Design of Experimental Teaching System for Biochemistry and Molecular Biology in Cloud Course Platform

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Abstract. Biochemistry and molecular biology experiment is an important professional basic experimental course for biology majors, which plays a very important role in the cultivation of practical skills of related majors. Network teaching platform can expand the teaching time and space, and provide a public platform for the release of experimental course resources and the reform and innovation of teaching mode. This paper discusses the establishment of network assisted teaching of Biochemistry and molecular biology experiment course under the network environment combined with cloud course platform. Starting from the training objectives of the course teaching, the online course platform is used to promote the reform of practical teaching.

Keywords: Cloud course · Biochemistry · Molecular biology · Experimental teaching · Network platform

1 Introduction

With the continuous development of network technology, its application in teaching is more and more extensive. The great promoting effect of network teaching on teaching activities and the advantages of network teaching are becoming more and more obvious, which represents a development direction of modern education. In 2015, the Ministry of Education issued the opinions on strengthening the application and management of online open courses in Colleges and universities (Jiao Gao [2015] No. 3), pointing out that it is necessary to accelerate the construction of online open courses and platforms suitable for China's national conditions and promote the application of courses. Network teaching platform can expand teaching space and time, stimulate students' learning enthusiasm and autonomy, and provide a public platform for course construction and network teaching activities for the release of experimental course resources and the reform of teaching mode [1].

With the continuous development of biology, mastering its basic experimental operation technology has become the basic requirement for students majoring in biology, and also provides the necessary practical basis for their follow-up courses. Biochemistry and molecular biology experiment is an important professional basic course for

biology majors. It is an extension of the theoretical teaching of Biochemistry and molecular biology. It is also an important link to master the two theoretical courses. It is a discipline to impart knowledge, train basic skills, and cultivate scientific research ideas and methods. Therefore, the teaching reform of the course should also meet the needs of the development of biology, it plays a very important role in the cultivation of practical skills of biology related professionals, and it is also one of the modes and ways to update educational concepts, actively promote innovative education, and strive to explore the cultivation of innovative talents.

In this paper, based on the online cloud course platform of Higher Education Press, how to establish the network assisted teaching of Biochemistry and molecular biology experiment course is discussed. Starting from the training objectives of course teaching, the online course platform is used to promote practical teaching.

2 Design of Cloud Course Platform System

The cloud course is mainly designed for teachers and students in Colleges and universities. In the design of course platform, the mainstream Web terminal is mainly considered to assist teachers and students to teach. The back-end of cloud course platform is mainly composed of B/S structure and SSH framework. The front end is composed of HT, JavaScript, CSS, J ρ uery, sass and bootstrap. The back-end page template is JSP page. The platform mainly adopts framework to develop, which can avoid repeated class library. Many function libraries have been implemented in popular frameworks, such as control inversion of spring framework and face slicing programming. Using framework can make developers focus on business implementation, and SSH framework also reduces the coupling of the system, When refactoring, extending or adding new functions occurs after the project, the project architecture can also adapt well [2].

Traditional recommendation algorithms mainly include: knowledge-based algorithm recommendation, content-based algorithm recommendation, collaborative filtering and hybrid recommendation. The classification of recommended algorithms is shown in Fig. 1.

This method uses vector to represent the user rating information of the project in the system, and the angle between vectors represents the difference between users. The smaller the angle, the smaller the difference and the higher the similarity. The specific formula for calculating the similarity between u and V is shown in (1).

$$Sim_{uv} = \cos(u, v) = \frac{\sum_{i \in I_{luv}} r_{ui} r_{vi}}{\sqrt{\sum_{i \in I_u} r_{ui}^2} \sqrt{\sum_{i \in I_v} r_{vi}^2}} \tag{1}$$

After calculating the similarity between users, some method is used to filter the target users to form a neighborhood set with similarity. According to the evaluation of adjacent users, the predicted value of target users is given. The prediction scoring formula is shown in (2).

$$P_{ui} = \overline{r_u} + \frac{\sum_{v \in N} sim(u, v) \times (r_{vi} - \overline{r_v})}{\sum_{v \in N} |sim(u, v)|} \tag{2}$$
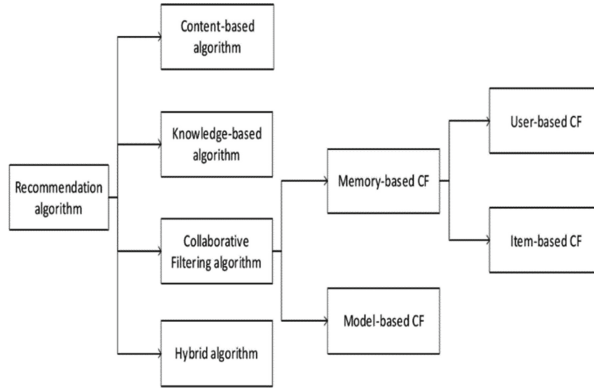
Fig. 1. Classification of recommendation algorithms

3 Increase Network Discussion and Deepen Experimental Understanding

After the experiment, students are required to complete the experiment report in time. One of the important components of the experiment report is the discussion and analysis of the experimental results. In the undergraduate learning stage, through this kind of learning and training, it can provide great help for the future graduate students to analyze and solve problems in the process of study and work, which is conducive to the cultivation of innovation ability [3]. With the network platform, students can discuss the experimental phenomenon on the network in time after completing the experiment.

