Construction of Online Open Distance Teaching Platform for Meridians and Acupoints of TCM

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Abstract. In the traditional teaching platform, because the function of the platform is not perfect, the interaction of the platform is poor, and the response time of the platform is affected. Through setting up self-study function and micro-courseware teaching function, self-study course of the platform is completed, and through setting up videotape course, live broadcast course and online discussion mode, the teaching of meeting course is optimized to realize the optimization of SPOC network to the online teaching function of the Aike platform. Through adjusting the formula of error function and pixel resolution, the teaching environment is established, and the interaction between students and the platform is realized by transforming the human model of TCM meridians and acupoints. Experimental results: Compared with the three groups of traditional platforms, the platform is more interactive and has a faster response time when facing the same teaching content.

Keywords: TCM meridians and acupoints · Online remote · Open teaching platform · The human body model

1 Introduction

Online teaching, also known as distance education, realizes any learner's personalized learning task at his own pace at any time and at any place through the Internet, and the virtual learning community it provides also makes the communication and interaction between teachers and students, learners quick and convenient. It is a new type of education method that combines flexibility, initiative, creativity and interaction in one. It has the characteristics of individualized learning, information transmission of teaching information and popularization of educational objects. The science of meridians and acupoints is the basic theory and core content of acupuncture and moxibustion, which is composed of the science of meridians and collateral and the science of acupoints [1]. Meridian, which relates to the physiology, pathology, diagnosis and treatment of TCM, is of great significance to acupuncture and other clinical subjects of TCM. The science of acupoints is a subject which is guided by the meridian theory and expatiates on the distribution, function and clinical application of acupoints. As one of the classic disciplines

W. Fu et al. (Eds.): eLEOT 2021, LNICST 389, pp. 489–501, 2021.
https://doi.org/10.1007/978-3-030-84383-0_42

of TCM, the science of meridians and collaterals and acupoints has been concerned by people all over the world. With the progress of the times, traditional classroom teaching alone can not meet the demand of today's learning [2]. With the help of online education platforms, we can break traditional classroom teaching on time, space and personnel constraints, so that more people have the opportunity to understand account knowledge. At the same time, the online teaching of meridian and acupoint science also provides a good way for students to selectively learn independently before and after class and to communicate with teachers conveniently.

At present, many colleges and universities of TCM are organizing a large number of professional manpower and material resources to develop and build an online teaching platform of meridian and acupoint science. Although many schools have obtained or are applying for the construction of state-level, provincial level and school-level excellent courses in the study of meridians and acupoints, there are also teaching syllabuses, related courseware, video recordings of teachers' lectures and so on for this course on their excellent course websites in the study of meridians and acupoints. Some also include teaching notes and exercise questions, which are conducive to students' systematic and standardized knowledge learning, induction and consolidation [3]. However, the online teaching content is mainly based on the mode of "courseware teaching video", with a single and boring form, which is only open to teachers and students, lacks vitality and communication, and cannot show the advantages of open sharing of resources and convenient and free exchange between teachers and students.

Therefore, this paper studies the construction method of a new online open teaching platform for TCM meridians and acupoints.

2 Establishing an Online Open Teaching Platform for Meridians and Acupoints of Traditional Chinese Medicine

2.1 The Online Teaching Function of AIKE Platform is Set up Based on SPOC Network

The teaching plan of TCM meridian and acupoints is based on 4 meridians as a teaching unit, including 2 self-study courses online, 2 meetings offline and 1 practice of acupoint pointing. In order to realize the online distance open teaching task, the online teaching mode of the distance teaching platform is adjusted. Therefore, the SPOC network teaching of the teaching platform should adjust the online teaching content according to the students' self-study status in time to ensure the students can study "Acupoint Study of Meridians" at home.

