

Research Article

Hybrid Element Heuristic Algorithm Optimizing Neural Network-Based Educational Courses

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Received 12 October 2021; Revised 6 November 2021; Accepted 12 November 2021; Published 6 December 2021

Academic Editor: Haibin Lv

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The rapid development of computer networks has enabled information technology to penetrate many fields, providing unprecedented opportunities for all aspects of our lives. In order to allow students to acquire necessary knowledge and skills through efficient learning, this article studies the design and development of educational technology courses based on hybrid metaheuristic algorithms to optimize neural networks. This paper proposes a metaheuristic algorithm and explains the simulated annealing algorithm and microregular annealing algorithm in detail. Using these algorithms, a mathematical model of the normal scheduling problem was also constructed, and the mathematical model was applied to the design and development of educational technology courses. In addition, the neuron model in the neural network and the activation function of the neural network are discussed from various aspects. In the experiment, according to the needs of students, a learning platform for educational technology courses was designed and developed. The experimental results of this article show that there are significant differences in the starting point of the ability level of learners for different majors. Education majors have a higher level of understanding of educational technology courses; 38.20% of students know well, while art majors have a low level of understanding of education technology courses, with 36.05% of students majoring in art.

1. Introduction

In the process of deepening education reform, cultivating high-quality talents with innovative spirit has become the historical mission of education. The widespread application of modern information technology in education is represented by multimedia and network technology. It has had a significant impact on the traditional teaching style, teaching methods, content, and teaching methods. Correspondingly, the application of network technology in teaching is more and more extensive, and the form of networked teaching is becoming more and more abundant. MOOC, microclasses, and online learning have all become new forms of education in the Internet age. “Education should face modernization, face the world, and face the future,” and the use of new educational technology is one of the measures of education modernization. Schools of all levels and types should carry out current educational technology activities and fully apply new educational technology methods to specific teaching activities.

The ability of educational technology undoubtedly occupies an important position in the professional skill system of teachers. The advantage of the traditional classroom is that it can play the leading role of teachers, the teaching level is quite high, and it can also promote the emotional exchange between teachers and students. The disadvantage is that the basic role of students is not fully reflected, resources are limited, and students rely on teachers to a high degree. Through online learning, students can use computer communication and multimedia technology for multidimensional, resource-intensive, time-limited, and personalized learning. The problem is that the role of teachers is not fully reflected, and students’ “learning ability” is obviously limited. In this case, we need to learn how to better design and develop educational technology courses. The analysis of learning needs is the prerequisite of teaching planning. The success or failure of learning need analysis is related to the success or failure of teaching results, which helps to understand the real needs of educational technology teaching, provide teaching design to meet

the individual learning needs of students in different disciplines, and also help improve students' academic performance.

Regarding the design and development of educational technology courses, scholars at home and abroad have conducted research on this. Ritzhaupt et al. designed to document the design, development, and evaluation of statistical courses tailored for doctoral students in educational technology in an online program. Using quantitative and qualitative data sources, it proved the use of real and relevant data sets based on peer-reviewed publications in the field of education technology, and it was found that students' statistical anxiety levels decreased significantly in three key areas [1]. Olusola and Kolapo investigated the perceptual relevance of preservice teachers to educational technology content, digital tools, and their performance in educational technology courses. This study was conducted on 261 preservice teachers, and the results showed that students' perception of educational technology courses is highly relevant. The correlation coefficient is 0.015, which shows the positive correlation between preservice teachers' perception of educational technology courses and the final exam scores of the course semester [2]. Matsukawa et al. use topic modeling based on potential Dirichlet assignments to analyze approximately 60,000 data sets collected by a university over the past nine years to analyze the free descriptions obtained through the course evaluation questionnaire. Then, according to a series of steps, the extracted 170 topics were annotated, and the effectiveness of the annotation was verified [3]. Sletten aims to examine the relationship between two variables, namely, students' perceptions of the flipped model and their self-regulated learning (SRL) behavior, and the impact of these variables on flipped classroom performance. In this study, 76 participants from the flipped introductory biology course were asked about their views on the use of the SRL strategy and the flipped model. Through regression analysis, it is found that students' cognition of the flip model positively predicts students' use of several SRL strategies [4]. In order to explore the development of self-regulation in the flipped classroom environment, Çakıroğlu and Öztürk conduct problem-based learning activities in the flipped classroom to promote self-regulation. Thirty undergraduates from the Department of Mechatronics participated in this study. Through the experiences of students and teachers, including their opinions and behaviors, self-regulation skills are discussed [5]. Huang et al. investigated the characteristics of deep and superficial learning methods in online students' responses to teachers' qualitative feedback on multistage, poorly structured design projects. In addition, it examines the relationship between learning methods and two learner characteristics: cognitive beliefs (EB) and closed needs (NFC). Four emerging themes were identified, in which the learning methods of students spread from deep to superficial learning: the number of feedback items processed, the understanding of feedback, the quality of processing feedback, and overall thinking [6]. Hussain et al. adopt a student-centered approach and implement a "flipped classroom" model in engineering courses to achieve constructivism (i.e., learning based on experience) and individualized learning for students. A new method based on fuzzy logic is designed to evaluate students' survey

responses from qualitative survey data. The flipped classroom model helps students improve their grades and strengthen their interaction with teachers and peers [7]. The results of these studies may all help other scholars to strive to achieve personalized learning based on experience and students, but their research is not comprehensive.

The innovations of this paper are the following: (1) This paper introduces a metaheuristic algorithm to solve the optimization problem and chooses the simulated annealing algorithm and the microregular annealing algorithm suitable for this research to solve the problem. (2) The design and development of educational technology courses based on the hybrid metaheuristic algorithm to optimize the neural network, which is studied in this paper, use the fusion of metaheuristic algorithm and artificial neural network to solve the current problems in the field.

