

Study on the Design of Cloud Computing Flipped Classroom Teaching Case Library

Yuanyuan Wang, Haiyang Tian, Shaofeng Yan, Junxun Zhu, Haiyan Zhang, Wenhao Wang, Chunhua Jin

School of Computer and Software Engineering, Huaiyin Institute of Technology, Huai'an, Jiangsu, 223003, China

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Abstract: In order to further standardize classroom teaching, change traditional teaching methods, take this opportunity to drive the reform of education and teaching methods, and improve the achievement of teaching objectives, this paper studies the design of a teaching case bank based on a cloud computing course. This paper takes the design of a flipped classroom case library based on a cloud computing course as an example to enable students to better understand the knowledge framework, learning methods and course objectives of the course, so that students can take the initiative to learn, cultivate good thinking and learning methods, enrich the teaching content of the classroom, and thus create a high-quality teaching system.

1. Introduction

Cloud computing courses play an important role in the professional knowledge structure, laying a good foundation for students to grasp computer and data science expertise from the application level and to develop system thinking and construction skills. According to the latest research data, the market size of cloud services in China will continue to grow, and in the post-epidemic era, cloud computing technology and the real economy continue to help each other, from "digital anti-epidemic" to "digital-real integration", the booming development of the industrial Internet has brought endless imagination to reshape the new digital economy. The booming development of industrial Internet has brought endless imagination to reshape the new ecology of digital economy and accelerate the digital transformation of industries. Cloud computing and big data technology is the underlying logic of digital transformation, cloud computing development engineers and cloud computing architects are in short supply and have a far-reaching development space in the industry^[1,2].

The case designed in this research focuses on teaching the basic concepts and core technologies of cloud computing and cloud-native, understanding the application scenarios of cloud computing and cloud-native, and mastering the methods of deploying applications on cloud platforms. The case design of the introductory lesson of the course, for example, has an overarching and radiating effect on the course content, enabling students to understand the knowledge framework, learning methods and course objectives of the course. It is particularly important to build a good framework structure for students' knowledge content of this chapter, which can stimulate students' learning

interest and motivation, optimise students' knowledge system, cultivate good thinking and learning methods, enrich the classroom. It is also important to develop good thinking and learning methods, enrich the content of the classroom and create a high-quality teaching system. Students should understand the definition and characteristics of cloud computing, data centres, Eastern and Western computing, key technologies of cloud computing, and applications of cloud computing and big data.

2. Teaching philosophy

2.1 Stimulating students' interest in learning

Interest is the best teacher. Through the micro-lesson, the work content of cloud computing development engineers and cloud computing architects, the development of cloud computing, and the operation and maintenance of large cloud computing data centres at home and abroad are demonstrated in the form of videos. Through the video introduction, students can intuitively feel why they need to learn cloud computing, so that they can have a strong interest in learning the cloud computing course, and at the same time, they can also achieve good teaching effect.

2.2 Student-centred, focused on student progress and development

The teacher assigns students pre-reading for the course case in advance: to understand the development of cloud computing, the core technologies of cloud computing, and in class the teacher asks students to participate in the class by talking about what they know from the students' perspective about the development of cloud computing, the technologies, and what applications of cloud computing are around us, leading them to take the initiative to participate in the class.

2.3 Focus on teaching and learning outcomes

As a teacher, you cannot only focus on how much you have taught your students in a classroom session, but also on their learning outcomes and students' performance and participation in class.

Students are encouraged and praised for their performance and participation in class, and for their careful preparation of pre-reading materials before class. The content explained by students in class can also be used as a supplement to class content or for students' self-study after class^[3,4].

2.4 Develop good habits of reflection

After the lesson, reflect on whether the students have mastered the content of this course and met the teaching objectives, and from time to time, communicate with students in class, firstly to see how well they have absorbed the knowledge, and secondly to identify their own shortcomings in teaching from the main body of students for continuous improvement in the next lesson. And to keep a record of the issues raised by the students in their conversations with them, and to do a good job of learning from each lesson.

3. Teaching objectives

This course provides students with an understand cloud computing definition and characteristics, data centers, key technologies, cloud computing and big data applications. The ideological and political elements of the course can not only establish students' cultural self-confidence, but also give students a sense of mission of the times to rejuvenate the country through science and technology. Case: the development of domestic cloud computing - "the more blocked the more powerful", from "stuck neck" to "dominant" The development of domestic cloud computing

Domestic companies such as Ali Cloud, Huawei Cloud, Tencent Cloud, Baidu Cloud, Qingyun, Yunhong and Longchao are already in a mature state.

