

Design of Virtual Simulation Experiment Platform for Big Data Management Specialty

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Abstract. Virtual simulation experiment teaching is an effective way to enhance the comprehensive practice and innovation capacity of students majoring in big data management. The paper first analyzes the necessity of the construction of virtual simulation experiment platform for big data management specialty, proposes a three-levels virtual simulation experimental tutoring system to adapt to students' learning needs with different levels, and designs a virtual simulation experimental platform with six modules, which can stimulate students' innovative thinking and make a beneficial exploration for talents cultivation of big data management specialty.

1. Introduction

With the rapid growth of Internet, big data, virtual reality and other information technologies, virtual simulation experiment came into being[1]. Virtual simulation is used to simulate the real experiment, and a highly simulated virtual experimental environment and experimental object are created to display the invisible structure or principle. Students can complete the corresponding experimental content in virtual environment, so as to achieve the expected teaching goal, which can quickly respond to the needs of experimental teaching, shorten the distance between experimental teaching and engineering practice, and improve students' self-learning and inquiry learning. Therefore, since 2017, the Ministry of Education of the People's Republic of China has started to promote the demonstration project of virtual simulation experiment teaching, which can guide colleges and universities to positively probe personalized and intelligent experimental teaching mode, and form a new system of higher education informatization experimental teaching project with reasonable discipline layout, excellent teaching effect, open and sharing.

2. Related Works

In 2017, the Ministry of Education issued a notice on the construction of demonstration virtual simulation experimental teaching projects from 2017 to 2020. Therefore, domestic colleges and universities set off an upsurge of active development and application of virtual simulation experimental tutoring projects.

On the basis of the principia of combining virtual with reality, Song Zhenghe et al.[2] put forward a virtual simulation experimental tutoring system with "three platforms and nine modules". Xue Yongji et al.[3] analyzed the status and role of experimental practice tutoring of economics and management specialty, applied information technology to system development, curriculum and platform construction, and explored and practiced virtual simulation experiment teaching. Luo

Jian[4] used KVM technology and hyper-converged infrastructure and devised a new construction framework of big data virtual simulation experiment platform. Liu Yuxi proposed a construction scheme of financial information engineering virtual simulation experimental platform based on resource sharing, and constructed an experimental teaching system according to the ability system, experimental content and experimental project[5]. Wei Sujuan summarized the specific implementation of promoting the construction and practice of virtual simulation experimental teaching resources from five aspects of overall deployment, construction ideas, framework design, construction process and operation process[6].

At present, the research on virtual simulation experimental tutoring in foreign universities mainly focuses on the design and development of experiments and the application of virtual simulation experiments. The research trends center on the use of new technologies in virtual simulation experiment teaching, and the construction of teaching laboratories with complete virtual experimental environment, such as the expandable collaborative learning space of the University of Pittsburgh[7] in America and Virtual DC motor Laboratory of Gazi University in Turkey[8]. K. Al-Zoubi and G. Wainer presented a set of collaboration mechanisms based on Fog and Cloud computing resources to carry out simulation experiments[9].

As the "big data management and application" is a new major in the late years, colleges and universities positively advance the construction of big data specialty, and in the meantime carry out the construction of big data laboratory, so as to fulfil the training requirements of big data practical and compound talents. Big data experimental teaching and research have high requirements on computer hardware, software, data, etc., and the construction cost is high. Therefore, this paper proposes a low-cost design scheme of big data virtual simulation experiment platform, which integrates teaching and research.

3. Design of Virtual Simulation Experiment Platform for Big Data Management Specialty

3.1. Necessity of Building Virtual Simulation Experiment Platform for Big Data Management Specialty

3.1.1. Exploring "Internet + Education" Mode

Following the principle of "high-level, innovative and challenging" of the Ministry of Education, we adhere to the "research feedback teaching" mode, integrate the scientific research achievements into the teaching process, take the actual scientific research problems as the guidance, and actively explore the virtual simulation experiment teaching mode. The platform adopts the teaching mode of "self-learning + inquiry learning", which combines the knowledge learning and ability training of students. It can cultivate students' big data thinking and the ability to resolve physical problems by using big data technology, and explore the modern student training mode of "Internet + education".

We should cultivate students' ability of thinking big data and solve the practical problems with big data analysis technology, and explore the modern student training mode of "Internet plus education".

3.1.2. The Need of Cultivating Innovative Big Data Management Talents

As big data management related disciplines are emerging disciplines, the teaching practice experience of relevant specialties in colleges and universities is insufficient. However, due to the

lack of bit data technology and big data management talents in China, it cannot suit the development of national political and economic. Big data analysis and big data management is a discipline with strong practical ability. For the sake of the requirements of students' practical ability training, the construction of big data simulation experiment teaching platform is promoted. The platform applies big data analysis technology to practical cases, which can realize the experimental operation of students simulating the actual management scene with the teachers' direction, enable students to explore and learn independently, and which is helpful to cultivate students' innovation capability and problem-solving ability.