2. Design and Development Method of Educational Technology Courses Based on the Hybrid Metaheuristic Algorithm to Optimize the Neural Network

2.1. Metaheuristic Algorithm. Compared with the optimization algorithm, the metaheuristic algorithm is an improvement of the heuristic algorithm [8, 9]. It combines two types of random algorithms and local search algorithms and, aiming at a specific problem, iteratively obtains an approximate optimal solution that can be used to calculate a given problem under the complexity of time and the complexity of a given area [10]. The overview diagram of the metaheuristic algorithm is shown in Figure 1.

2.1.1. Simulated Annealing Algorithm. The simulated annealing algorithm is derived from the principle of solid annealing and is a probability-based algorithm. The solid is heated to a sufficiently high level and then allowed to cool down slowly; when heating, the internal particles of the solid become disordered with the temperature rise, and the internal energy increases. When cooling slowly, the particles gradually become orderly, reaching an equilibrium state at each temperature and finally reaching the ground state at room temperature, and the internal energy is reduced to a minimum. The simulated annealing algorithm is an extension of the local search algorithm [11]. Different from the local search algorithm, it selects the high-cost state in the neighborhood with a certain probability. This is a proposed global search algorithm. The general algorithm flow of the simulated annealing method is shown in Figure 2.

2.1.2. Microregular Annealing Algorithm. The microregular annealing algorithm was proposed by Michael Creutz in 1983, and it is also the process of simulated annealing, but the microregular annealing algorithm focuses on the energy change process of the system, not the change of the system temperature [12, 13]. Among them, in the simulated annealing algorithm, there is a process of a greedy mechanism, which can accept a new state that increases the value of the objective function and uses another mechanism to accept a new state that deteriorates the value of the objective function

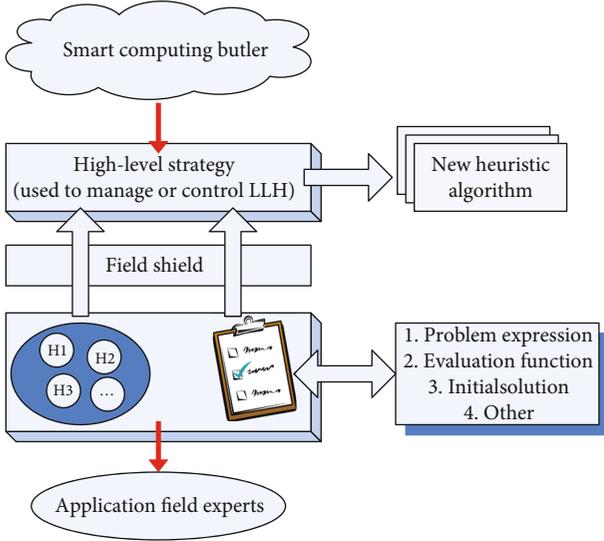


FIGURE 1: Overview of metaheuristic algorithm.

to a certain extent. The conditions for deteriorating the new state are becoming more and more demanding, and the poor state is accepted with a small probability according to the Metropolis criterion [14]. Compared with these two mechanisms, only one mechanism is used in the microregular annealing algorithm to accept the next state. It accumulates all the energy to change $\sum \Delta E$ in each inner cycle of annealing and accepts the current bad state as long as the accumulated energy $\sum(-\Delta E)$ taken away is positive.

The microcanonical Monte Carlo simulation method is based on the concept of microcanonical system [15]. In this simulation technology, β is no longer directly dependent, and the form of the distribution function Z becomes

$$A = \sum_B \sum_C \delta[E(B) + K(C) - E_0], \quad (1)$$

where E_0 is the initial energy value and $K(C)$ is the energy of momentum C in state B .

Assume that E_D is a positive number and the initial value is generally equal to zero. At this time, the form of Z is

$$A = \sum_B \sum_{E_D} \delta[E(B) + E_D - E_0]. \quad (2)$$

The initial system state can be arbitrarily configured. When released with 0 initial energy, it will randomly enter the state area and try to modify the current state. If this action can reduce the power consumption of the system, it will absorb the energy difference involved [16, 17], which is

$$E_D' \leftarrow E_D + E_j + E_l. \quad (3)$$

Among them, E_l and E_j , respectively, represent the system energy corresponding to the old and new distribution schemes.

2.2. Mathematical Model of Normal Arrangement Problem. When the conventional scheduling problem cannot be solved manually, the simulated annealing algorithm and the micro-rule algorithm in the metaheuristic algorithm used in this article are used to solve the conventional scheduling problem.

There are x students, y subjects, and r classes. Each student i 's grade for each subject is S_{iu} . Most students will have old classmates or friends, and sometimes, some of them will have "enemies" who often conflict. For each student, there are two corresponding lists containing old classmates and enemies of the same gender. All students will be assigned to r classes.

i represents the i th student, $i \in \{1, 2, \dots, x\}$; u represents the u th subject, $u \in \{1, 2, \dots, y\}$; k represents the k th class, $k \in \{1, 2, \dots, q\}$; $a(i)$ represents the gender of the student i , equal to 1 is a girl, and equal to 0 is a boy; M_{ik} is a binary variable; when $M_{ik} = 1$, student i is assigned to the k th class; when $M_{ik} = 0$, the opposite is true, because a student can only be assigned to one class, so there is $\sum_{k=1}^q M_{ik} = 1$; N_{ik} is a binary variable, when $N_{ik} = 1$ means student i . If you are assigned to class k and do not have an old classmate of the same gender, the opposite is true when $N_{ik} = 0$, there is obviously $\sum_{k=1}^q N_{ik} \leq 1$; W_k is an integer variable that indicates how many conflicting pairs of students in class k .