4. Pedagogical design

There are several methods that can be used to introduce a cloud computing course case.

4.1 Example introduction method

Example 1: What technologies are used to play games, browse the web, buy the products you want, take a taxi to work, travel and navigate, and order takeaway? The Logo on the home page of the software when running the mobile app, Ali Cloud provides services for Taobao, Baidu Cloud provides computing services for Baidu Maps, Jingdong Cloud provides shopping services for Jingdong, UnionPay Cloud provides payment services for banks, Meituan Cloud provides ordering services for Meituan, and Drip Cloud provides travel services for Drip. So what are Ali Cloud, Baidu Cloud and Meituan Cloud, and what convenience do these technologies provide for our daily life and work?

Example 2: The National Library's immersive reading experience area is showcased through a video that brings the massive amount of content on the cloud to life through real-time interaction in VR, allowing readers to travel through the book scrolls and get a glimpse of the millions of books in the collection.

Example 3: The 2022 Winter Olympic Games made extensive use of cloud computing technology, with IOC President Bach meeting and handing over the torch to the Shanghai Holographic in the closed ring of the Beijing East Olympic Games, a scenario that would only be seen in science fiction, using CloudMe's video cloud technology in cloud computing, so what exactly is cloud computing? How will cloud computing change all aspects of our lives?

Example 4: Before the emergence of cloud computing, enterprises built IT systems through localized deployment. For example, to develop a product sales website by yourself, you first need to vacate a room in the store as a computer room to put the website server, purchase servers, 10,000 Gigabit fiber network, recruit IT engineers to build the environment and operation and maintenance system, and require the developer to build a sales system. If your website is popular and the traffic has reached a high level, then you need to repeatedly purchase dedicated storage servers and network equipment to connect multiple hardware devices, and you must have dedicated personnel to maintain and manage the power and cooling equipment computer room. In order to solve the above pain points, cloud computing services came into being.

Example 5: The East is similar to the "South-North Water Transfer", "West-East Gas Transmission" and "West-East Electricity Transmission" projects, solving the problem of imbalance between resource supply and demand regions. For example, Zhangbei County in Zhangjiakou, Zhongwei and Ulanqab in Ningxia, Tencent built its data centre in a cave in Gui'an, Guiyang, and perhaps the photos you uploaded to the cloud are stored in a cave in Guizhou; in 2018 Microsoft deployed 864 servers to the seabed 35 metres underwater, relying on seawater for heat dissipation; Alibaba in Qiandao Lake, Hangzhou, uses the circular flow of deep lake water to dissipate heat to its servers.

Example 6: In future life, cloud computing will be combined with technologies such as artificial intelligence, big data, and the Internet of Things. And all home appliances and other items will be connected to the Internet. For example, the smart bed wakes you up in the morning and reminds you of today's weather. The refrigerator screen shows your food inventory and provides suggestions for replenishing it, and the smart watches can remind the elderly of their health. All of the above require the support of cloud computing technology.

4.2 Inspirational introduction method

Example: According to Gartner's latest IT Service Market Share 2020, of the top three global cloud computing IaaS markets - Amazon, Microsoft and Aliyun - Aliyun is growing at the brightest rate, with its share nearly tripling in the past five years.

4.3 Introduction by analogy

Example: Cloud computing services are analogous to gas, water and electricity, easy access and low cost. Large enterprises build massive data centres, centralize and transform computer resources such as hardware, servers and storage devices into service products, sell hardware resources in software mode, so that computing power is also sold like a commodity, and ordinary users use these computing powers online through the network at a distance, and you pay for how many resources you use You pay for what you use.

4.4 Question-based introduction

The questions asked are closely aligned to the lesson objectives and trigger students' thinking so that they are all able to actively participate in the lesson and lesson discussions.

5. Teaching models

The Cloud Computing course is taught in a hybrid online and offline and flipped classroom format. The course requires students to master the core technologies of cloud computing and the deployment of different types of applications on cloud platforms, and requires students to read a large amount of research on the latest technologies and trends related to cloud computing in addition to the textbook^[5-8].