3.2. Construction of Teaching System of Virtual Simulation Experiment Platform for Big Data Management Specialty

Around the talent training system of big data management specialty, the paper highlights the training objectives of College students' application ability, innovation ability and research ability, focuses on students, and constantly upgrade experimental projects from easy to difficult, and constructs a multi-level virtual simulation experiment teaching system for big data management specialty, as shown in the figure 1.

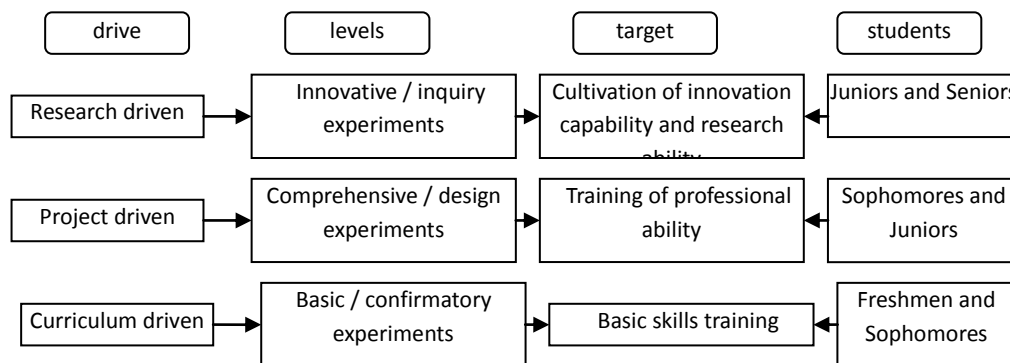


Figure 1. Virtual simulation experiment teaching system of big data management specialty.

3.2.1. Confirmatory Experiments

The confirmatory experiments are mainly for freshmen and sophomores, and pay attention to the basic knowledge of the course content, mainly including course content experiments. The goal of course content experiments is mainly to make students verify the relevant theories and methods of the course through experimental operations, consolidate the basic theory. For example, program design course experiments, database course experiments, big data environment configuration experiments, etc.. Confirmatory experiment is the basis of other experiments.

3.2.2. Comprehensive Experiments

The comprehensive experiments are mainly for sophomores and juniors. The content of the experiment involves the comprehensive knowledge of one course or several related courses, mainly including the comprehensive experiment of a course, the comprehensive experiment of the specialty, and the annual paper. At this stage, the courses are mainly professional courses. For the major, students have a certain professional knowledge and skills foundation. The practical courses should also be transformed from the confirmatory experiments to the comprehensive experiments. According to the professional knowledge and social needs, teachers put forward the experimental design topics. The students use the professional knowledge, basic principles and experimental skills to design the specific scheme of the experiment, draw up the experimental steps, select the

environment, complete the operation and programming independently, record the experimental data, draw charts, analyze the results and finish the experiment reports. The purpose of comprehensive experiment is to foster students' comprehensive capacity to resolve problems by using their professional knowledge, accurately choosing research methods and tools in practice.

3.2.3. Inquiry Experiments

Inquiry experiments are mainly for juniors and seniors. Students have basically completed their major courses and have a comprehensive understanding of their major. The practical courses should also be transformed from design experiments to inquiry experiments. This kind of experiment takes college students' innovation and entrepreneurship competition, various disciplines competition projects, school enterprise cooperation projects and teachers' scientific research projects as the breakthrough points, stimulates students' innovative ideas, guides students to do scientific study and exploration. Its aim is to foster students' team cooperation capacity, innovation capacity and scientific research capacity, and to improve students' professional quality in scientific research.

The new multi-level experimental teaching system follows the characteristics of students in each stage and the discipline foundation, and gradually improves the practical ability of students.

3.3. Architecture of Virtual Simulation Experiment Platform for Big Data Management Specialty

The content of the virtual simulation experiment platform for big data management specialty is consistent with the teaching system, and different modules are established according to the needs of the tutoring system, detailed in Figure 2.

