



Distance Teaching Method of Welding Process Course for Mobile Learning Platform

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Abstract. The current distance teaching method is mainly to complete the explanation of basic knowledge by recording course video, students' autonomous learning or with the help of remote communication function. It is difficult for students to fully mobilize their enthusiasm, resulting in poor teaching effect. In order to alleviate the problems of inapplicability and poor teaching effect when the current distance teaching method is applied to welding processing course, this research designs a distance teaching method of welding processing course for mobile learning platform. According to the characteristics of mobile learning platform, the communication path of distance teaching of welding processing course is determined. Then formulate the 5E Teaching Mode and design the teaching process of the course distance teaching platform. Finally, collaborative filtering algorithm and firefly algorithm are used to recommend personalized mobile learning resources for students and generate course learning paths. The experiment shows that after applying this method, the average score of students is improved by about 9.2%, and their learning enthusiasm is significantly enhanced.

Keywords: Mobile learning platform · Welding processing courses · Distance learning · Teaching methods · Collaborative filtering · Firefly algorithm

1 Introduction

With the rapid popularization of mobile Internet and intelligent terminals and the continuous development of educational informatization, students can complete the learning of relevant courses through mobile learning [1]. The development of learning intelligent terminals promotes the dissemination of learning resources, can help students better integrate learning tasks into daily arrangements, and can help teachers effectively respond to students' needs by allowing two-way communication.

With the development of industrial technology, there is an increasing demand for welding processing technicians in relevant fields. Welding processing has become a popular specialty and a key training specialty in many colleges and universities. The course of welding processing not only requires students to master theoretical knowledge, but also requires students to have basic practical ability [2]. However, the practical operation of the welding processing course needs to be carried out under the strict guidance of

teachers, so as to prevent students from being in danger due to improper operation during the practical operation. However, in the long-distance teaching of welding processing course, students can not carry out practical training under the guidance of teachers, but can only learn the theoretical content of the course. Therefore, in the theoretical teaching of welding processing course, ensuring that students can master theoretical knowledge and lay a solid foundation for offline welding practice has become the research focus of remote teaching of welding processing course [3].

Relevant scholars have proposed a series of research achievements such as distance teaching methods based on information integration, distance teaching methods based on human-computer interaction, and so on. However, in practical application, it is found that the application effect of the above-mentioned traditional methods still has room for improvement.

Based on the above analysis, this paper introduces information technology to deepen the reform of teaching mode of welding processing course, and uses mobile learning platform to assist students in learning welding processing course, so that these problems can be effectively solved. This paper designs a remote teaching method of welding processing course oriented to mobile learning platform. The specific design ideas are as follows:

- (1) According to the characteristics of the mobile learning platform, the communication path of remote teaching of welding processing course is determined.
- (2) Design the business process of distance teaching platform and 5E Teaching mode.
- (3) Through collaborative filtering, personalized mobile learning resources are recommended for students, and then fireflies are used to calculate and generate curriculum learning paths.
- (4) Through experimental verification, it can be seen that after the application of this method, the average test scores of students in welding processing courses have increased by about 9.2%, which indicates that the teaching effect of this method is better and can promote the further development of distance teaching more effectively.

2 Method Research

According to the characteristics of mobile learning platform, this paper defines the communication path of remote teaching of welding processing course. Then, based on the design of the business process of the distance teaching platform, the 5E Teaching mode is formulated. Finally, the collaborative filtering algorithm is used to recommend personalized mobile learning resources for students, and the course learning path is generated based on the firefly algorithm. The specific design steps are shown in Fig. 1.

