



Design of Online Teaching Assistant Platform for Technical Courses of Physical Education Specialty

Changmin Lv^(✉), Shujun Zhang, Yingying Huang, and Mengyang Liu

Zibo Normal College, Zibo 255100, China

lsj56980@tom.com

Abstract. In order to increase the number of online users that can be accommodated by the physical education teaching auxiliary platform, so as to improve the actual teaching ability of physical education technology courses, an online teaching auxiliary platform for physical education professional technology courses is designed. The B/S three-tier architecture is used to provide the necessary conditions for the connection of database application structure and teaching process management module, and complete the overall design of physical education online teaching auxiliary platform. On this basis, set the key session interface, calculate the specific value of the weight of the evaluation index through the way of curriculum standardization, complete the online evaluation of the technical courses of physical education, and then combine the relevant hardware equipment structure to realize the design and application of the online teaching auxiliary platform of the technical courses of physical education. The experimental results show that, compared with the traditional online teaching system, with the application of teaching assistance platform, the number of logged in online users has increased significantly, which can play a strong role in promoting the actual teaching ability of physical education technology courses.

Keywords: Physical education · Professional courses · Online teaching · Auxiliary platform · B/S architecture · Database

1 Introduction

As the name suggests, online teaching is a teaching method based on the network. Through the network, students and teachers can carry out teaching activities even if they are thousands of miles apart; In addition, with the help of network courseware, students can learn anytime and anywhere, which really breaks the restrictions of time and space. For workplace people with busy work and uncertain learning time, network distance education is the most convenient way of learning [1]. With the rapid development of information technology, especially from the Internet to mobile Internet, a cross time and space way of life, work and learning has been created, which has fundamentally changed the way of knowledge acquisition. Teaching and learning can be free from the

restrictions of time, space and place, and the channels of knowledge acquisition are flexible and diversified. Online education platform, i.e. online training system, is a tool software for implementing online training and online education. It is a distance online education college that can be customized and expanded by using network technology and software technology. It helps the government, industry or enterprises quickly establish their own proprietary knowledge base system through simple and easy-to-use courseware and test question introduction and production functions, and provides training demand investigation, training goal setting, curriculum system design, training plan management, training process monitoring and assessment evaluation to help customers effectively implement employee training and assessment tasks.

With the rapid development of computer technology and broadband network technology, great changes have taken place in people's work style, life style and learning style. At the same time, a profound change is also quietly carried out in the field of education. Computer network learning goes deep into the school and all aspects of teaching, which has promoted the qualitative change of teaching mode and educational concept. In the traditional teaching mode of physical education, the main task of students is to listen to the teacher's explanation and complete the cognition of knowledge; The main task of teachers is to study the teaching materials, complete the teaching plan and design the teaching process according to the content of the teaching materials. This model highlights the role and guidance of teaching materials, highlights the dominant position of teachers, and ignores students' subjective initiative [2]. The online teaching platform, the use of network advantages, according to the main content of physical education classroom teaching, combined with the latest computer, multimedia and other technologies, in the teaching process to create the scene and method to guide students to learn, make the teaching resources in a more diversified, flexible way, vividly displayed. Beyond the limitation of time and space, it provides a platform for students to study independently after class, review and test; Provide a platform for teachers to integrate teaching resources and teach students according to their aptitude; Provide a platform for teachers and students to communicate in time. Based on these innovative points, online network teaching auxiliary platform has become the favored professional course teaching mode of colleges and universities.

2 Overall Design of Physical Education Online Teaching Auxiliary Platform

The hardware execution environment of online teaching assistant platform is based on B/S three-tier architecture, and can realize the adjustment and planning of course progress under the action of database application structure and teaching process management module. The specific design methods are as follows.

2.1 B/S Three-Tier Architecture

The online teaching auxiliary platform for technical courses of physical education specialty adopts the three-tier architecture design of B/S mode, namely user layer, business layer and data layer. The specific architecture mode is shown in Fig. 1.