First, set up a platform for self-study courses. Online autonomous learning is "student-centered", which includes four links: self-study, micro-teaching, cooperation and mutual study, and online test. The self-study course of SPOC teaching platform of "Acupoint Study of Meridians and Collaterals" is mainly online study. Teachers use the platform to upload videos and Scorm courseware to guide students to learn the contents of meridians and acupoints, and make video recordings and live broadcasts to assist students to learn, "self-learning" and "micro-learning". On the Aike Teaching Support Platform, set up a "Self-Study Question Area" to guide students to publish learning

postings about difficulties and puzzles encountered in self-study or experience sharing, so that teachers and students can discuss with each other and realize "cooperation and mutual learning". In addition, the teacher will test questions embedded in the Scorm courseware, in each unit, after the setting of the relevant homework and tests, complete the "online test" link. Therefore, on the self-study function of the platform, teachers upload relevant learning materials on the Aike teaching support platform, including electronic version of textbooks, Scorn courseware and bilingual teaching. After downloading the electronic version of the textbook and syllabus, students will understand the original text of the textbook and the learning requirements of each chapter, and use the scorm courseware to learn the basic contents of the course, such as the understanding of the original text of the circulation of channels and the application of specific points. After mastering the basic knowledge of books, students can watch the video of acupoint pointing to deepen the memory of acupoint positioning. Students who have the ability to learn can use bilingual teaching materials to learn the English expressions of meridians and collaterals and acupoints, so as to conduct multi-way and all-round self-study. Secondly, the platform is designed to help the teaching function. Online teaching with prominent teaching theme. Because the course is usually presented by short video, and the topic is prominent, it has the characteristics of fragmentation of knowledge points, such as rehabilitation and health care methods about acupoints, acupoints selection methods and so on, it can let students learn new knowledge intuitively and strengthen the absorption of new knowledge.

In addition, the length of the video teaching can be looked at indefinitely, there is no time limit, and the time arrangement is relatively loose, which is convenient for students to make use of spare time to study independently according to the actual situation and their own needs, strengthen the flexibility of self-study, and construct the knowledge of meridians and acupoints preliminarily. Also in the cooperation mutual study aspect, the student who can not understand question may through "the self-study discussion question area" carries on the post question. Other students can answer the questions according to the book knowledge, or by consulting the literature, not only relieving others of the confusion encountered in self-study, but also enriching their own acupuncture knowledge [4]. In addition to the problems encountered in self-study, teachers can guide students to express their views on acupoints learning, such as "small tips on acupoints positioning memory", "personal views on the essence of meridians" and so on. In order to strengthen online mutual help and mutual learning.

Through the backstage data of Aike Teaching Support Platform, the teaching team counts the times each student speaks, and adds corresponding scores to the students according to the number of questions and answers. Online discussion can not only stimulate students' inner drive and promote them to reflect on their own self-study, but also deepen the knowledge structure of acupuncture, form a good class atmosphere and realize "cooperation and mutual learning". Finally, in order to let the students master and apply the knowledge of acupoints further, the teacher arranges the network homework and test on the Aike platform to carry on the "online test". Assignments and exams submitted by students will be graded accordingly. According to the students' grades, the teaching team understands the situation of students' mastering meridians and collaterals, and summarizes the problems existing in students' self-study. The teacher guides the

students to think and discuss these questions in the online meeting class, and strengthens the students' self-study effect.

Second, set up a platform for meeting courses. Online teaching has synchronous, asynchronous, mixed and other forms, "Acupoint Science of Meridians and Collaterals" SPOC teaching adopts mixed online teaching mode. Students can finish the task of self-study by watching the video of micro class, recording and playing video and learning Scorm courseware. On this basis, teachers take the form of live teaching, online learning at the same time. The meeting class in the form of recording and live broadcast can deepen mutual understanding, facilitate face-to-face teaching in the future, achieve the best learning effect and promote teaching informationization. Therefore, the first set of recorded courses. The teacher collects and identifies the learning difficulties and common problems of the students during the course of self-study, and records the first round of tutoring videos in combination with the assessment of the students' in-class tests, so as to further guide the students to solve the problems, integrate the new and old knowledge and deepen their understanding of the new knowledge. For example, in the first video recording and broadcasting, the method of acupoint selection of some acupoints is explained to answer the doubts of students when they study on their own. After the live meeting, the class representative collected the students' problems, and the teacher recorded the second round of video and uploaded it to the Aike teaching support platform to answer questions and strengthen the teaching effect. Video recordings can be viewed repeatedly when students are confused, and can be paused and started at any time, through the flexibility of video viewing time, to meet the needs of personalized learning [5]. Second, set up live courses.