Online discussion allows students to enter the cloud course platform at any time and place to express their opinions according to the problems set by the teacher, and also to view the views of other students. It provides a communication platform for students to enhance the universality of participation, which can be multi-directional communication between teachers and students, or even between students. At the same time, because the network platform can also upload text files, image files or multimedia files as the support of the argument, it can make the discussion more vivid and intuitive.

After the completion of all the experiments, the students were asked to consult the relevant literature, analyze their own problems, and compare the results of others' experiments, so that students can have an opportunity to show themselves on the platform, promote students' Thinking on the experimental results, and enable teachers to ask questions in person to check their understanding of these problems, At the same time, it enlightens and guides students how to analyze and solve the problems in the experiment by themselves, so as to let students explore extensively, so as to gradually exercise their innovation ability, problem-solving ability and scientific research ability of independently carrying out new experiments.

4 Changing Teaching Concept and Enriching Network Teaching Resources

Network teaching resources can consolidate, supplement and expand the contents of paper-based teaching materials, expand students' knowledge, enhance their awareness and ability to acquire knowledge independently, and promote students' autonomous learning [4].

Network teaching not only brings various advanced ideas, but also increases the workload of teachers. Teachers should become the guide of students' learning. Therefore, teachers need to change their original teaching concepts, organize network teaching effectively, and make extensive and in-depth communication and discussion between teachers and students, and students, so as to fully reflect the interactivity and flexibility of network teaching [5].

With the continuous reform of experimental course content, teaching video should be constantly updated. The teaching team should make corresponding teaching video according to the teaching content, and the video content less than 15 min should be used as the network platform resources, which is conducive to students' watching and learning.

In order to expand students' knowledge, teachers should also pay attention to collecting the development data of various disciplines, timely tracking the new development, so that students can have a better understanding of the subject development, which can also update the knowledge structure of teachers, improve the knowledge system of teachers, improve the teaching effect, and embody the connotation of "teaching and learning benefit each other". With the continuous development of science and technology, timely supplement and update teaching resources is also an important aspect of network assisted teaching mode reform (see Fig. 2).
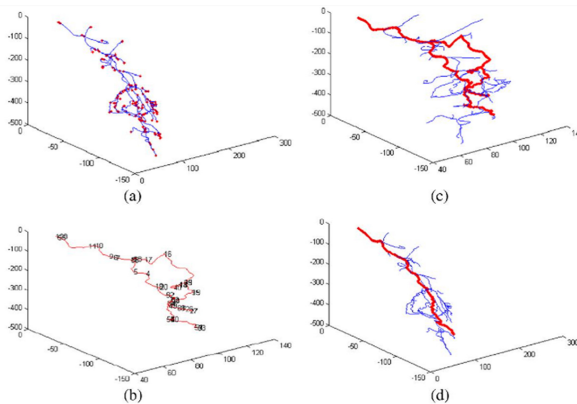

Fig. 2. Simulation for network teaching

5   Aggregation of Cloud Course Platform and Social Media

5.1   Design Concept

Formal learning and informal learning are two independent concepts. It is a formal learning environment with a clear learning goal. Before the concept of informal learning was put forward, the design of network teaching environment was centered on formal learning, also known as virtual learning environment (VLE), which was generally expressed as the hierarchical organization and activity design of learning units. With the continuous change and development of Web2.0 technology and learning philosophy, the network teaching environment with formal learning as the service object increasingly highlights the defects of learners' weak autonomy, lack of learning enthusiasm and low learning efficiency. The design of network teaching environment began to change from the informal learning environment, and the virtual learning environment was gradually replaced by the personal learning environment (PLE). Ple emphasizes that learning comes from the interaction, cooperation and sharing of learners. Learners become the center of all learning activities and master the main control of learning [6].

Based on the concept of integrating formal learning and informal learning, this paper proposes the aggregation mode of cloud course platform and social media. Cloud course platform, which serves for formal learning, is used as an organization platform for teaching activities such as course management, activity design and task arrangement, which provides direction guidance for learners' learning activities and cultivates learners' self-organization ability; social media is used as an auxiliary informal learning place, which allows learners to choose learning tools independently to meet their individual needs, It can control its own learning process at any time; through the aggregation mode, it can break through the boundary between cloud course platform and social media, integrate the advantages of formal learning and informal learning, and form a more perfect and adaptive learning ecosystem [7].

