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Construction of Cloud Computing and Big Data Course Teaching System Based on CDIO

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Abstract: CDIO education model has become a hotspot in the field of education with its emphasis on the cultivation of engineering practice and design thinking ability, while cloud computing and big data, as an important direction of the current development of information technology, have become increasingly important in higher education. This paper mainly elaborates on the definition of CDIO education model, advantageous features, the relationship and mutual influence between cloud computing and big data. After that, it puts forward specific measures for the construction of the course teaching system, including the principles of course design, course content and teaching methods, evaluation and improvement of DIO. The in-depth discussion and practice of this study will provide useful reference and guidance for the teaching of cloud computing and big data courses.

1. Introduction

With the rapid development of cloud computing and big data technology, higher requirements have been put forward for the cultivation of advanced talents to meet the needs of the modern information society. In order to equip students with comprehensive ability and practical ability in the field of cloud computing and big data, it is crucial to construct an effective teaching system. CDIO education model, as an education model focusing on engineering practice, has been widely used in the teaching of engineering courses[1]. This thesis aims to explore the strategy of constructing a teaching system for cloud computing and big data courses based on CDIO, which provides students with comprehensive knowledge and ability development by integrating relevant concepts, cultivating design thinking, focusing on practice orientation and promoting teamwork. The study provides reference and guidance for the teaching of cloud computing and big data courses, and promotes the innovation of education mode to cultivate advanced professionals who meet the needs of the information age[2].

2. Overview of CDIO Education Model and Analysis of Advantageous Features

2.1 Definition

CDIO is a modern engineering education model, the core concept of which is to combine engineering practice with disciplinary knowledge to cultivate students' innovation, design,

communication and teamwork abilities.The definition of the CDIO model includes four key elements: conception, design, implementation, and operation. These four elements represent a complete engineering cycle, starting from problem identification and requirements definition, through the design programme development and implementation process, and finally reaching the operation phase of the product or system[3].

2.2 Advantages and Characteristics

The advantages and characteristics of CDIO education model are mainly reflected in the following aspects. Firstly, CDIO focuses on cultivating students' interdisciplinary ability so that they can comprehensively apply multidisciplinary knowledge to solve practical problems[4]. This comprehensive learning approach helps to broaden students' horizons and improve the flexibility and innovativeness of problem solving. Secondly, CDIO advocates project-driven learning, which enables students to better understand and apply what they have learnt and develop their teamwork and communication skills through the setting of practical projects[5]. Thirdly, CDIO emphasises engineering practice and focuses on combining theoretical knowledge with practical application to develop students' practical skills and professionalism. In addition, CDIO also emphasises students' self-directed learning and continuous feedback, promotes students' active learning and continuous improvement ability, and develops their ability to adapt to the rapidly changing technology and social needs. It can be seen that the CDIO education model, with its interdisciplinary, practice-oriented and comprehensive ability cultivation features, provides effective guidance and methods for teaching cloud computing and big data courses [6].

3. Analysis of the relationship and mutual influence between cloud computing and big data

Cloud computing and big data are two interrelated concepts in the field of information technology, and there is a close relationship and mutual influence between them. Cloud computing provides powerful computing and storage resources, while big data involves processing and analysing huge amounts of data[7].

First, cloud computing provides a highly scalable infrastructure for big data processing and analysis. Big data usually contains huge data sets, and traditional local computing resources may not be able to meet the demands of such scale. With a cloud computing platform, computing and storage resources can be dynamically allocated and managed as needed to meet the requirements of big data processing. The distributed computing environment and elastic resource provisioning capabilities provided by cloud computing make big data processing no longer limited by the performance and capacity of a single server, enabling more efficient data processing and analysis[8].