In the process of live teaching, the teacher first of all the focus of each meridian point and the need to master the content of crosstalk, and then systematize the knowledge. For example, the three meridians of the Foot Three-Yang Meridian should be told together to compare the following parts and indications of each meridian, so as to strengthen the horizontal comparison of students' and deepen the positioning memory of acupoints. In addition, the points will be classified by location, focusing on key areas, such as sternocleidomastoid muscle, elbow lines and other parts. Students memorize the points of each meridian in order, then memorize according to the position, and finally memorize according to the points with the same characters, such as the points with the word "Tian". Teachers through the live platform to talk about the difficult content, and the pre-operation for comments, summed up and evaluation of students self-study, and then answer questions. Teachers in the QQ group so that each group leader summed up the process of autonomous learning in each group before class problems encountered. Then the teacher in the process of live broadcast, the summary of the problems presented on the computer screen and share. Instead of answering questions directly, the teacher should encourage students to speak up, think, and discuss the questions together. Each student will attempt to answer questions from other groups.

The teacher will record the number of times the students answer the questions and make them part of their grades. After the students speak, the teacher makes comments and corresponding supplements. After the students have all spoken, if the problem has not been solved, the teacher will give the final unified answer. For example, the students have doubts about the corresponding relationship between three yin and three yang of the twelve meridians, because the Shaoyin Meridian corresponds to the Taiyin Meridian, the Taiyin Meridian and the Yangming Meridian, that is, the corresponding relationship between two yin (Shaoyin) and three yang (Taiyin) and two yang (Yangming) in the twelve meridian and the corresponding relationship between one yin (Jueyin) and one yang (Shaoyin) and two yang (Yangming) in the Neijing. Teachers can explain the origin of meridian naming by combining relevant materials and deducing the initial meridian theory through the theory of "correspondence between man and nature". Not only can answer the students' doubts, but also the corresponding knowledge expansion, expand the students' professional field of vision, and strengthen their interest in learning acupuncture. Finally, set the online discussion mode. Online discussion is a step for students to deepen their knowledge.

Compared with the self-study question area set up in the self-study course, the online discussion takes a relatively long time to learn, and can be discussed repeatedly in the online forum. In addition, the online discussion can get the teacher's answer immediately, and the teacher will expand and extend accordingly to enrich the students' acupuncture knowledge. The "online discussion" link of meeting class and the discussion link of "cooperation and mutual learning" of self-study class echo each other, promote the communication and interaction between teachers and students through the collision of thinking, and strengthen the learning effect of students' self-study points [6].

2.2 Building a Virtual Teaching Platform with Human-Computer Interaction

According to the functional characteristics of the online teaching platform of meridians and acupoints of traditional Chinese medicine, a virtual scene is built by using the remote multimedia teaching system, and a virtual teaching platform with human-computer interaction is built by using model-based technology and image-based drawing technology, both of which can be realized in 3DMAX software. Upload the entity data information of Chinese medicine meridian and acupoints online teaching to the computer, simulate the curved surface of Chinese medicine meridian and acupoints with different curves or figures, and create the basic models at different body positions. The selected model components can be triangles, rectangles or other polygons. Then, according to the trend of meridians, the error adjustment function is used to adjust the size of a single model, and three-dimensional meridian acupoint models with various shapes and types are made through model building and splicing [7]. The error function for adjusting the model size is:

$$s = \frac{\Delta q}{\gamma} = \frac{\alpha \omega_i - \gamma}{\gamma} \tag{1}$$

In the formula: s represents the actual relative error, which is the ratio of absolute error to actual true value; Δq represents absolute error, which not only indicates the size of data difference, but also indicates the positive and negative directions of the difference; α is a coefficient, which indicates the ratio between virtual model components; ω_i represents the drawn independent virtual model assembled by i independent sub-models. Then, according to the functional requirements of the teaching platform of Chinese medicine meridians and acupoints, the parameters of the established model are adjusted to obtain virtual models with different resolutions, which meet the display requirements of the platform for the teaching content of Chinese medicine meridians and acupoints. It is assumed that there are m_i pixels in the horizontal direction and n_i pixels in the vertical direction of the designed model, and the total pixels of the model are $p = m_i n_i$ [8–10]. To adjust the pixel resolution of the module, the calculation expression is:

$$\begin{cases} \lambda_1 = x_1 \cos \beta tb \cdot s \\ \lambda_2 = x_2 \cos \beta tb \cdot s \end{cases} \tag{2}$$

In the formula, λ_1 represents the model pixel in the positive direction; λ_2 represents the model pixel in the reverse direction; x_1 is the model length in the positive direction; x_2 represents the model length in the reverse direction; β indicates the connection angle between components [11, 12]; t represents the trend control parameter of meridians in each stage; b represents the number of model component surfaces in each direction.