5.1 Online teaching

The online teaching platform provides all the learning materials related to the course, including learning videos, learning courseware, methods of using the cloud platform, technical methods of deploying applications in the cloud platform and course assessment requirements, so that students can access all aspects of the course resources and learning methods through the online teaching platform.

5.2 Off-line teaching

While the course is delivered offline, the live online recording via the pinned group allows you to keep the lecture as part of the course resources.

5.3 Flipping the Classroom

The teaching objectives of this course are to understand the definition and characteristics of cloud computing, data centres, the East Digital and West Computing Project; to understand the key technologies of cloud computing, and the applications of cloud computing and big data. Therefore, before class, the teaching platform releases students' pre-study tasks for this course, and students need to consult a lot of relevant literature in advance to complete the pre-study of knowledge points; in the classroom, the teacher not only teaches the knowledge points in the form of lectures, but also arranges several students to present pre-study cases in advance for each course, and the focus of the

class changes to the interaction between the teacher and students, so as to achieve the teaching objectives of this course. In this way students not only grasp the teaching examples prepared by the teacher for the lesson, but through the presentation of student examples, the students' horizons are further expanded and they are able to focus more on active project-based learning, enabling them to learn actively.

6. Resource building

All teaching materials and learning resources of the course have been uploaded to the online classroom platform. Teaching resources mainly include: lesson plans, teaching knowledge micro-video, teaching PPT, audio and video materials, graphic materials, course assignments, course cases, etc. At the same time, the course announcement is issued to inform students of the relevant requirements for course learning and assessment, and students can preview the course according to the teaching resources provided by the teaching platform.

7. Main content

This case study is designed to teach.

1) The concept of cloud services is introduced through the mobile app that everyone can't live without.

2) The National Library Immersive Reading Experience Zone video showcases the 2022 Winter Olympics fully in the cloud, illustrating through the above examples the practical application of cloud computing technology, what changes cloud computing will have on various aspects of our lives, and what specific technologies are included.

3) It is easier for students to understand cloud services by comparing them to power generation services in power plants. Large enterprises build massive data centres, centralise and transform computer resources such as hardware, servers and storage devices into service products, sell hardware resources in a software model, so that computing power is also sold like a commodity, and ordinary users use these computing powers online over long distances via the internet, and you pay as much as you use the resources, i.e. pay as you go, just like gas, water and electricity. Easy access and low cost.

4) Students will understand the model of cloud services through the difference between the local and cloud deployment models of IT systems before and after the emergence of cloud computing.

5) The analogy of the "South-North Water Transfer" project to the East and West Computing project leads to the construction of data centres, the infrastructure for cloud computing services. Considering the above three key factors for data centre construction and operation: land, power supply and climate conditions, the Internet majors will build their data centres in geographic locations where land is sparsely populated, supported by clean power and with low temperatures.

6) Cloud computing in China is becoming a global leader, with China being one of the world's largest and fastest growing markets. Of the top three in the global cloud IaaS market, Amazon, Microsoft and AliCloud, AliCloud is growing at the brightest rate, with its share nearly tripling in the past five years.

7) The KubeSphere container platform, an open source project of China's Qingyun Technology, has become an open source container platform with world-class impact, a process that cannot be achieved without a spirit of excellence.

8) Demonstrating the impact of cloud computing combined with technologies such as artificial intelligence, big data and the Internet of Things on the future of life, where all appliances and other items are networked and where computing and technology in the era of artificial intelligence + the Internet of Things need to be supported by cloud computing technology.

9) Although we are a little short of the world's top technology, technology is the first productive force and we have been struggling to catch up, and this year's Olympics on Cloud proved to the world our technological prowess.

8. Implementation process

1) The teaching and learning implementation process is divided into pre-course, in-course and post-course.

Pre-lesson tasks are posted via the course platform before the lesson, student pre-learning information is collected and course assessments are carried out. The lessons focus on teacher-student and student-student interaction to achieve the teaching objectives. The lessons focus on consolidating knowledge, guiding students in extended learning and conducting post-lesson assessments.

2) The teaching and learning implementation process corresponds to the aforementioned teaching and learning design. This case focuses on addressing the key teaching and learning points: key technologies of cloud computing, data centres, East Digital West Computing Project, and service models of cloud computing. It is supported by examples and scenarios, which in turn enhance the effectiveness of classroom teaching.