Second, cloud computing facilitates big data storage and sharing. Big data usually needs to be stored in a reliable, secure and scalable storage system. Cloud computing provides a variety of storage services, such as object storage, block storage and file storage, which can meet the needs of big data storage. In addition, cloud computing platforms provide mechanisms for data sharing and access control, which make it easy to share big data to multiple users or applications. In addition, cloud computing provides powerful computing power for big data analysis[9]. Big data analyses usually require complex algorithms and model calculations, which have high requirements for computing resources. Cloud computing platforms provide high-performance computing instances and distributed computing frameworks, such as Hadoop-based MapReduce and Spark, which can accelerate the process of big data analysis and improve computational efficiency and processing speed. At the same time, big data also challenges and promotes cloud computing[10]. Due to the massive, high-speed and diverse characteristics of big data, it puts higher requirements on storage, computing and network bandwidth. In order to meet the demands of big data, cloud computing

platforms continue to develop and evolve, introducing new technologies and solutions, such as distributed file systems, containerised deployment and automated management, to provide better cloud computing support [11].

4. Analysis of the teaching system construction of cloud computing and big data courses based on CDIO

4.1 Determination of Curriculum Design Principles

The principle of course design based on CDIO refers to the construction of an organic teaching system in cloud computing and big data courses, following the guiding ideology and principles of the CDIO education model, and aiming at cultivating students' innovation ability, design thinking and practical skills[12]. Specific design principles include: (1) Conceptual integration: cloud computing and big data involve a wide range of concepts and technologies, including virtualisation, containerisation, data storage and processing. The CDIO-based curriculum design should integrate these concepts to form an organic knowledge system so that students can fully understand the key concepts and interrelationships of cloud computing and big data. (2) Design Thinking Cultivation: The CDIO education model emphasises the cultivation of students' design thinking ability, i.e. the ability to apply theoretical knowledge to practical problem solving. In the course design, a project-driven approach can be adopted to guide students to exercise their design thinking ability through actual case analysis and design practice. For example, students can be organised to participate in actual projects in the field of cloud computing and big data, so that they can learn and apply what they have learned in practice. (3) Practice-oriented: cloud computing and big data is a highly practical discipline, and the application of theoretical knowledge cannot be separated from practical operation and case analysis. CDIO-based course design should focus on practice orientation and provide rich practical opportunities so that students can gain an in-depth understanding of cloud computing and big data related technologies and tools through practical operations and experiments. At the same time, students' ability to solve practical problems is cultivated through the analysis and discussion of actual cases. (4) Teamwork: The application of cloud computing and big data often requires the co-operation of multiple individuals to complete, so the ability of teamwork is very important. CDIO-based course design should encourage students to cooperate and communicate in teams to develop their teamwork ability. Activities such as project tasks and group discussions can be designed to allow students to work together in teams to solve problems and strengthen their communication and collaboration skills[13].

4.2 Curriculum content and teaching methodology setting

4.2.1 Course Content Setting

The course content setting includes several aspects, for example, in cloud computing foundation learning, it is necessary to learn to introduce the concept, architecture and key technologies of cloud computing, including virtualisation, cloud service model (IaaS, PaaS, SaaS), containerisation, etc. The learning objectives are to understand the fundamentals and development trends of cloud computing, and to be able to analyse and evaluate different types of cloud computing solutions[14]. And in Big Data Fundamentals learning, in which the content focuses on exploring the definition, characteristics and challenges of Big Data, introducing Big Data storage and processing technologies, such as distributed file systems, batch processing and streaming processing. The learning objectives focus on understanding the basic concepts and technologies of big data and being able to apply appropriate tools and techniques to process and analyse big data[15]. In Cloud

Computing and Big Data Convergence, the main learning content examines the convergence of cloud computing and big data applications, including big data storage and processing on the cloud, data analysis on the cloud and machine learning. The learning objectives are based on understanding the relationship and impact of cloud computing and big data on each other, and being able to design and deploy big data applications based on cloud computing platforms [3].

