, introducing experiment instruments, explaining experiment contents, data recording and processing, etc. There are few inspiration and guidance teaching methods. At present, some university physics teachers in China have made preliminary progress in using computer-aided processing of physical experiment data.

We are in the information age, and more and more information needs to be acquired and processed in our work, study and daily life. For the students who are in the learning stage in school, how to use computer technology to process a large number of useful information, so as to make more efficient use of these resources, will become one of the necessary abilities of students. Modern educational technology must be adopted in teaching, which is one of the indispensable means and methods to promote quality education. Therefore, it is necessary to integrate big data assisted experiment with university curriculum, which is conducive to promoting teaching reform.

3. Rresearch Contents

Mr. John Dewey, a 20th century philosopher of education, said, "If we teach today's children the way we taught them yesterday, we will rob them of their tomorrow!" Yesterday was the industrial age. Physics experiment teaching was mainly manual. The teaching mainly took the form of blackboard writing, single-machine experiment of industrial analog instrument, table recording and physical archiving. Today is the PC era, digital, teaching mainly Flash, PPT projection, lesson preparation and learning efficiency has been greatly improved, some single computer data acquisition, data image processing. Tomorrow is the era of industrial interconnection. Big data. The main teaching methods are interactive homework, framework system, remote control, multi-point sensing, data acquisition and transmission, processing, judging and application of big data.

As the first scientific experiment course for college students, college physics experiment should not only train students with strict and systematic experimental skills, master the basic knowledge, methods and skills of scientific experiment, but also cultivate students' rigorous scientific thinking ability and innovative spirit, and train students' ability to integrate theory with practice, analyze and solve practical problems. They are the comprehensive ability to adapt to the development of science and technology, the innovation ability to adapt to the development of the times and the progress of science and technology.

The main contents of this paper are as follows:

(1) The combination of big data and industrial internet. Each industrial equipment will be labeled as a node, installed sensors, informationized the operation of the equipment, and even the key components of the equipment can be tracked, and then the production and manufacturing environment can be monitored and collected. Through the industrial internet, the information from tens of thousands or even tens of millions of sensors can be aggregated, and then based on the large data platform, according to the corresponding indicators and rules to be filtered and analyzed, a lot of useful information will be found.

(2) From the location and video surveillance of the concept of the Internet of Things, it really evolved to add value to university physics experiments.

(3) Cloud computing is oriented to IT infrastructure; big data is more closely related to the curriculum of College Physics experiments.

The experimental method based on big data computer greatly saves the time of recording, observing, calculating and analyzing in the process of traditional scientific experiment, and makes the focus of experiment fall on the assumption, analysis and thinking of the problem. And these are the basic qualities that we need to cultivate students in scientific research and engineering. Using large data computer to collect and analyze data can realize real-time data acquisition, and improve the accuracy, repeatability and stability of data acquisition. It can achieve high sampling rate, real-time capture of instantaneous changes. Large data cloud computing software is easy to understand, powerful, and can save, analyze and export data in real time.

The comparison results between several experiments combined with big data and college physics experiments and traditional physics experiments are as follows:

Figure 1. Frank Hertz Experiment

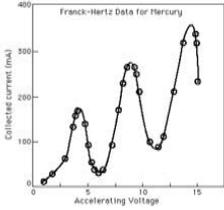
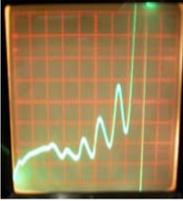
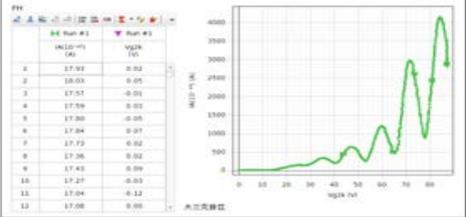
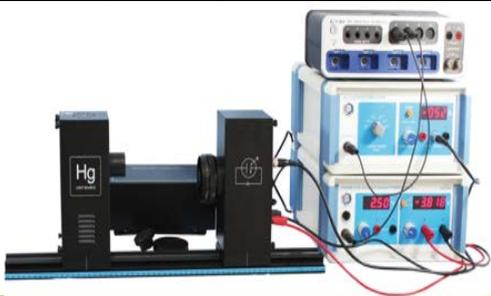
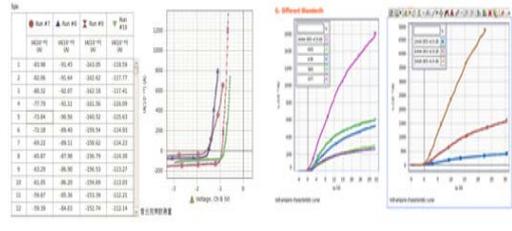
	Conventional method	Big data acquisition
Experimental installation		
Data logging	It is necessary to design the step size of the collected data before the data is collected, and the point to be taken at the point where the curvature changes. However, when the student is in the shape of an unknown curve, this is difficult to achieve.	Just set the appropriate sampling frequency (up to 10MHz), such as 100MHz
Experimental period	It takes a school hour to collect about 80 sets of 100 sets of data, and it takes a picture to draw at the end of the experiment.	It takes tens of seconds to collect 600 point data, and the data is synchronized with the image.
Experimental result	 	