5.2   Design Principles

Based on the above design concept, the teaching environment design of cloud course platform aggregating social media should follow the following principles [8].

(1) In the teaching environment, the guidance and control of teachers to learners is an indispensable part. In the third chapter of the questionnaire survey, most learners pointed out that one of the major factors restricting their use of learning platform is the lack of teacher guidance. Therefore, the teaching environment design of cloud course platform aggregating social media should emphasize the guidance role of teachers in the learning process, which should be reflected in the guidance of the learning process, question answering and other auxiliary teaching levels, rather than surpassing the learners' thinking. The guidance for learning can be implemented in two ways. First, in the formal learning environment, teachers should organize and plan learning objectives, learning contents and learning plans according to different levels, and construct learning scaffolding and templates for learners to set their own learning pace. For example, learners can set learning time according to the curriculum offered by teachers. The second is that teachers can synchronize the updated content of teaching activities to social media to

guide learners in an informal learning environment. For example, the arrangement of activity time can be sent to learners through microblog, or questions can be answered on social networking sites [9].

(2) The principle of autonomy. Personalization, self-management and active participation are the key to effective learning. Therefore, in the construction of teaching environment, we should fully guarantee learners' autonomous management authority, embody the humanistic thought of taking learners as the center, and fully mobilize learners' subjective initiative. Although it is necessary for teachers to guide the learning process, learners can still carry out learning activities in a way of individual autonomy according to their own needs. Learner autonomy is mainly manifested in the following aspects: having the right to choose the use of learning tools and social media; being able to invite other partners to participate in learning discussion or collaborative learning, controlling the nature, process and participants of learning activities; having the right to decide whether individual learning records, discussion activities, comments and other contents are shared, and the choice of sharing objects. In the design of teaching environment, giving learners full autonomy helps to enhance learners' viscosity and interest, and improve learners' participation [10].

(3) Learning extension principle. According to relevance theory, today's knowledge is distributed in a network, and learning is the process of establishing connections among knowledge nodes in the network and transforming the original cognition. Therefore, learners' learning activities should not be limited to a certain platform, but should be transformed into the process of building knowledge network [11]. The design of teaching environment should help learners to find the relationship between knowledge, and constantly improve their personal knowledge system in the process of establishing the relationship. There are many ways to establish association, such as browsing related content, interactive discussion with others, and carrying out collaborative learning around the theme. The premise for learners to explore the relationship between knowledge is to extend learning, let more like-minded people join in learning activities, so that the original learning can spread to other nodes of the network. On this basis, learners can find more content related to learning activities, and establish links with them, so as to obtain a more comprehensive and in-depth understanding of knowledge.

6   Analysis on the Mode of Aggregating Social Media on Cloud Course Platform

6.1   Aggregation Mode of Cloud Course Platform and Social Media

The aggregation mode of cloud course platform and social media is not only a bridge between formal learning and informal learning, but also a key step to extend formal learning to informal learning. Learning is human learning. The extension of learning is inseparable from learners' subjective initiative. Learners' own social relations play a very important role in the transfer of learning. Professor Wilson (2008) emphasized the importance of social relations to the construction of teaching environment when redefining the teaching environment. He believed that the essence of social relations network is a collection of people, services and resources distributed in each node of the

network. The establishment of teaching environment is to establish association between these elements through learning tools, extend learners' learning activities, and form a social learning network [12]. The aggregation mode of cloud course platform and social media is shown in Fig. 3.
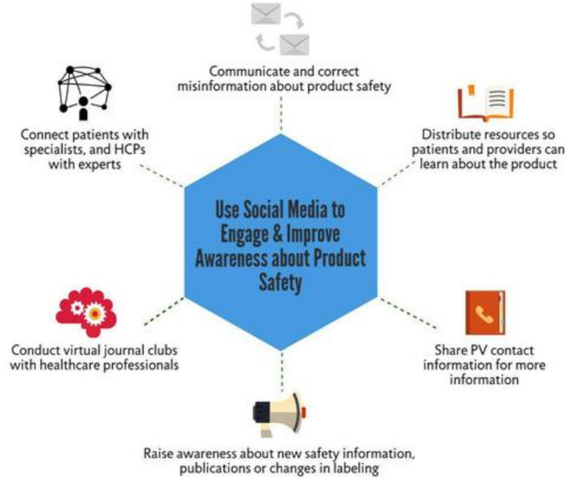

Fig. 3. Aggregation mode of cloud course platform and social media

6.2 Aggregation form of Cloud Course Platform and Social Media

The aggregation of cloud course platform and social media is based on mashup technology, which is mainly divided into two forms: content level aggregation and service level aggregation [13].