The similarity of the number of people in each class can be expressed as the value of the following formula as small as possible:

$$\min \left(\max_{k=1} \left\{ \sum_{i=1}^x M_{ik} \right\} - \min_{k=1} \left\{ \sum_{i=1}^x M_{ik} \right\} \right). \quad (4)$$

A similar number of girls in each class can be expressed as the value of the following formula as small as possible, and similar formulas can be used for boys:

$$\min \left(\max_{k=1} \left\{ \sum_{i=1}^x M_{ik} a(i) \right\} - \min_{k=1} \left\{ \sum_{i=1}^x M_{ik} a(i) \right\} \right). \quad (5)$$

The students in each class have at least one old classmate of the same gender, which can be expressed as the value of the following formula as small as possible:

$$\min \left(\max_{k=1} \left\{ \sum_{i=1}^x N_{ik} \right\} \right). \quad (6)$$

Students who have had conflicts should avoid being placed in the same class, which can be expressed as the value of the following formula as small as possible:

$$\min \left(\max_{k=1} \{W_k\} \right). \quad (7)$$

For course u , we can calculate the average grade of each class k . The difference between the maximum average score and the minimum average score in all classes can be used as a scalar for the difference in the course scores. All courses

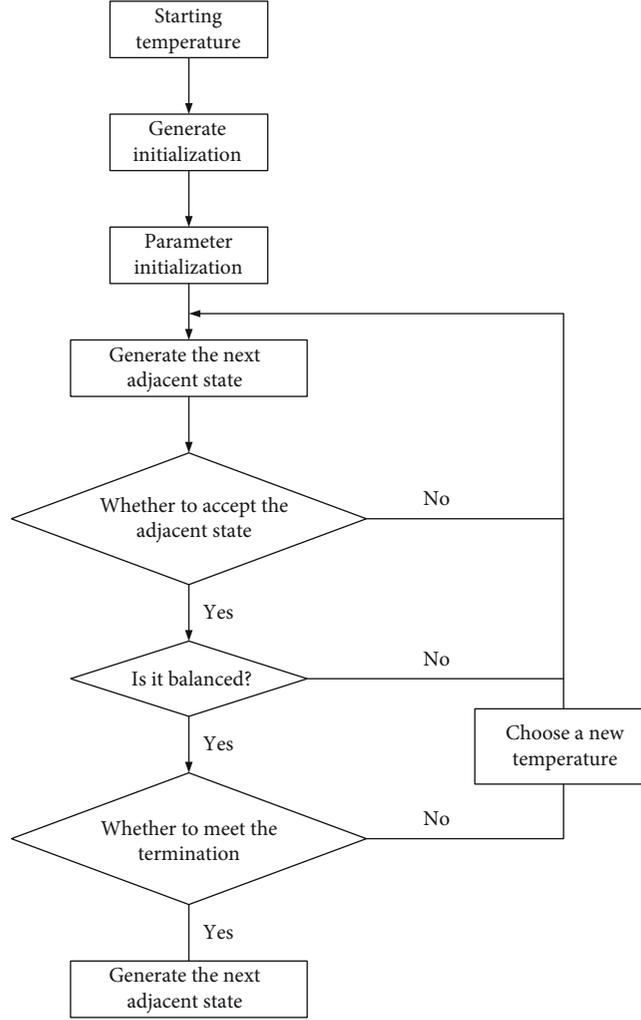


FIGURE 2: Block diagram of simulated annealing algorithm.

have similar average grades in each class, which can be expressed as the value of the following formula as small as possible:

$$\min_{u=1} \left\{ F_u^5 \left(\max_{k=1} \left\{ \frac{\sum_{i=1}^x M_{ik} S_{iu}}{\sum_{i=1}^x M_{ik}} \right\} - \min_{k=1} \left\{ \frac{\sum_{i=1}^x M_{ik} S_{iu}}{\sum_{i=1}^x M_{ik}} \right\} \right) \right\}, \quad (8)$$

where F_u^5 is the average weight of the course u .

For the course u , we can sort students' grades from small to large, use $H_{uk}(D)$ to represent the highest grade of D , and divide this sequence into $[x/q]$ parts; excluding the last part, every other part has q elements; each part can calculate the average score:

$$s_u(l) = \sum_{D=lq}^{lq+q-1} H_u \frac{(D)}{q}, \quad (9)$$

where l is a nonnegative number less than or equal to $[x/q]$. From these average grades, we can construct the score of a

template class. This class has $[x/q]$ students, and the grade is $s_u(l)$. Then, we use $H_{uk}(D)$ to represent the student scores of the ranking D of the course u in class k . The following formula is the standard deviation of the grades of course u for class k and template class, denoted by B :

$$B = \sqrt{\frac{\sum_{i=1}^x M_{ik}}{\sum_{D=1}^x (s_u(D) - H_{uk}(D))^2}}. \quad (10)$$

The similarity of the score distribution of each course in each class can be expressed as the value of the following formula as small as possible:

$$\min_{u=1} \left\{ F_u^6 \max_{k=1} \left\{ \sqrt{\frac{\sum_{i=1}^x M_{ik}}{\sum_{D=1}^x (s_u(D) - H_{uk}(D))^2}} \right\} \right\}, \quad (11)$$

where F_u^6 is the distribution weight of course u .