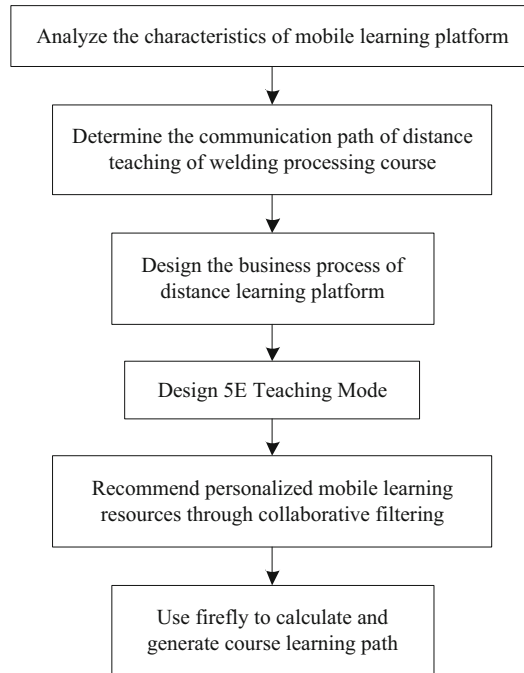


Fig. 1. Design steps of distance teaching method for welding processing course

2.1 Determine the Communication Path of Distance Teaching of Welding Processing Course

Distance teaching includes electronic technology, video, interactive multimedia and other forms, so text, audio, video, PPT, computer software and other modes can be selected for Distance Teaching of welding processing courses. Teachers and students use the mobile learning platform to complete the distance teaching interaction of the course. In the process of distance teaching, analyzing the communication path of the course can effectively grasp the main content of the course teaching and improve the effect of the course teaching. In fact, distance teaching activities are also a kind of information dissemination activities. Distance teaching can be seen as the redesign and combination of the five elements of communication subject, communication media, communication content, communication audience and communication effect.

In the process of offline classroom teaching, knowledge communication is a top-down linear communication mode. Teachers first sort out the knowledge they have mastered, and then spread the knowledge to students. This kind of teaching is carried out face to face. Teachers have a strong control over the overall situation of the classroom. When using mobile learning platform for distance teaching, teachers and students are separated in space. Teachers can't understand their real listening state according to their expressions and expressions. The original teaching design needs to be readjusted. Teachers need to adapt to the mobile teaching platform and the new environment of distance teaching in a short time. Distance teaching breaks through the teaching time and space of the

traditional classroom in the past. It not only changes the place and environment of class, but also changes the teaching methods of teachers and the learning methods of students.

In the teaching process of welding processing course using mobile learning platform, teachers are not only the imparter of knowledge, but also the guide of students' thinking, leading them to explore broader and deeper knowledge outside the classroom, and helping them improve their autonomous learning ability. Teachers are facing many challenges in the process of distance teaching, among which the average value of teaching methods, teaching habits and teaching concepts that need to be changed is very high [4]. Distance teaching poses a greater challenge to teachers. In order to achieve good teaching results, teachers need to optimize and restructure the original curriculum content and teaching plan design. Students tend to slack off when they spend time studying on the screen, which requires teachers to change the original teaching methods, highlight the key points in the teaching process, and be good at mobilizing the classroom atmosphere, which requires teachers to spend more time and energy in the process of lesson preparation. Distance teaching is different from the previous classroom teaching. In order to achieve better teaching results, teachers need to spend more time in the process of lesson preparation.

With the rich teaching functions of mobile teaching platform, the teaching environment of offline classroom is restored to a great extent. In the process of live broadcast teaching, teachers can conduct split screen teaching, switch freely between courseware and electronic blackboard, and have real-time audio and video interaction with students. After the live broadcast, students can also play back [5]. Teachers can also organize online examinations. The platform includes single choice, multiple choice, blank filling and other types of test questions. Teachers can freely arrange in class tests and the marking function of the final examination system, which saves teachers a lot of time.

In the final analysis, the teaching objective of welding processing course serves the talent training, and the whole training objective must be implemented into the detailed rules and practice of all courses. Learning is not a process in which learners passively accept ready-made conclusions, but a process in which learners independently construct information structure through real situations. For example, in the teaching of materials and heat treatment related knowledge points in the welding processing course, the main teaching purpose is to let students understand the relevant structure and properties of metal through explanation, form an understanding of the different properties of metal, clarify its internal crystal structure, understand the mechanical properties of metal and the organizational structure of heat treatment, and finally have a certain cognition and understanding of the treated materials in welding, Be able to skillfully select appropriate welding process parameters and effectively control the weld quality according to the nature of processing materials and relevant knowledge of the course in the practice of welding specialty, and be able to objectively and comprehensively analyze the welding defects according to the welding quality inspection results and take corresponding control measures [6].