Figure 2. Photoelectric Effect Experiment

	Conventional method	Big data acquisition																																																																		
Experimental installation																																																																				
Data logging	The step size of the collected data needs to be designed before the experimental data is collected, and a little more should be taken at the point where the curvature changes. However, when students do not know the shape of the curve, this is relatively difficult to do.	Just set the appropriate sampling frequency (up to 10MHz), such as 100MHz																																																																		
Experimental period	Point by point recording, about 3 data per wavelength, 4 wavelengths, about 120 data, about 1 lesson	It takes 5-10 minutes for 600-800 point data to be collected for each wavelength, and total of 3000 sets of data is required. Data synchronization with image																																																																		
Experimental result	<table border="1" data-bbox="395 1059 866 1290"> <tr> <td>V</td> <td>-3.00</td> <td>-1.80</td> <td>-1.45</td> <td>-1.40</td> <td>-1.20</td> <td>-1.00</td> <td>-0.80</td> <td>-0.60</td> <td>-0.40</td> <td>-0.20</td> </tr> <tr> <td>μA</td> <td>-0.3</td> <td>-0.2</td> <td>-0.1</td> <td>0.0</td> <td>0.2</td> <td>0.7</td> <td>1.3</td> <td>1.9</td> <td>2.8</td> <td>3.7</td> </tr> <tr> <td>V</td> <td>0.00</td> <td>0.20</td> <td>0.40</td> <td>0.60</td> <td>0.80</td> <td>1.00</td> <td>1.20</td> <td>1.40</td> <td>1.60</td> <td>1.80</td> </tr> <tr> <td>μA</td> <td>4.5</td> <td>5.4</td> <td>6.3</td> <td>6.8</td> <td>7.5</td> <td>7.9</td> <td>8.2</td> <td>8.6</td> <td>9.1</td> <td>9.3</td> </tr> <tr> <td>V</td> <td>2.00</td> <td>2.50</td> <td>3.00</td> <td>5.00</td> <td>10.00</td> <td>15.00</td> <td>20.00</td> <td>25.00</td> <td></td> <td></td> </tr> <tr> <td>μA</td> <td>9.5</td> <td>10.2</td> <td>10.5</td> <td>12.0</td> <td>13.0</td> <td>13.9</td> <td>14.2</td> <td>14.5</td> <td></td> <td></td> </tr> </table>	V	-3.00	-1.80	-1.45	-1.40	-1.20	-1.00	-0.80	-0.60	-0.40	-0.20	μA	-0.3	-0.2	-0.1	0.0	0.2	0.7	1.3	1.9	2.8	3.7	V	0.00	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	μA	4.5	5.4	6.3	6.8	7.5	7.9	8.2	8.6	9.1	9.3	V	2.00	2.50	3.00	5.00	10.00	15.00	20.00	25.00			μA	9.5	10.2	10.5	12.0	13.0	13.9	14.2	14.5			
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4. Summary

In a word, in the process of physics experiment teaching, using big data and traditional physics experiment instruments to reproduce and implement knowledge points can simplify physical research, strengthen experimental conditions, accelerate or delay physical process, visually and vividly display details, scientifically and accurately transmit a large amount of information, turn abstraction into image, stimulate students' interest in learning physics, and improve teaching. Learning quality. In physics experiment teaching, the combination of computer and physics experiment correctly and skillfully can break through the limitations of conventional experimental instruments and equipment, operate those difficult to observe, complex and difficult experiments, and bring unprecedented changes to our teaching and learning.

5. References

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