Now, we can get the formula that considers all factors at the same time:

$$\min \left(F^1 \left(\max_{k=1} \left\{ \sum_{i=1}^x M_{ik} \right\} - \min_{k=1} \left\{ \sum_{i=1}^x M_{ik} \right\} \right) \right), \quad (12)$$

$$F^2 \left(\max_{k=1} \left\{ \sum_{i=1}^x M_{ik} a(i) \right\} - \min_{k=1} \left\{ \sum_{i=1}^x M_{ik} a(i) \right\} \right), \quad (13)$$

$$F^3 \max_{k=1} \left\{ \sum_{i=1}^x N_{ik} \right\}, \quad (14)$$

$$F^4 \max_{k=1} \{ W_k \}. \quad (15)$$

Add formula (8) to formulas (12), (13), (14), and (15), and add

$$F_u^6 \max_{k=1} \left\{ \sqrt{\sum_{D=1}^x M_{ik} (s_u(D) - H_{uk}(D))^2} \right\}. \quad (16)$$

Among them, F^1 , F^2 , F^3 , F^4 , F_u^5 , and F_u^6 are the calculation weights of the corresponding formulas. The function value of the sum of these formulas is called the objective function value. It can be known from the derivation process of the formula that the smaller the objective function value, the better the current result, which means that the current result meets the requirements.

2.3. Neural Network

2.3.1. Neuron Model. The basic processing unit of a neural network is a neuron, which is a simulation of a biological neuron [18, 19]. The connection between each neuron and its corresponding neuron is biologically called a synapse. In the mathematical model, we call each synapse the weight of the network, and the neural network trains the network by adjusting these weights [20, 21].

x_1, x_2, \dots, x_n represents the input of the neuron, and $\omega_{i1}, \omega_{i2}, \dots, \omega_{in}$ is the connection weight. Use a certain calculation to combine the effects of the input signal to give the total effect, expressed by net_i . According to different calculation methods, the expression of net_i is different. The following is the simplest linear weighted summation form, namely,

$$net_i = \sum_{j=1}^n \omega_{ij} x_j. \quad (17)$$

The output y_i is the value after the action of the excitation function f . In this way, the mathematical expression of the above model is

$$net_i = \sum_{j=1}^n \omega_{ij} x_j - \theta_i, \quad (18)$$

$$y_i = f(net_i).$$

In the formula, θ_i is the threshold of neuron i and net_i is the net input, which is the total effect of combining the effects of the input signal by a certain operation.

2.3.2. The Excitation Function of the Neural Network. After the neuron gets the network input, it should give the corresponding output [22]. Used to perform the transformation of the network input obtained by the neuron, this is the activation function, also known as the activation function [23, 24]. Typical activation functions are linear function, nonlinear function, threshold function, and sigmoid function. The four function images are shown in Figure 3.

2.3.3. Linear Function. The most basic activation function in a neural network is a linear function, and its role is to appropriately amplify the input signal obtained by the neuron [25]. Its form is

$$f(net) = k \times net + c. \quad (19)$$

In the formula, k is the magnification factor and c is the displacement. Both k and c are constants.

2.3.4. Nonlinear Ramp Function. Choosing a linear function will affect the performance of the neural network and may also make the performance of a multilevel neural network become a single-level network. Therefore, we introduce a nonlinear ramp function.

The nonlinear ramp function is a piecewise linear function. The value range of the function is in the range $[-\gamma, \gamma]$:

$$f(net) = \begin{cases} \gamma, & net \geq \theta, \\ k \times net, & |net| < \theta, \\ -\gamma, & net \leq -\theta. \end{cases} \quad (20)$$

Among them, γ is a constant, and $\gamma > 0$ is usually specified. It is called the saturation value, which is the maximum output of the neuron.

2.3.5. Threshold Function. The threshold function is also called the step function. Its function is to determine whether the network input obtained by the neuron exceeds the set value θ . The form of the function is

$$f(net) = \begin{cases} \beta, & net > \theta, \\ -\gamma, & net \leq \theta, \end{cases} \quad (21)$$

where β , γ , and θ are all nonnegative real numbers and θ is the threshold.

Usually, people use its binary form:

$$f(net) = \begin{cases} 1, & net > \theta, \\ 0, & net \leq -\theta. \end{cases} \quad (22)$$

Sometimes, 0 in the above formula is also changed to -1; then, it becomes the following form:

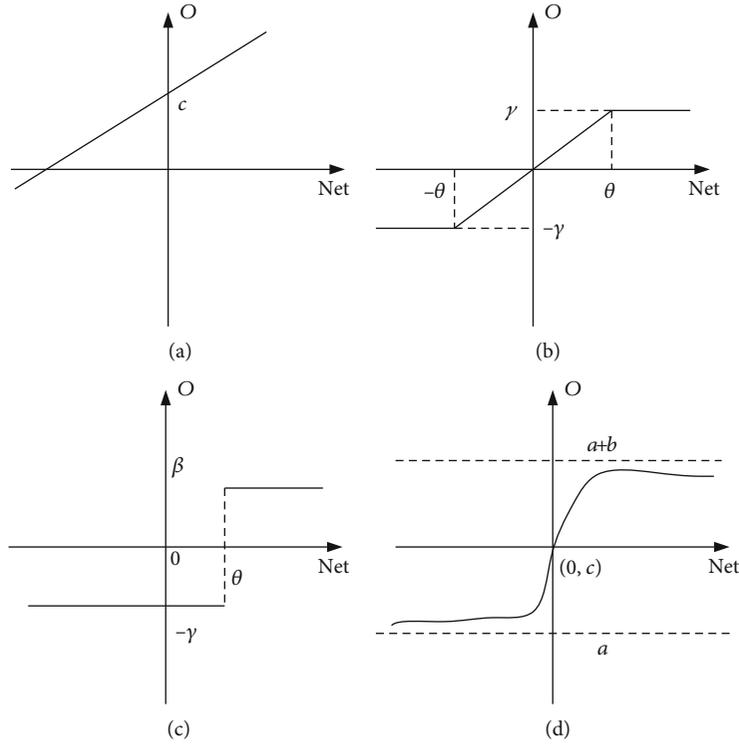


FIGURE 3: Four activation function images.