All meridians and acupoints of traditional Chinese medicine are marked on the model, and students can communicate with the teaching content by rotating, zooming in and zooming out the manikin in the virtual platform. The core of the designed teaching platform lies in the design of interactive functions [13]. Therefore, VRML language is used to simulate the equipment function, and set the three-dimensional coordinates of the teaching equipment to meet the spatial transformation of the virtual human body model and ensure that the model can be arbitrarily adjusted, as shown below:

```
DEF Cylinder01-TIMER TimeSensor {loop TRUE enabled FALSE cycleInterval}
TimeSensor
DEF xiabie-POS-INTERP Position Interpolator
key{0,0.2,0.22,0.47……0.54,0.57,}
keyValue{36.54 3.766-3.345……16.87 3.766-35.45}
DEF xiabie-ROT-INTERP Orientation Interpolator
key{0,0.2,0.22,0.47……0.54,0.57,}
keyValue{1000,1000……0 -1 0 -1.134}
```

According to the instruction program compiled by the above code, set the dynamic demonstration rules in the teaching scene, and import the dynamic teaching scene with a certain duration into VRML to realize the set interactive function [14, 15]. The behavior interaction module is assigned to a virtual meridian, and the analysis of meridian trend is realized in the form of flow chart. According to the existing online teaching framework

of meridians and acupoints of traditional Chinese medicine, the open operation mechanism of the platform is arranged, and the trigger [16], data transmission and model conversion of complex teaching programs are completed by using response functions. The calculation expression of the response function is [17–19]:

$$f(k) = \mu\varphi - \theta_i \tag{3}$$

In the formula: $f(k)$ represents the response function under the k teaching program; μ represents the response conventional coefficient of the platform, φ represents the online teaching level of Chinese medicine meridians and acupoints, and θ_i represents the comprehensive response coefficient of the teaching model to the problem under the selected i operation objective. Using this function, the students can trigger the operation program when learning Chinese medicine meridians and acupoints, and then quickly enter the virtual scene according to a series of chain reactions [20–23]. After students enter the virtual teaching environment, they switch scenes through joysticks or data gloves, send instructions to the virtual platform, and obtain teaching information fed back by the platform. So far, the online remote open teaching platform of Chinese medicine meridians and acupoints has been completed.

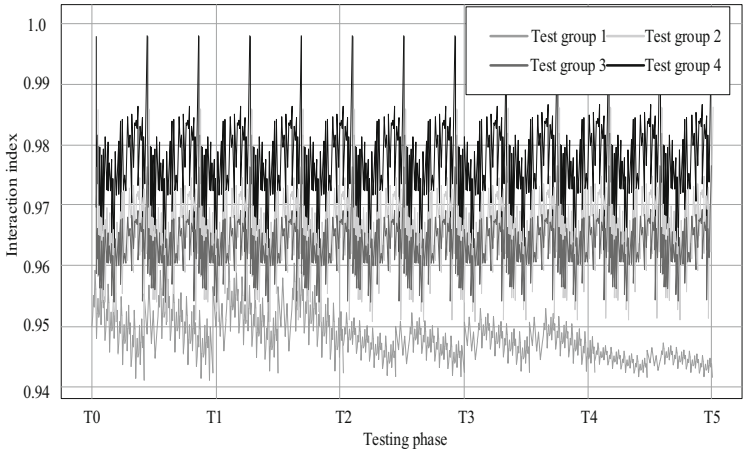
3 Experimental Research

Platform function test is an important link in the task of platform construction, so as to analyze the performance of the designed teaching platform and whether it meets the design requirements. In order to make the test results more intuitive, three groups of traditional teaching platforms were taken as control group A, control group B and control group C, and the platform constructed this time was taken as experimental group. Compare the platform constructed by traditional methods with the designed platform, and find out the functional differences between them. Upload the designed platform and three groups of traditional platforms to four computers with the same configuration. The hardware environment selected in the experiment is: 4 pieces of 1024 MB memory constitute a communication dual channel, the CPU is dual-core 2.65 GHz, the GF9800GT graphics card supports 3D model, and the 64-bit operating system Windows XP is pre-installed.