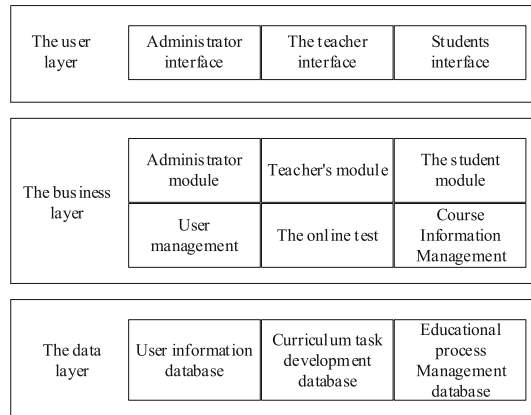


Fig. 1. B/S architecture of online teaching assistant platform

According to Fig. 1, the B/S architecture of online teaching assistance platform can be divided into:

User Layer

Teachers and students can interact with the system through the presentation layer to complete the required operations. Different users have different permissions, and they can access different interfaces, including administrator interface, teacher interface and student interface. The presentation layer is realized through WebForms of ASP.NET and adopts the way of browser, making the interface friendly and easy to use.

Business Layer

The business layer is the bridge between the presentation layer and the data access layer. It contains the logic related to the tasks of the core physical education curriculum. It is composed of many modules, which are stored on the server side according to different functions. The business logic layer in this auxiliary platform includes administrator module, teacher module and student module, each module is composed of different contents such as user management, online test and course information management. The business logic layer is connected to the data access layer through ADO.NET controls.

Data Layer

Data layer is the basis for the realization of online teaching assistance platform, which is composed of user information database, curriculum task formulation database, education process management database, etc. [3]. The user information database mainly includes the basic information of administrators, teachers and students. The curriculum task formulation database provides data support for the online test module, including student numbers, educational course options, etc. The message forum database provides data support for the message forum module, including the content composition of the post number and post type.

B/S is a network architecture, also known as browser/server architecture. In this mode, WEB browser is the main application structure of online teaching assistance

platform. It unified the client and centralized most of the system functions on the server, greatly simplifying the process of platform development, platform maintenance and platform application.

2.2 Database Application Structure

The demand analysis of online teaching assistant platform database is to analyze the needs of teachers and students. It is mainly to collect information, analyze and sort out the information, so as to provide guarantee for the follow-up professional and technical courses of physical education. It is the most difficult and time-consuming stage in the whole design process, but it is the basis of the design process; It is the starting point of database design, but it affects the design of other stages of the whole. It requires a comprehensive and detailed investigation of the specific situation of curriculum application, and then collect the needs, basic data and data flow of teachers and students according to the overall design goal of the auxiliary platform. It includes three stages of demand information collection, analysis and review [4].

The construction of database application structure must follow the following design principles: the teaching auxiliary host must be able to express the needs of teachers and student users in rich languages, including describing the relationship between various things, and can quickly establish the course service mapping relationship between data layer server and business layer server. On the one hand, it can realize the proper arrangement of physical education professional and technical courses, On the other hand, it can also increase the number of real-time connections of online users, so as to effectively ensure the educational effect of online courses. Figure 2 reflects the complete E-R diagram structure of online teaching auxiliary platform database.

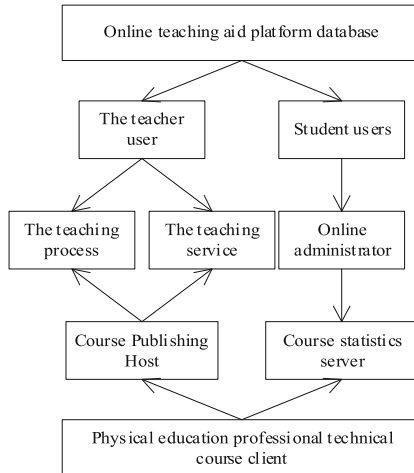


Fig. 2. E-R diagram of database of online teaching auxiliary platform

As can be seen from Fig. 2, the database application structure must have strong adaptability because the physical education online teaching curriculum arrangement always presents a constantly changing existence state.