2.2 Teaching Process Design of Course Distance Teaching Platform

The distance teaching platform provides students with a variety of different businesses, and the basic functions are suitable for Distance Teaching of different courses in all colleges and universities. Figure 2 shows the business process of mobile learning platform during distance teaching of welding processing course.

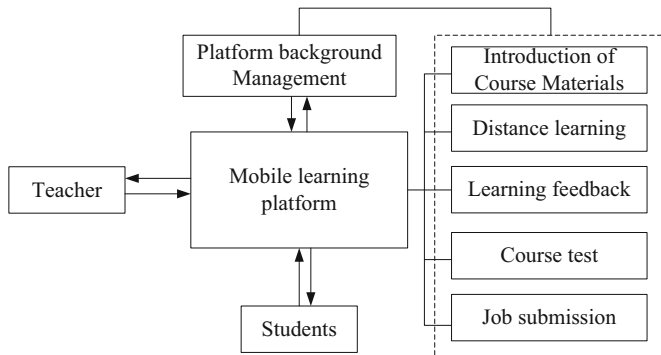


Fig. 2. Business process diagram of mobile learning platform

Homework is the core business of distance teaching management and an effective way to communicate between students and teachers after class. The traditional homework management is mainly through paper, which brings great inconvenience to students and teachers. The long-distance teaching platform greatly simplifies the communication between teachers and students by submitting homework by students through mobile phones and then correcting online by teachers through mobile phones.

Although there are some differences between distance teaching and traditional offline teaching mode, students' learning still needs to follow the principle of step-by-step. Therefore, it is necessary for teachers to make good use of time and communication in the process of classroom teaching, so as to ensure the students' good understanding and mutual acceptance in the process of distance teaching. In addition to the teaching itself, we must also do a good job in the follow-up links, focusing on the quality inspection and evaluation of the whole teaching process. On the one hand, we need to evaluate each student's classroom performance, and also teach students according to their aptitude [7].

Teachers need to combine the characteristics of students' thinking mode and related knowledge, and then choose appropriate methods to show the content of knowledge to students. The first is to do a good job in the relevant theoretical basis, that is, the teacher should fully explain the theoretical content required by the welding specialty at the beginning, fully stimulate the students' interest, summarize and summarize the difficult contents into easy to understand sentences, and try to show the students in a vivid way, so that they can master the welding specialty theory on the basis of full understanding. Through the creation of problem situations and other ways to trigger appropriate information uncertainty, stimulate students' interest in the learning content itself, help them form internal motivation, and pay attention to the expansion of students' original cognitive structure and the cultivation of learning initiative and enthusiasm [8].

Remote online communication is a modern way to realize the traditional after-school Q & A. In the past, students needed to find teachers to answer questions after class. Then this way has the limitations of time and space. The online communication business on the mobile learning platform can help teachers and students have multi person online discussions.

In order to achieve better remote teaching effect of welding processing course, the teaching mode should first highlight the leading role of teachers; Second, we should embody the subjectivity of students; Third, we should diversify the teaching contents and forms. Based on the constructivist teaching view, this study adopts the 5E Teaching mode. Table 1 shows the specific contents of 5E Teaching Mode of welding processing course.

Table 1. 5E teaching mode of welding processing course

Stage	Teaching subject
Knowledge introduction	Based on the students' existing experience, set up welding processing teaching situations and activities to stimulate students' interest in learning, expose wrong concepts and participate in new concepts, so as to lay the foundation for the next stage
Research on knowledge points	Teachers are promoters. Teachers initiate the introduction of knowledge points of teaching content to guide students to operate and think. In addition, teachers can import relevant welding processing materials, welding processing videos, simulation analysis and other tangible materials and specific welding experience
Knowledge point explanation	Guide students to express their understanding of the knowledge points of welding processing course in their own words. Teachers use demonstration videos, simulation teaching and other methods to elaborate concepts to help students have an in-depth understanding of the knowledge points
Refinement of knowledge points	Teachers provide relevant situations, expand students' conceptual understanding, and students apply new knowledge points to the problem-solving process, which is a process of continuous refinement of new knowledge points
Learning effect evaluation	Teachers evaluate students' understanding and application. Teachers can understand the effect of teaching through observation, questioning, paper and pencil test, group discussion and so on