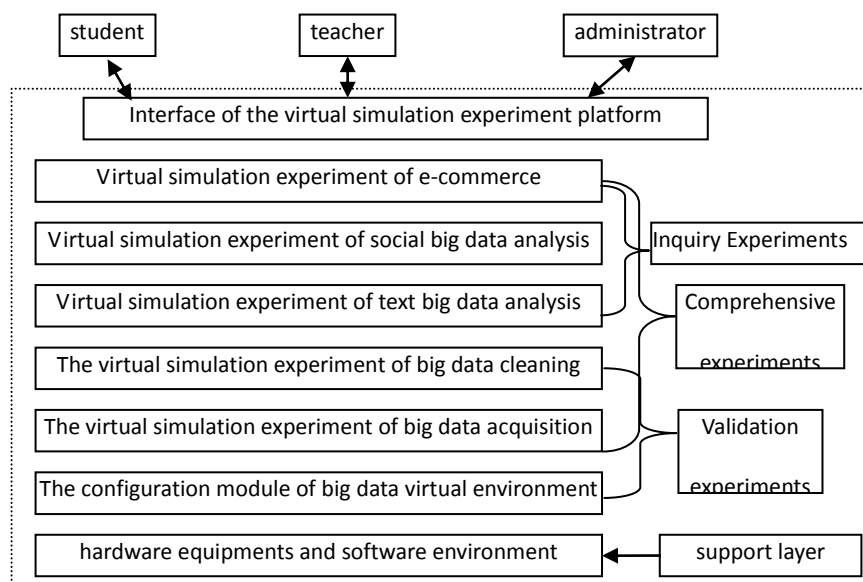


Figure 2. Architecture of virtual simulation experiment platform for big data management specialty.

The support layer of big data virtual simulation experiment platform includes hardware equipments and software environment. Hardware equipment includes hardware products that meet the needs of experimental resources, such as servers, switches, routers, UPS power supply, cabinets, etc. The software environment includes software platforms that meet the requirements of teaching experiments, such as Linux, Java, Mysql, Python, Hadoop, Spark, Hive, HBase, etc.

The configuration module of big data virtual environment mainly includes the allocation of virtual machine and the construction of distributed cluster environment, which is mainly in the way of parameter setting for students to choose. It includes: master node configuration, slave node configuration, host file configuration, firewall configuration, SSH configuration, Hadoop distributed environment configuration, Hive installation and configuration, MySQL installation and configuration, Spark environment installation and configuration, etc.

The virtual simulation experiment of big data acquisition mainly designs a web crawler to crawl the required data. According to the website address provided, it analyzes the structure of the website and its web page structure, and formulates the crawling rules according to the analysis results of the web page structure, crawls the specified data from the website, analyzes the JSON data, and outputs the formatted data to the HDFS file system. It includes parameter setting module, web structure analysis module, crawling criterion module, JSON data parsing module and data format output module.

The virtual simulation experiment of big data cleaning includes null data processing module, repeated data processing module and obvious abnormal data processing module. Among them, in the null data processing module, for data of different types (such as numerical, text, date, etc.), users can adopt different processing methods (filling with adjacent records, directly assigning values, filling with median, filling with average number, etc.) or directly delete them. In repeated data processing module, for repeated data, deletion or other operations can be performed as required. The abnormal data processing sub module uses statistical methods such as maximum, minimum, average and median to find abnormal data, and deals with them according to the needs of experimental tasks.

In the virtual simulation experiment of text big data analysis, firstly, word segmentation and stop word processing are carried out for large-scale text. On this basis, virtual simulation experiments of text analysis such as keywords cloud analysis, semantic computing, emotional analysis are further carried out.

Virtual simulation experiment of social big data analysis mainly includes social network node attributes analysis, social users relationship analysis and visualization, community discovery and visualization, social users influence analysis and visualization.

The virtual simulation experiment of e-commerce big data analysis includes sentiment analysis of e-commerce users' comments, e-commerce users behaviors analysis, customers value analysis, products sales analysis, products quality problem mining and other modules.

The last three experiments modules include a large number of machine learning models and data mining algorithms. Students can carry out innovative thinking and exploratory experiments according to the actual problem orientation and teachers' scientific research projects, so as to excavate deeper rules and provide suggestions for management decision-making.

3.4. Teaching Method of Virtual Simulation Experiment

3.4.1. The Combination of Autonomous Learning and Inquiry Learning

For the confirmatory experiments, students can learn interactively according to their own knowledge level, which is out of limitation of time and space. After class, learners can use personal

terminal equipment to log in the experiment platform at any time and learn the basic experiment knowledge. They can repeatedly learn and experiment until they are satisfied. For comprehensive experiments and exploratory experiments, students can independently analyze problems, design a plan how to solve a problem, and analyze conclusions in real scenes. Through inquiry learning, students can foster their capacity to think, analyze and resolve problems all alone.

3.4.2. Combination of Personalized Learning and Group Discussion Learning

For inquiry experiments, students with different abilities can carry out independent personalized learning according to their own learning progress and knowledge level. For the analysis of experimental conclusions and the formulation of management countermeasures, students need to form a study group to discuss. On the basis of their explorative experimental study of real scenes, the students discuss the experimental results and conclusions and formulate management countermeasures to solve the problems, which is helpful to the cultivation of students' team consciousness and team cooperation ability.

4. Conclusion

Virtual simulation experiment teaching promotes the reform of experimental teaching in colleges and universities, and is helpful to the cultivation of professional talents. The paper designs a virtual simulation experiment teaching platform for big data management specialty, which includes three-level experimental teaching system and six modules. From easy to difficult, the platform is suitable for the needs of different levels of students' big data virtual simulation experiment operation. It can not only help students to learn professional knowledge and professional skills, but also cultivate their capacity of self-learning and inquiry-learning. It makes a beneficial exploration for the education and teaching reform and personnel training of big data management specialty.

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