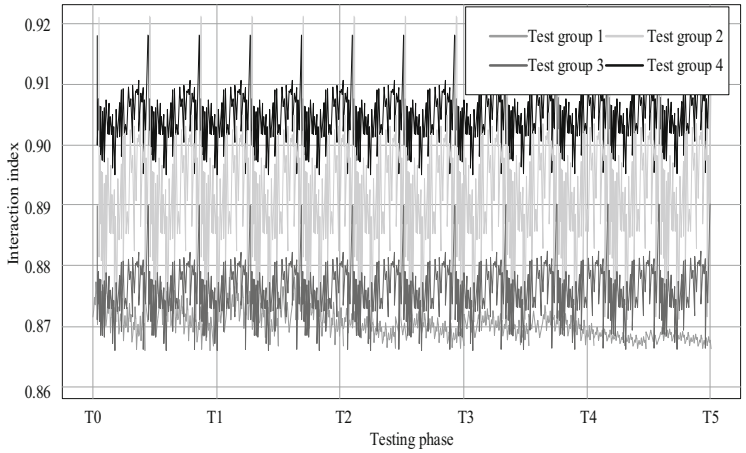
3.1 Interactivity Test

Figure 1 shows the comparison test results of four groups of platform interaction performance.

In order to make the experimental results more convincing, four sets of test schemes are set up for the online teaching content of TCM meridians and acupoints. At the same time, the preset interaction index value is greater than or equal to 0.95, which proves that the online teaching platform has excellent interaction performance. According to the test results in Fig. 1, the interaction index of the experimental group is more than 0.95, and the interaction index test results of the three groups of traditional methods are less than the test results of the experimental group, and also less than the preset interaction performance test standard. The average value of interaction performance index of four groups of online teaching platform is counted, and the results are shown in Table 1.

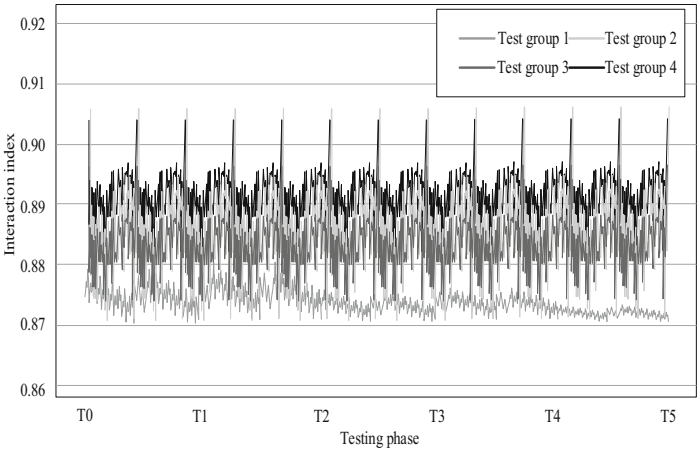


(a) Experience group

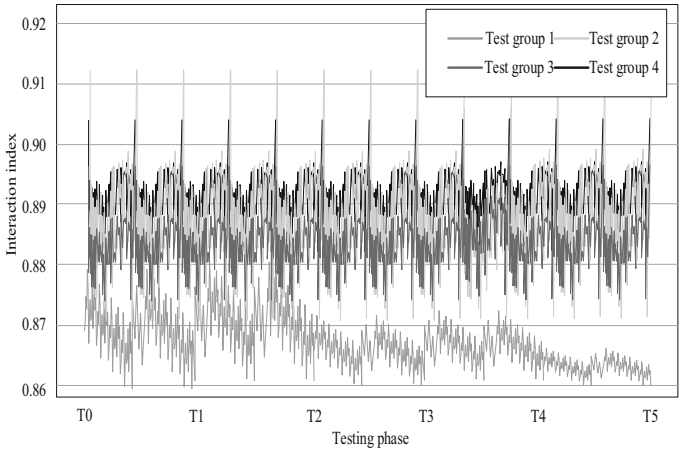


(b) Control group A

Fig. 1. Platform interactivity test results



(c) Control group B



(d) Control group C

Fig. 1. (*continued*)