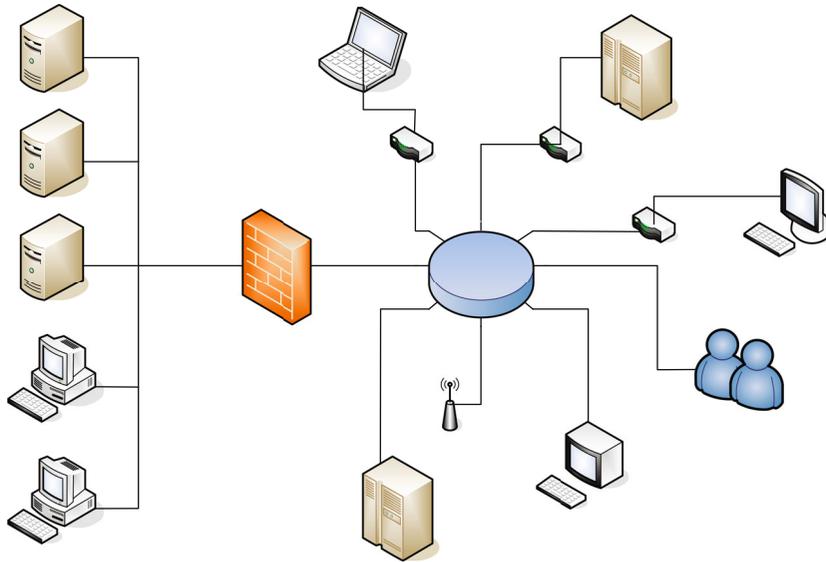


FIGURE 4: B/S structure.

$$f(\text{net}) = \begin{cases} 1, & \text{net} > \theta, \\ -1, & \text{net} \leq -\theta. \end{cases} \quad (23)$$

(0, 1) and can be used for binary classification. The effect is better when the feature difference is more complicated or the difference is not particularly large. Its form is

2.3.6. *S-Shaped Function.* The sigmoid function is also called the compression function, and it is the most widely used. The sigmoid function is also called the logistic function. It is used for the output of hidden layer neurons. The value range is (0, 1). It can map a real number to the interval of

$$f(\text{net}) = a + \frac{b}{1 + \exp(-d \times \text{net})}. \quad (24)$$

In the formula, a, b, d are constants.

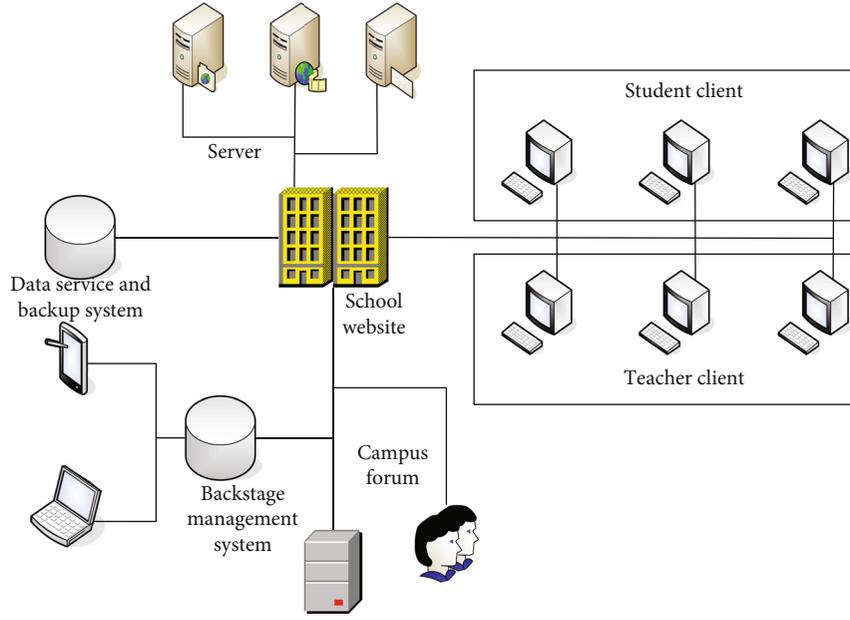


FIGURE 5: Topology diagram of learning platform system architecture.

The general form of this function is

$$f(\text{net}) = \frac{1}{1 + \exp(-d \times \text{net})}. \quad (25)$$

At this time, the saturation value of the function is 0 and 1, and the hyperbolic function or extended square function can also be used. When taking the expansion function,

$$f(\text{net}) = \begin{cases} \frac{\text{net}^2}{1 + \text{net}}, & \text{net} > 0, \\ 0, & \text{else.} \end{cases} \quad (26)$$

The saturation values are still 0 and 1. When taking the hyperbolic function,

$$f(\text{net}) = \tan(\text{net}) = \frac{e^{\text{net}} - e^{-\text{net}}}{e^{\text{net}} + e^{-\text{net}}}. \quad (27)$$

Saturation values are -1 and 1.