4.2.2 Teaching Methods

In the face of the current cloud computing as well as big data technology, the teaching methods used also need to be more innovative, and the methods that can be used include:(1) Case study: real or virtual cases are used to guide students to understand and apply the concepts and technologies of cloud computing and big data. This method can help students combine theoretical knowledge with real-world problems and develop problem-solving skills and critical thinking. (2) Project practice: based on actual projects, students work in teams to complete projects related to cloud computing and big data. Students can comprehensively understand and apply the technologies and tools of cloud computing and big data through the stages of planning, design, implementation and evaluation of the project. This approach promotes students' practical ability and teamwork. (3) Discussion sessions: Students are organised to participate in discussions and debates to delve into important issues and challenges in the field of Cloud Computing and Big Data. Through open-ended discussions, students can share their insights, experiences, and perspectives, and gain inspiration from the different perspectives and viewpoints of other students. This approach helps to develop students' critical thinking and communication skills. (4) Experiments and Demonstrations: By conducting experiments and demonstrations, students can experience first-hand the working principles and application scenarios of cloud computing and big data. They can use the corresponding software tools and platforms to perform operations such as data processing, analysis and visualisation. This approach strengthens students' practical operation ability and problem solving ability.

4.3 Evaluation and Improvement

Evaluation needs to be carried out in accordance with relevant indicators before it is conducted, such as judging students' knowledge mastery and assessing their understanding of concepts, technologies and principles related to cloud computing and big data, including whether they are able to accurately explain the key concepts, describe the working principles, and apply what they have learnt to analyse and solve problems. Alternatively, students are judged based on their practical ability to assess their ability to apply cloud computing and big data technologies in real-world environments, including whether they are able to design and implement cloud computing and big data systems, process and analyse large-scale data, and provide corresponding solutions [4].

Improvement measures are proposed as a process of optimisation for course design and teaching methods based on the evaluation results of cloud computing and big data courses. For example, the course design is optimised by adjusting the course content and learning objectives. Based on the evaluation feedback and industry needs, the cloud computing and big data concepts covered in the course can be updated and enhanced, and the latest technology trends and case studies can be introduced. This will ensure that the course content keeps up with industry developments and enable students to gain the latest knowledge and practical experience in the learning process. Alternatively, an effective feedback mechanism can be set up to establish an effective communication channel between students and teachers. Regularly collect students' feedback and suggestions on the programmes and take timely action to improve them. At the same time, co-operate with the industry and invite industry experts to participate in curriculum design and

teaching to provide valuable experience and insight from a practical perspective.

4.4 Lesson Plan Implementation

Lesson plan implementation consists of two aspects, which are lesson scheduling and resource preparation. Timing involves identifying the specific time slots for the course in the semester, taking into account other related courses and the school's schedule. Alternatively, the number of hours required for each module or topic should be allocated according to the content and learning objectives of the course. When designing a course, it is important to carefully consider the time requirements for various teaching activities, such as theory lectures, case studies, and practical exercises. In addition, the preparation of resources should not be overlooked, which include textbook resources and laboratory facilities resources. To ensure effective learning, suitable textbooks or reference books should be selected as teaching materials, aligning their content with the course objectives. Furthermore, when conducting practical operations and experiments, the adequacy of laboratory facilities, as well as hardware and software resources, should be ensured. Lastly, it is crucial to check and prepare the necessary cloud computing and big data platforms for students to use in their practical and experimental work. In addition, in terms of faculty availability, there is a need to ensure that a faculty member with professional knowledge in the field of cloud computing and big data, and with rich teaching experience, is the lead instructor of the course.

5. Conclusion

In summary, the teaching system construction strategy of cloud computing and big data courses based on CDIO has an important cultivation for improving students' comprehensive ability and application skills, which can further enhance students' professionalism in the field of cloud computing and big data. This paper mainly discusses the advantages of the CDIO education model and combines it with the cloud computing and big data courses to construct a comprehensive, practice-oriented teaching system, through the application of which the core competencies required for the overall development of students can be further cultivated. It helps students to better adapt and cope with the rapidly developing cloud computing and big data industry, and lays a solid foundation for their future success.

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