For the welding processing course, students not only need to complete various basic tasks in traditional teaching activities, but also need to be familiar with the processing parameters of different welding technologies, precautions for the use of welding equipment and safety protection in the process of welding processing. These are unable to rely

solely on teachers to achieve the best teaching effect by means of explanation or PPT through mobile learning platform. For the above details, this study will use a variety of learning methods to complete the course teaching tasks, such as constructing scenarios, flipping classroom and interactive collaborative learning.

2.3 Personalized Mobile Learning Resource Recommendation and Path Generation

The teaching goal of each chapter is to provide students with time to understand, and each teaching chapter should have its own teaching objectives. Each teaching chapter should have its own teaching objectives. It should not take up too much time for students to explain. Secondly, the differences of students should be targeted. Students' acceptance speed and thinking mode of knowledge are different. Using the mobile learning platform, teachers can set different personalized self-learning schemes for students.

Students are independent individuals, and their will is not transferred by the will of teachers. Their choice hobbies and visual preferences have their personalized characteristics. In order to meet the needs of different students' learning and development, the construction of teaching content should also be diversified. Personalized learning is a learning method in which learners independently select learning resources, formulate appropriate learning strategies, and independently arrange learning time and place according to their own interests and needs. It has the characteristics of active exploration, high autonomy and on-demand learning. This learning method can not only promote learners to learn more effectively and actively, but also give full play to learners' personality and ability in the learning process. In the process of learning using mobile learning platform, learners can select various forms of learning resources according to their own learning basis, which greatly improves learners' autonomy and learning interest. At the same time, it can also better cultivate learners' awareness and self-study ability. Therefore, according to the teaching characteristics of welding processing course, this paper will generate personalized mobile learning resource recommendation and path when students use mobile learning platform for learning.

This paper uses collaborative filtering algorithm to realize personalized learning resource recommendation by analyzing the students' learning data collected on the mobile learning platform. Figure 3 is the flow chart of collaborative filtering algorithm for personalized recommendation of learning resources to students [9].

In the process of distance teaching, the differences of students' different understanding ability and knowledge mastery ability increase the students' demand for personalized learning path. This study will use the firefly algorithm to input teachers into the teaching design of mobile learning platform to generate different learning paths, so as to recommend suitable learning paths for students.

The firefly algorithm uses all feasible solutions in the search space to simulate the firefly individuals in the night sky, simulates the search and optimization process as the mutual attraction and position moving and updating process of firefly individuals, determines the position of firefly individuals by the fitness value of the objective function to solve the problem, and compares the process of survival of the fittest to the iterative process of replacing poor feasible solutions with good feasible solutions in the process of search and optimization.

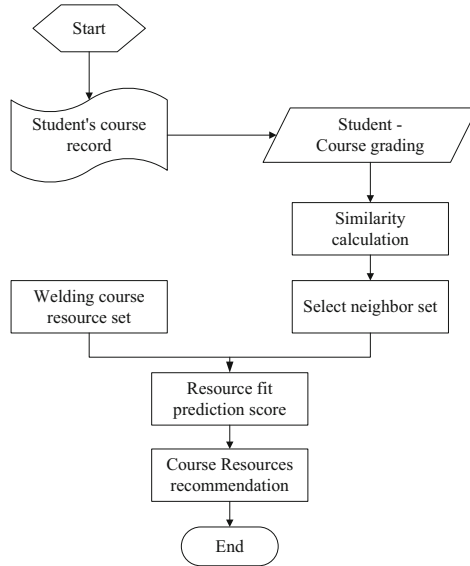


Fig. 3. Collaborative filtering process of personalized recommendation of learning resources