3. Experiments and Experimental Results

3.1. Learning Resource Needs. Learning resources are all things that can help a person study and work effectively. In a broader sense, learning resources are the general term for things that provide learning. Learning resources support and promote learning. It should also include elements such as personnel, tools, strategies, methods, and environment. Learning resources in a narrow sense refer to learning content and learning resources, providing platform-based learning resource design to meet teaching and learning needs. The quality of platform resources directly affects students' learning interest and enthusiasm and also affects students' academic performance [26, 27]. The research process of this

TABLE 1: Contrast table of α coefficient value and reliability degree.

α value	Reliability
$\alpha < 0.5$	Unacceptable
$0.5 \leq \alpha < 0.6$	Acceptable
$0.6 \leq \alpha < 0.7$	Generally
$0.7 \leq \alpha < 0.8$	High reliability
$0.8 \leq \alpha < 0.9$	High confidence
$\alpha \geq 0.9$	Very high reliability

experiment is carried out through the method of a questionnaire survey, which analyzes the views of learners on learning resources and also provides different kinds of learning resources.

3.2. Overall Design of the Platform. According to demand analysis, a learning platform for educational technology courses is designed and developed. The main modules of the platform include the student service center, curriculum resource center, teacher service center, interactive communication center, and management center.

3.2.1. B/S Structure. The B/S structure, that is, the client only needs to access the server resources through the browser, is a change and improvement to the C/S structure. The common architecture diagram of the B/S structure is shown in Figure 4. The B/S architecture is an improvement from the C/S architecture, which can be said to be a three-tier C/S architecture, which shows that the relationship between the two is not general. B/S broke away from C/S. Later, with the rapid development of WEB technology and the deepening of people's dependence on the network, B/S became the most popular network architecture in one fell swoop.

TABLE 2: Reliability test results.

α value	Number of questions	Reliability
Status of learner skills and knowledge	8	0.768
The status of the learner's theoretical knowledge	7	0.794
Total table	15	0.775

TABLE 3: KMO factor analysis and evaluation criteria.

Detection category	Range of values	Factor analysis suitability
KMO value	>0.9	Very suitable
	0.8-0.9	Very suitable
	0.7-0.8	Fit
	0.6-0.7	Not very suitable
	0.5-0.6	Barely fit
	<0.5	Not suitable
Bartlett P value	≤ 0.01	Fit

3.2.2. *Multilayer Structure Mode.* The multilayer structure pattern is developed on the basis of the three-layer structure pattern. The business logic layer in the three-layer structure pattern is further decomposed according to the needs and decomposed into more layers. This system uses a multilayer structure model in the development structure, which is composed of five layers: user interface, business logic layer, business rule layer, data access layer, and database, as shown in Figure 5.

3.3. *Design of the Questionnaire.* The main purpose of designing the questionnaire is to determine the needs of the learners of educational technology courses and the needs of the learners for blended teaching. The overall questionnaire is designed mainly through three aspects: the basic background of learners, teaching needs, and educational technology learning needs. Then, it is divided into five small parts. The first part is mainly to obtain the personal background information of the survey object and the background of the survey object. The second part mainly obtains the actual learning needs of the surveyed subjects in offline learning. The third part is to obtain the actual needs of the survey respondents in traditional online classrooms. The fourth part is presented in the form of a scale, which is divided into five levels. It mainly obtains the knowledge level of the survey subjects before learning the content of educational technology courses and investigates the starting level of the two types of knowledge, software skill level and theoretical knowledge. The fifth part is mainly to obtain the survey object's learning expectations in educational technology courses.

Since the online questionnaire survey tool is relatively mature, the questionnaire is divided into two parts. The questionnaires are distributed on a trial basis using manual and online questionnaire survey platforms, which can save manpower, material resources, and financial resources and

help data collation and analysis. The trial issuance of the questionnaire is to test the rationality of the questionnaire itself, whether it meets the research requirements and whether the results obtained meet the purpose of the research. Whether the questionnaire meets expectations, it is necessary to pass the reliability and validity test of the questionnaire.

3.3.1. *Reliability Analysis of the Questionnaire.* In this study, the questionnaire used the alpha coefficient method established by Cronbach to test the reliability, which is the commonly used reliability test in the attitude scale method. Different research scholars have given different limits for the boundary value of the α coefficient, as shown in Table 1.

In this study, a preliminary questionnaire was issued to 50 learners of education majors. The effective data was 50. The reliability of the returned questionnaire was analyzed through SPSS22. The test results are shown in Table 2.

It can be seen from Table 2 that the scale is used to test the skills, knowledge, ability, and theoretical knowledge of educational professional learners, and the questionnaire scale α value is 0.775, greater than 0.7, indicating that the test scale has high overall reliability and high internal consistency. On the current situation of learners' skill knowledge, the α coefficient value is 0.768, greater than 0.7, indicating that this part has high item reliability and does not need to make major changes to this topic.

3.3.2. *Validity Analysis of Questionnaire.* In this study, the validity of the overall questionnaire is analyzed. Before the validity analysis of the questionnaire, the KMO value analysis of the data is first tested. The KMO value is the standard to judge whether the data is suitable for factor analysis. The expression boundary of the KMO value is shown in Table 3.

3.4. *Experimental Investigation Results.* Figure 6 shows the survey results of students' grades, genders, and majors.

The survey results of students' learning styles and learning resource types are shown in Figure 7.

It can be seen from Figure 7 that for the learning method of online learning resources, a total of 94% of students will choose to use online learning as the primary or secondary learning method, and only 6% use other learning methods, indicating that most learners prefer online learning [28, 29].

A survey of online learning resources frequently used by learners found that 42% chose to use textual materials; 29% chose to use video and audio learning resources, such as sound files and video files; 18% chose online courses, for example, learning recorded in the classroom; 11% choose other learning resources.