2.3 Teaching Process Management Module

In order to facilitate PE Teachers' users to manage the teaching process, teachers can build an automatic notification system based on Google calendar on the teaching assistance platform. The specific methods are as follows: ① Teachers use Google account to create Google Calendar, add daily teaching arrangements and work items, and set three reminder methods of e-mail, pop-up window and SMS for personal schedule management [5]. ② Teachers import contact information from Gmail address book and set different sharing permissions for students and colleagues in the calendar. For example, students only have permission to view teaching arrangements, while colleagues have permission to view and modify work matters. ③ For student cadres who need to contact frequently for notification, guide them to create Google Calendar and open SMS reminder. In this way, once they encounter notification matters such as teaching arrangement adjustment and homework assignment, teachers only need to modify the schedule content in the calendar, and Google Calendar can automatically send reminder SMS to shared users in advance to realize the automatic notification function [6]. ④ For work matters such as meetings that require colleagues to participate in cooperation, teachers can send an invitation notice to relevant personnel in advance by "sending it to a friend". Gmail email will automatically update the calendar content after receiving the confirmation information, which is convenient for teachers to arrange their daily work.

3 Online Evaluation of Technical Courses of Physical Education Specialty

3.1 Session Interface Settings

Session interface is the most important interface for the online teaching auxiliary platform of technical courses of physical education specialty. However, in the application platform system, the instantiated session is a lightweight class. Creating and destroying it will not occupy a lot of resources. This is really important in the actual project, because in the client program, session objects may be created and destroyed continuously. If the cost of session is too large, it will have an adverse impact on the system. But it is worth noting that the session object is non thread safe, so in your design, it is best for a thread to create only one session object.

Under the function of the online teaching assistant platform for technical courses of physical education specialty, session can be regarded as an intermediate interface between data connection and transaction management. Teachers and users can imagine a session as a buffer of persistent objects. Hibernate can detect the changes of these persistent objects and refresh the database in time [7]. In specific teaching cases, the session interface can also be regarded as a persistence layer manager, because it contains some persistence layer related operations, such as storing persistent objects to the database

and obtaining them from the database. Hibernate session is different from httpsession in JSP Application. When the term session must be used, the platform host refers to the session in Hibernate, and all subordinate application nodes can be called user sessions. It is worth noting that session is not thread safe. Therefore, when designing software architecture, multiple threads should be avoided sharing the same session instance.

Let r and p represent two different interface setting parameters. For the online teaching auxiliary platform of physical education technical courses, the inequality condition of $p > r$ is always true. u_r represents the session interface marking coefficient when the parameter value is r , u_p represents the session interface marking coefficient when the parameter value is p , i represents the coding characteristic value of physical education professional and technical courses, β represents the practice coefficient of educational courses, and \bar{y} represents the average value of course practice. By combining the above physical quantities, the session interface setting standard can be defined as:

$$W = \frac{\left(\prod_{r=1}^p u_p - u_r \right)^2}{\sum_{i=1}^{+\infty} |\beta \cdot \bar{y}|^2} \quad (1)$$

When setting the session interface, it is stipulated that the value of the minimum practical quantity of physical education professional technical courses must be greater than the physical natural number “1”.

3.2 Course Standardization

Because the meaning of each curriculum evaluation index is different from each other, and the form of expression is also different. Some are absolute indicators. Some are relative indicators, others are average indicators; The function trend of technical course teaching of physical education specialty is also inconsistent, some belong to positive indicators, some belong to inverse indicators, and there is no comparability between various indicators [8]. If the so-called standardized treatment or dimensionless treatment is not carried out, the comprehensive evaluation cannot be carried out, and the real significance and value of the comprehensive evaluation will be lost.

The standardized treatment of teaching evaluation indicators of technical courses of physical education specialty is to eliminate the dimensional (unit) influence of indicators through certain mathematical transformation, that is, to transform indicators with different properties and dimensions into a relative number – quantitative value that can be integrated. Theoretically, the standardized treatment of teaching evaluation indicators of technical courses of physical education specialty is very important, but in practice, people often ignore its importance, ignore the nature and significance of various indicators, simplify the treatment methods, and are used to adopting linear treatment methods. Of course, according to the nature of some indicators, the change of the actual value causes a corresponding proportional change of the quantitative value. It is understandable to use the linear processing method, but for most indicators, the impact of the change of the actual value of the indicators on the change of the quantitative value is not equal.