Firefly algorithm involves two key factors: relative fluorescence brightness and relative attraction. The brightness of the firefly’s light depends on the target value of its position. The higher the brightness, the better the position, that is, the better the target value. The brighter the fire moves in this direction, the higher the attraction of the firefly. If the luminous brightness is the same, the fireflies move randomly. The brightness and attraction are inversely proportional to the distance between fireflies, and both decrease with the increase of distance. In this paper, the firefly algorithm is improved by using decision attributes to solve the problem of learning path generation in mobile learning environment.

n firefly individuals are randomly distributed in a K dimensional target search space, and each firefly carries luciferin y_i . Firefly individuals emit a certain amount of fluorescence, interact with the surrounding firefly individuals, and have their own decision domain $d_k^i (0 < d_k^i < d_s)$. In the initial firefly, each firefly carries the same luciferin concentration y_0 and sensing radius d_0 . The algorithm implementation includes four important formulas: fluorescein update, firefly movement probability, position update and dynamic decision radius update, as shown in the following [10].

The calculation formula of fluorescence brightness is as follows:

$$I(d) = I_0 \exp(-\xi d) \tag{1}$$

where, I_0 is the maximum fluorescence brightness of firefly, that is, its own fluorescence brightness; Related to the objective function value, the better the objective function value is, the higher its brightness is; ξ is the light intensity absorption coefficient, because the fluorescence will gradually weaken with the increase of distance and the absorption of media, so the light intensity absorption coefficient is set to reflect this characteristic. d is usually the Euclidean distance between firefly i and j .

The fluorescein update formula is as follows:

$$y_i(t+1) = (1 - \delta)y_i(t) + \xi F(x_i(t)) \quad (2)$$

where x_i is the component of firefly i in dimensional space, that is, the position of firefly.

The probability calculation formula of selecting individual j to move to the adjacent set domain is as follows:

$$p_{ij} = \frac{y_j(t) - y_i(t)}{\sum y_j(t) - y_i(t)} \quad (3)$$

The individual location update formula of firefly is as follows:

$$x_i(t+1) = x_i(t) + s \left[\frac{x_j - x_i}{\|x_j - x_i\|} \right] \quad (4)$$

The dynamic decision radius is as follows:

$$d_k^i(t+1) = \min \left\{ d_s, \max \left\{ 0, d_k^i(t) + \gamma n_i - \gamma N_i(t) \right\} \right\} \quad (5)$$

where, γ is the attraction of light source to fireflies; n_i is the number of firefly decision-making groups; $N_i(t)$ is the number of fireflies in the neighborhood of the current location.

The essence of the recommendation of learning resources and the generation of learning paths is the process of decision-making, screening and selection of learning resources one by one according to the characteristics and needs of learners. Learning resources include several learning objectives, namely skill objectives. Each skill objective should be carried out according to the set decision attributes.

The four elements that need to be tested before the learner's ability to master the activity are pre test; At the same time, after the completion of mobile learning activities, post test is set for feedback and evaluation to test learners' learning results; By comparing pre test and post test, it can effectively reflect learners' attitude and the rationality of learning path. In order to effectively generate the optimal learning path, according to the ability-based theory, set the following five decision attributes for each skill goal: importance, relevance, pre task, professionalism and learning time, so as to judge the learning value of each goal and its position in the learning sequence.

Aiming at the improvement of firefly coding, a variable sa_i is added to the algorithm to represent the learning ability of learners; Add variable lt_i to represent the lower limit of learners' expected learning time; Adding variable et_i represents the upper limit of learning time expected by learners; Add an array variable $A[]$ to represent the learner's learning objectives. The following personalized learning path decision-making objective function is established from five aspects: the proportion of learning resources covering target knowledge points, the matching of learning resources, students' learning time expectation, the distribution of learning resources and unit learning income:

$$\min F(x) = \sum_{i=1}^q w_i F_i \quad (6)$$

where, w_i is the weight of different influencing factors. The improved firefly algorithm combined with decision attributes is used to screen learning resources according to learners' learning objectives. Finally, recommend appropriate learning resources and learning paths to learners for mobile learning. Through the above research, this paper analyzes the current ways and methods of distance teaching of welding processing courses in Colleges and universities for mobile learning platform, which provides theoretical support for the development of online teaching period and subsequent distance learning and further study of relevant personnel.