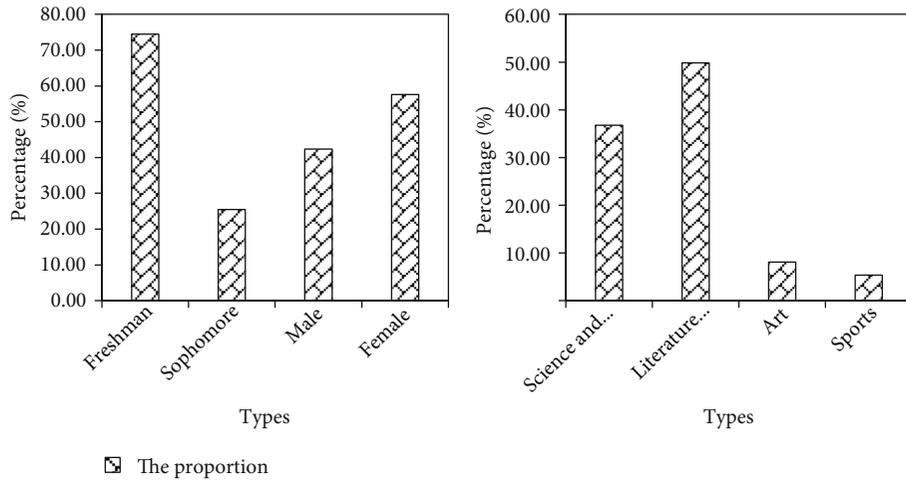


FIGURE 6: The basic situation of the survey object.

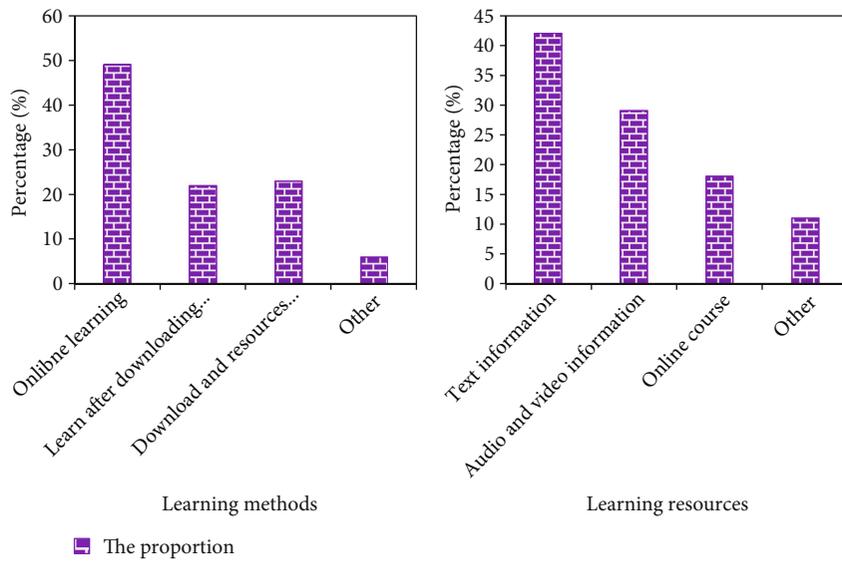


FIGURE 7: Survey results of students' learning styles and types of learning resources.

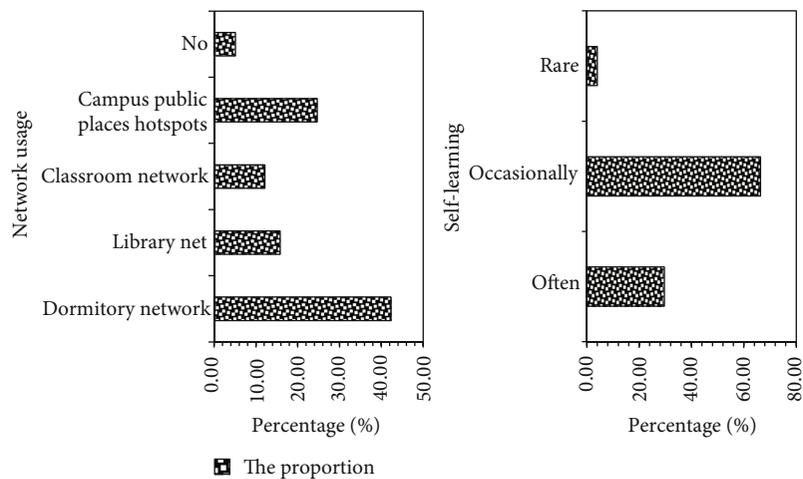


FIGURE 8: Survey results of students' use of the Internet and autonomous learning.

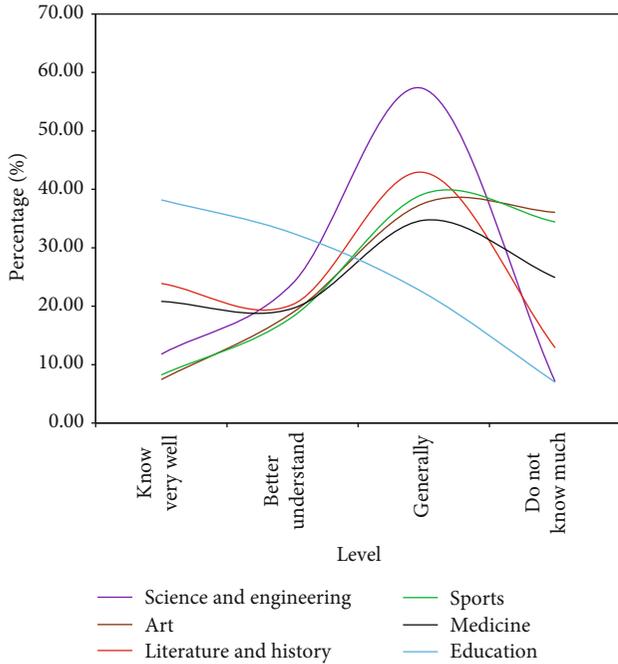


FIGURE 9: Scale-level statistical results of different professions.