Let ΔT represent the unit performance duration of physical education professional and technical course evaluation, χ represent the online teaching coefficient index, λ represent the auxiliary teaching characteristic value, and $\hat{\phi}$ represent the online teaching practice expression coefficient of physical education professional and technical course, s_1 and s_2 represent the practice quantity of two different physical education online teaching courses, $s_1 \neq s_2$, and for the auxiliary application platform, the inequality condition is always true. With the support of the above physical quantities, the result of course standardization can be expressed as follows by simultaneous formula (2):

$$Q = \frac{\lambda W - \inf(\hat{\phi})}{\sup^2(s_2 - s_1) / \chi \cdot |\Delta T|} \quad (2)$$

In order to ensure the effectiveness of technical courses of physical education specialty, the design of online teaching auxiliary platform must refer to the numerical calculation results of course standardization.

3.3 Evaluation Index Weight

In order to quantify the implementation process of technical courses of physical education specialty, the weight of evaluation indicators must establish corresponding quantitative tools. Its foundation is extension set theory, which includes extension set theory, correlation function and extension relationship. In extenics, the concept of “correlation function” is established. Through the correlation function, the degree and change of elements with certain properties can be described quantitatively. That is, the elements belonging to the same domain can also be divided into different levels according to the value of the correlation function, and the relationship of “within class, i.e. same class, i.e. different” can be developed into “within class, i.e. different levels”. In order to reflect this property, the correlation function on the real axis is established, and the concept of the highest application level in the real variable function is extended to the concept of distance, which is the basis for expanding the qualitative description to the quantitative description.

Let ΔA represent the transfer amount of physical education courses per unit time, α represent the minimum teaching evaluation index, ω represent the maximum value result of α index, and m and n represent two different quantitative evaluation coefficients, For the online teaching auxiliary platform for technical courses of physical education specialty, the inequality condition of $m \neq n$ is always true, l_m represents the physical education curriculum practice weight value when the quantitative evaluation coefficient is m , l_n represents the physical education curriculum practice weight value when the quantitative evaluation coefficient is n , μ represents the quantitative evaluation difference, and ξ represents the scalar of online teaching knowledge, h indicates supplementary education indicators. With the support of the above physical quantities, the calculation result of the evaluation index weight of the online teaching auxiliary platform of physical education professional and technical courses can be expressed as:

$$K = \sum_{\alpha=1}^{\omega} Q \frac{|l_m^2 - l_n^2|^{\mu-1}}{\Delta A / |(\xi - 1)^2 \times \sqrt{h}|} \quad (3)$$

So far, the calculation and processing of various physical coefficient indexes are completed, and the design and application of online teaching auxiliary platform for technical courses of physical education specialty are realized without considering other interference conditions.

4 Case Analysis

In order to verify the practical application value of online teaching auxiliary platform for technical courses of physical education specialty, the following comparative experiment is designed. The experimental environment is Intel Core (TM) i5 -4590@3.30 GHz, the memory is 16 GB, the development language is Python, the programming environment is Eclipse4.2. The specific experimental process is as follows:

Step 1: Select two Internet computers with exactly the same configuration as the experimental object;

Step 2: Input the new online teaching auxiliary platform into the computer of the experimental group and the traditional online teaching system into the computer of the control group;

Step 3: Control the system connection time of the experimental group and the control group to be consistent, so that the students majoring in physical education can freely access the above teaching host;

Step 4: Analyze the actual changes in the number of online users in the experimental group and the control group.

Figure 3 reflects the numerical recording results of the number of online users under ideal conditions.

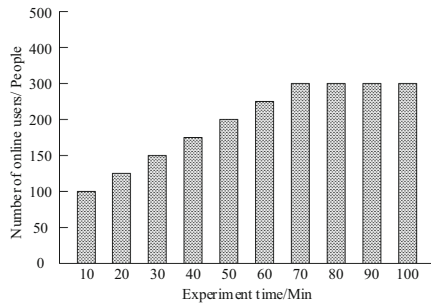


Fig. 3. Ideal number of online users

It can be seen from the analysis of Fig. 3 that before the experimental time reaches 70 min, the number of access users of physical education online teaching platform always keeps increasing, and the unit increase range is exactly the same; When the experimental time is between 70–100 min, the number of access users of physical education online teaching platform always maintains an absolutely stable numerical state; In the whole

experimental process, the maximum number of sports online teaching platform access users was 300, which increased by 200 compared with the minimum number of 100.