(1) The essence of content aggregation is the re organization of learning resources. Through the integration and presentation of relevant content, it can reduce learners' cognitive load and knowledge confusion in the face of massive resources, and reconstruct the application value of learning resources. In this paper, the aggregation form of content level is mainly the aggregation of blog and content sharing social media [14].

Content sharing social media provides rich learning resources, including videos, documents, pictures, slides and other types. It can make abstract concepts vivid and concrete, so as to arouse learners' interest. Content sharing social media is an effective medium to present structured courses. Effectively aggregating the learning content in this kind of social media into the cloud course platform can not only simplify the construction process of the course platform, but also realize the reuse and sharing of high-quality resources [15].

(2) The aggregation of service level is in cloud computing environment. Any business model that takes the Internet as the carrier and delivers and uses applications in the form of services can be regarded as SAS (software service) mode. From this perspective, all kinds of online social media are a service mode [16]. In the concept of SOA, the

functions of social media can be divided into multiple reusable and loose coupling service components, and can be packaged in the form of web service, and exposed to interface form through interface adapter. At present, most social media have disclosed their own API interfaces, such as user interface, relationship interface, friend grouping interface, user tag interface, search interface, etc. developers can easily call the required service interface and aggregate with other services to generate new service content. In addition to calling API interface, we can also use widget form to realize social media service aggregation some social media experience encapsulates common functions into widget components for developers to use. Because widget is implemented based on JavaScript and HTML, it can be embedded directly into web pages. Even if the programming ability is weak, developers can quickly master it, and can deploy multiple widget components in the same page as needed. When the widget provided by social media cannot meet the personal needs, the services required can also be packaged through widget API and uniformly scheduled on each page [17].

7 Architecture Design of Cloud Course Platform Aggregating Social Media

With the advent of the cloud era, computing power has become a service model that is ready to use. Cloud computing provides users with the most operational and collaborative technology platform, so that users can get rid of the shackles of technical ability and greatly reduce the complexity of application system development. In this paper, the aggregation of the course platform and social media is deployed on the cloud computing platform. The whole architecture is divided into four layers: infrastructure layer, application interface layer, application layer and user layer.

The infrastructure layer, also known as Las layer, mainly provides computing, data storage, network communication and other infrastructure resources (including physical hardware resources and virtualization resources) for high-level. Server, storage, network and so on are highly scalable services, which are provided to users in the way of on-demand distribution. The infrastructure layer provides dynamic and scalable underlying resources for the aggregation of cloud course platform and social media. In the development process, there is no need to care about the implementation details of the top-level hardware of the server, and there is no need to control the bottom hardware details, thus saving the allocation and maintenance costs of software and hardware resources. The application interface layer, or PAs layer, is the link between the application layer and the infrastructure layer. It directly faces the developers and provides an Internet-based application development and execution environment, including the running platform and the interface service application layer encapsulated by the bottom layer cloud computing capability, namely SaaS layer. It is also the presentation of cloud course platform and social media aggregation mode. Cloud course platform is the central platform for learners to carry out teaching activities. The aggregation of social media provides all kinds of learning support services for cloud course platform, and supports and expands functions for learners' knowledge acquisition, knowledge retention, knowledge representation, and conversion of explicit and implicit knowledge, connecting formal learning and informal learning environment. Learners can access the cloud course platform from

the Internet and connect with social media through account binding. While learning in the cloud course platform, they can share and push resources to the selected social media, so that learning activities can continue to be maintained outside the cloud course platform, which is helpful for learners to explore learning community in a wider network, and then promote the formation of social learning network. At the same time, teachers can make use of the push mechanism of the cloud course platform to synchronize the updated information of the course to the social media, so that learners can effectively master the learning process in any environment. In addition, the content of social media will also be aggregated in the cloud course platform, which will avoid the dilemma of learners looking for useful resources in the vast ocean of information, and discover the new value of knowledge in the gathering of information. The user layer is the highest level of the whole architecture, directly facing the end users.

8   Conclusion

"Higher education law" points out that "the task of higher education is to cultivate high-level specialized personnel with innovative spirit and practical ability, develop science and technology culture, and promote socialist modernization construction". Therefore, modern higher education advocates strengthening the practice link and cultivating students' innovative spirit and ability. On the basis of strengthening scientific research training, the experimental teaching platform for cultivating high-quality innovative talents should be built, students' subjective initiative should be mobilized, students' strong desire for knowledge should be induced, and students' innovative ability should be cultivated. This paper explores the teaching reform of Biochemistry and molecular biology experiment from the aspects of enriching teaching content, expanding teaching methods and optimizing network resources, and constantly enriches and improves in teaching practice. Only in this way can we better mobilize students' learning ability.

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