3 Example Verification

The distance teaching method of welding processing course for mobile learning platform is proposed above. This section will verify the application effect of this teaching method.

3.1 Validation Preparation

Select two classes a and B from 2021 students in a university as the example verification object. In order to ensure the effectiveness and practical application effect of the teaching method, the teaching method proposed in this paper is compared with the traditional distance teaching method, and applied to the teaching of welding processing course of class A and class B students respectively. A total of 50 students in class A as the experimental group, using the teaching methods proposed in this paper; A total of 50 students in class B served as the control group, using traditional teaching methods; The teachers in the experimental group and the control group are the same. The teaching practice of this study lasted 35 weeks, and the learning contents of the two classes were consistent with the teaching plan.

By comparing the test score distribution and learning intention of students in the two classes in the welding processing course, the advantages and disadvantages of teaching methods are evaluated.

3.2 Verification Results

Table 2 shows the score distribution of welding processing course test scores of students in the experimental group and the control group.

By analyzing the data in Table 2, it can be seen that when using the teaching method proposed in this paper to teach the welding processing course, there are 27 students with good grades in the experimental group, which is higher than that in the control group. Moreover, the average test scores of the students in the experimental group in the welding processing course have increased by about 9.2%, which proves that the teaching effect of using this method is better.

Table 3 shows the comparison of students' willingness to learn teaching methods when using different teaching methods.

Table 2. Comparison of score distribution of students' welding processing course test scores

Score section	Experience group		Control group	
	Number of people	Proportion	Number of people	Proportion
90–100	11	0.22	6	0.12
80–89	16	0.32	13	0.26
70–79	18	0.36	20	0.40
60–69	4	0.08	8	0.16
<60	1	0.02	3	0.06
Average	81.54		74.68	

Table 3. Comparison of students' learning enthusiasm for teaching methods

Learning enthusiasm	Experience group		Control group	
	Number of people	Proportion	Number of people	Proportion
Very positive				
Positive	14	0.28	5	0.1
commonly	20	0.40	11	0.22
Not active	10	0.20	18	0.36
Extremely inactive	6	0.12	12	0.24
Learning enthusiasm	0	0	4	0.08

By analyzing the data in Table 3, we can see that using the teaching method proposed in this paper, students have stronger learning enthusiasm and are more willing to carry out distance teaching, which also reduces the risk of poor learning effect due to students' weak self-control in distance learning.

To sum up, the distance teaching method of welding processing course for mobile learning platform proposed in this paper has good teaching effect, which can significantly improve students' academic performance and mobilize students' learning enthusiasm.

4 Conclusion

Online teaching has promoted the reform of teaching methods and educational concepts, and with the continuous development of network technology, the cost of distance network education has been continuously reduced, which has laid the foundation for distance network education to become more popular.

Facing the mobile learning platform, this paper proposes a distance teaching method suitable for welding processing course. On the basis of determining the communication path of remote teaching of welding processing course, the business process and 5E teaching mode of the remote teaching platform are designed, and the personalized

recommendation process of mobile learning resources and the course learning path are specified.

The effectiveness and feasibility of the teaching method are verified by an example. Students use the mobile learning platform for learning. The learning of welding processing course knowledge is not limited to the traditional classroom. Students can carry out learning according to their own situation without the influence of time, place and other factors. At the same time, it can also better increase students' enthusiasm for autonomous learning, improve students' learning efficiency and provide more help for students. In addition, it is of great significance to promote the research of mobile learning in Colleges and universities and promote the in-depth integration of welding processing courses.

However, due to the limitation of research time and other conditions, this method takes a long time to generate the personalized recommendation process of mobile learning resources and the course learning path, which reduces the overall work efficiency. In future research, optimization will be carried out in this aspect.

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