3) The teaching and learning implementation process highlights curriculum thinking.

Curriculum Civics:

Elements: building cultural confidence and giving a sense of mission of the times to the prosperity of the country through science and technology.

Case: The development of domestic cloud computing - "the more blocked the more powerful", from "stuck neck" to "dominant" The development of Chinese cloud computing has grown over a decade. China's cloud computing has developed and grown over a decade. As early as 2018, Ali Cloud defined its cloud computing and big data strategy, and decided to independently develop its own distributed operating system "Feitian". Domestic companies such as Ali Cloud, Huawei Cloud, Tencent Cloud, Baidu Cloud, Qingyun, Yunhong and Longchao are already mature.

4) The teaching and learning implementation process reflects the assessment of teaching and learning.

Relying on the online platform to strengthen the process evaluation before, during and after class, students' self-assessment and mutual assessment, teachers' inspection and evaluation, and behavioural analysis of teaching and learning are carried out.

9. Evaluation system

In accordance with the engineering accreditation standards and with the objective of orienting students towards the output of their abilities, the assessment mechanism of the achievement of course objectives based on the whole teaching process is completed in accordance with the College's approach to the assessment of the achievement of course objectives. In accordance with the teaching concept based on outcome-oriented education, the evaluation of the achievement of graduation requirements is completed so as to improve the quality of course teaching and the achievement of graduation requirements by students.

The achievement assessment of this case examines the students' pre-reading mastery of the following course objectives: definition and characteristics of cloud computing, data centres, East Digital West Computing Project, key technologies of cloud computing, and applications of cloud computing and big data. Students' understanding of the key technologies of cloud computing and the data centre material presented in class is examined, as well as their understanding of the latest core technologies of cloud computing and their application scenarios. Students will be assessed on

their extended learning of the research content discussed in class after class.

The teaching effectiveness of this case focuses on the achievement of the teaching objectives and the students' satisfaction with the teaching effectiveness. Students actively participate in learning discussions before and after class under the guidance of the teacher, and they master effective learning methods for the cloud computing course, acquire the knowledge required by the course objectives, and expand their knowledge within the course with the course objectives as the focus.

10. Conclusion

This paper takes the construction of a cloud computing course case library as an example and designs the construction of the teaching case library in detail from the aspects of teaching philosophy, teaching objectives, teaching methods, teaching mode, resource construction, teaching implementation process, evaluation system and teaching effect respectively. This paper can provide ideas and references for the design of case banks for big data and computer courses.

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References

- [1] Deng Hua, Song Fuyuan, Fu Ling, Oulu, Yin Hui, Gao Yi, Qin Zheng. A review of data security and privacy protection research in cloud computing environment. *Journal of Hunan University (Natural Science Edition)*, 2022, 49(04):1-10.
- [2] Gu Jie, Hu Wen, Ma Shuang. Research on the spatial pattern, agglomeration mode and innovation effect of cloud computing industry. *Science Research*, 2022, 40(04):619-631.
- [3] Zhang Minmin, Ma Xinqiang. The path of building a multidimensional structure translation case base. *Journal of Jiangxi Normal University (Philosophy and Social Science Edition)*, 2022, 55(03):138-144.
- [4] Fan Shu. Research on the construction and application of a case knowledge base for emergency intelligence systems based on complex networks. *Journal of Intelligence*, 2022, 41(01):39-44.
- [5] Sheng Shu, Huang Qi, Guo Jinjing, Xie Qiwen, Yang Yang. Automatic reasoning model for online health community treatment solutions based on knowledge base and case base. *Intelligence Science*, 2022, 40(05):161-172.
- [6] Wang Yanfu, Wang Miaomiao. Exploring the path of building a bilingual teaching case base. *Educational Theory and Practice*, 2022, 42(09):55-57.
- [7] Li Leo, Liu Kei, Tan Yingling. Exploring the service design of B&B hotels based on swarm intelligence and case reasoning. *Packaging Engineering*, 2022, 43(04):348-356.
- [8] Dai Xiaoi, Shao Huaiyong, Liu Hanhu, Jian Ji, Luo Zhiyong, Tian Shenggui, Yang Wunian. Construction of a case base for teaching GIS Civics on mountain disaster prevention and control. *Journal of Nanjing Normal University (Natural Science Edition)*, 2021, 44(S1):49-56.