Table 1. Statistical table of average value of platform interactivity index

Test plan	Experience group	Control group A	Control group B	Control group C
1	0.9763	0.9024	0.8952	0.8947
2	0.9658	0.8986	0.8917	0.8894
3	0.9612	0.8922	0.8874	0.8851
4	0.9507	0.8745	0.8695	0.8628

According to the test results in Table 1, the interactivity index of the experimental group is higher than that of the three traditional platforms. In order to facilitate comparison, calculate the average value of the four test groups' interactivity indexes, and compare the differences between the four groups' results and the preset values. The results are shown in Table 2 below.

Table 2. Statistical results of platform interaction index differences

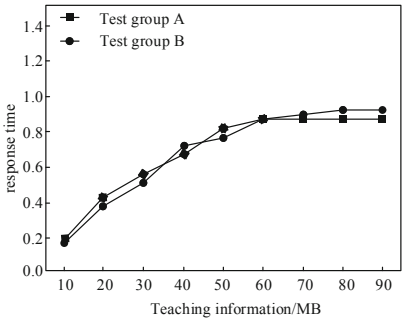
Test group	Average value	W1	W2
Experience group	0.9635	0.0135	–
Control group A	0.8919	0.0581	0.0716
Control group B	0.8860	0.064	0.0775
Control group C	0.8830	0.067	0.0805

In Table 2, W1 is the index difference between the test group and the preset value; W2 is the index difference between the test groups. According to the test results in Table 2, the online teaching platform of TCM meridians and acupoints has better interactive effect.

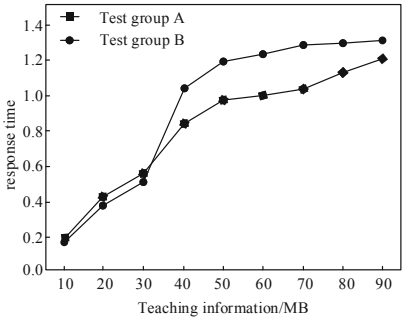
3.2 Response Time Test

In the second stage, the response time to a certain teaching content is tested when the four groups of platforms carry out online teaching of TCM meridians and acupoints. The results are shown in Fig. 2 below.

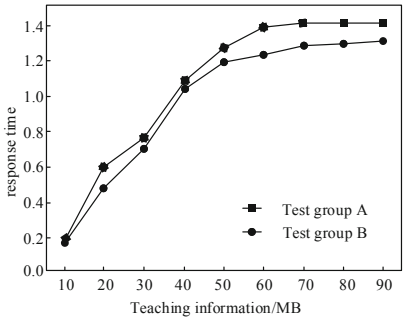
According to the test results in Fig. 2, the experimental group responded within 1.0 s when facing two groups of different teaching contents of TCM meridians and acupoints, while the average response time of the three control groups were 1.28 s, 1.37 s and 1.39 s respectively. According to the above test results, the open teaching platform has good response performance.



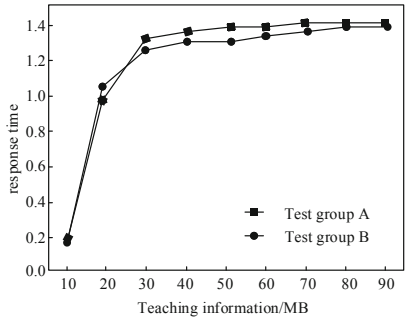
(a) Experience group



(b) Control group A



(c) Control group B



(d) Control group C

Fig. 2. Platform responsiveness test results

4 Conclusion

An ideal and mature online teaching platform for professional meridians and acupoints, with the help of network resources, will give full play to the standardization and vividness of basic teaching, the intuitive three-dimensional display of content, and the freedom and autonomy of learning. Based on the high sharing of online teaching of Meridian Acupoints and the breaking of time and space restrictions on learners, anyone can access professional knowledge of Meridian Acupoints through the network platform, and learn and communicate with each other, which promotes the prosperity and development of Meridian Acupoints and realizes the true fairness and freedom of learning.

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