Table 1 records the actual changes in the number of online users in the experimental group and the control group.

Table 1. Experimental values of the number of online users (group I)

Experiment time/Min	Number of online users/Person	
	The experimental group	The control group
10	100	100
20	160	117
30	213	144
40	272	196
50	304	225
60	355	270
70	407	292
80	460	322
90	514	341
100	554	367

It can be seen from Table 1 that during the first group of experiments, the number of users connected to the physical education online teaching platform in the experimental group and the control group kept increasing, but the increase in the experimental group was significantly greater than that in the control group. From the perspective of limit value, the maximum value of 554 in the experimental group increased by 254 compared with the ideal maximum value of 300; Compared with the ideal maximum value of 300, the maximum value of 367 in the control group increased by 67, which was much smaller than that in the experimental group.

It can be seen from the analysis of Table 2 that during the second group of experiments, the number of online teaching platform access users in the experimental group and the control group also maintained an increasing numerical change trend, but the overall increase was less than that in the first group. From the perspective of limit value, the maximum value of 503 in the experimental group increased by 203 compared with the ideal maximum value of 300; Compared with the ideal maximum of 300, the maximum value of 304 in the control group increased by 4, and the increase range is still less than that in the experimental group.

To sum up, with the application of the new online teaching assistance platform for physical education professional and technical courses, the number of connected online users does show a significant increase in numerical change trend, which can play a strong role in promoting the actual teaching ability of physical education technology courses and meet the actual application requirements.

Table 2. Experimental values of the number of online users (Group II)

Experiment time/Min	Number of online users/Person	
	The experimental group	The control group
10	100	100
20	154	108
30	204	130
40	251	141
50	302	170
60	343	193
70	397	221
80	426	270
90	485	286
100	503	304

5 Conclusion

Compared with the traditional online teaching system, the new online teaching auxiliary platform for technical courses of physical education specialty, with the support of B/S three-tier architecture system, improves the connection ability of database application structure and teaching process management module, and calculates the specific value of evaluation index weight by setting session interface. From the practical point of view, with the application of this new auxiliary platform, the numerical level of the number of online users shows a trend of appropriately increasing, which can effectively improve the actual teaching ability of sports technology courses, play an important role in promoting, and meet the needs of practical application.

References

1. Huang, J.: Successes and challenges: online teaching and learning of chemistry in higher education in china in the time of COVID-19. *J. Chem. Educ.* **97**(9), 2810–2814 (2020)
2. Jeffery, K.A., Bauer, C.F.: Students' responses to emergency remote online teaching reveal critical factors for all teaching. *J. Chem. Educ.* **97**(9), 2472–2485 (2020)
3. Andrada, A., Murdocca, R.M., Dondo, J., et al.: Didactic prototype for teaching the MQTT protocol based on free hardware boards and node-RED. *IEEE Lat. Am. Trans.* **18**(2), 376–382 (2020)
4. Baker, R.M., Leonard, M.E., Milosavljevic, B.H.: The sudden switch to online teaching of an upper-level experimental physical chemistry course: challenges and solutions. *J. Chem. Educ.* **97**(9), 3097–3101 (2020)
5. Mussig, J., Clark, A., Hoermann, S., et al.: Imparting materials science knowledge in the field of the crystal structure of metals in times of online teaching: a novel online laboratory teaching concept with an augmented reality application. *J. Chem. Educ.* **97**(9), 2643–2650 (2020)

6. Rodic, M.V., Rodic, D.D.: Plans vs Reality: reflections on chemical crystallography online teaching during COVID-19. *J. Chem. Educ.* **97**(9), 3038–3041 (2020)
7. Hermanns, J., Schmidt, B., Glowinski, I., et al.: Online teaching in the course “Organic Chemistry” for nonmajor chemistry students: from necessity to opportunity. *J. Chem. Educ.* **97**(9), 3140–3146 (2020)
8. Yan, X.X., An, X.W., Dai, W.B., Sun, N.L.: Image segmentation teaching system based on virtual scene fusion. *Comput. Simul.* **38**(4), 331–337 (2021)