TABLE 4: Software skill level of learners.

Type	Number of valid values	Number of missing values	Average value
PowerPoint	575	0	1.94
Adobe Photoshop	575	0	2.61
Adobe Flash	575	0	2.63
Adobe Captivate	575	0	2.98
Premiere, AE	575	0	2.72
Camtasia Studio	575	0	2.85

The survey results of students’ use of the Internet and autonomous learning are shown in Figure 8.

In terms of Internet usage, the Internet is used in the dormitory the most, with 42.3% of students using Internet in the dormitory. In terms of self-directed learning, 29.65% of students will study independently on a regular basis, and the number of people who study independently occasionally accounts for 66.37% of the total number of students, of which only 3.98% of students rarely study independently. From the data point of view, most learners have experience of autonomous learning or often learn independently, and the online learning of this teaching mode requires learners to carry out autonomous learning, and the ability of autonomous learning plays an important role in promoting teaching.

This study investigated the theoretical knowledge and skills currently possessed by learners of different majors by formulating a scale. The scale is divided into five levels,

namely, “very understanding,” “comprehensive understanding,” “average,” “not so familiar,” and “never heard.” The potential meaning of the average score of the scale is that the higher the average score, the less familiar the learner is with the theory; the lower the average score, the more familiar the learner is with the theory; the result is shown in Figure 9.

It can be seen from Figure 9 that education majors know more about educational technology courses, and 38.20% of them know very well, while art majors do not understand this well, with 36.05% art majors. Both said that they had never heard of this course.

The status quo of learners’ software skills was investigated, and the results are shown in Table 4.

It can be seen from Table 4 that the average score of learners in each software is less than 3. The level of familiarity is also caused by the professionalism of the software itself. According to the statistical results, it can be found that there are significant differences in software skills among professional learners.

With regard to the course online learning platform, when learners encounter problems, they hope for teachers’ response, with the survey results of response speed shown in Figure 10(a). Teaching requires learners to carry out independent online learning in their spare time. The survey results of how long learners think the online learning time should be after class per week are shown in Figure 10(b).

From Figure 10(a), learners expect to get more than 80% of teachers’ responses within half a day. Therefore, when developing blended teaching, tutors should ensure when learners are learning and when learners encounter problems. The teachers’ reply within half a day meets the learning needs of most learners. According to Figure 10(b), the proportion of learners who study online for less than 3 hours after class is more than 80%. Therefore, when designing off-line learning resources, the weekly learning time should be controlled within 3 hours.

4. Discuss

On the starting point of learning, there are significant differences in the starting point of learners’ ability level due to different majors. The learning of theoretical knowledge and software skill knowledge in educational technology courses needs to understand the degree that learners have mastered in advance. This study discusses the two aspects of learners’ theory and software based on data statistics.

Because students often use different online learning resources, different ways for students to learn online learning resources are defined. Video and audio transmission is a considerable network resource. If you download resources to learn, it will take a long time and more effort. Students are more willing to participate in online learning. Therefore, from the research on the use of student resources, it can be seen that audiovisual and online courses are relatively important learning resources. If students use online learning more, it can save a lot of time.

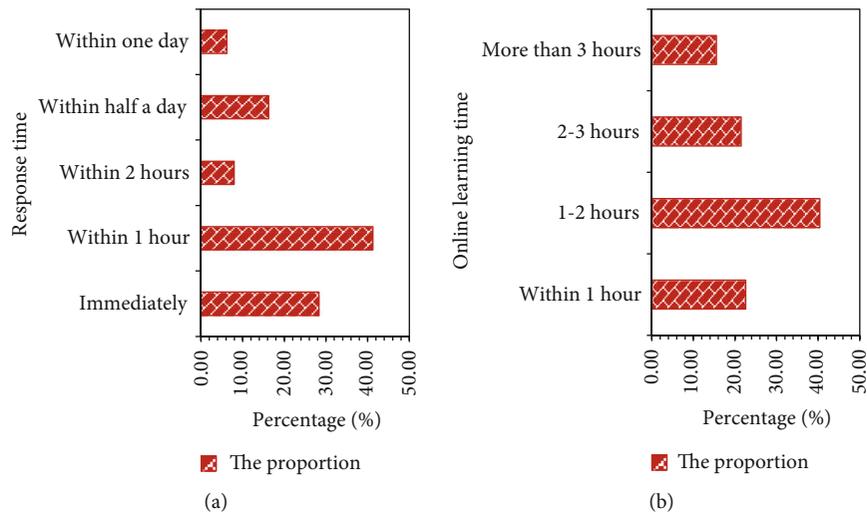


FIGURE 10: The expected response time and online learning time survey results of students.

5. Conclusions

The purpose of building a learning platform in the learning of educational technology courses is to help students make full use of the classroom and network to promote their more effective learning. The learning platform of educational technology courses designed in this paper not only provides a friendly platform and rich resources for learners' learning but also provides teachers with appropriate teaching modes to optimize their teaching effect. The platform realizes the complementary advantages of classroom teaching and network teaching and provides strong support for teachers and students. This platform can realize students' self-evaluation during online learning. For all, it is also easier to grasp the key and difficult points of teaching and implement individualized teaching. At the same time, it also promotes the communication between teachers and students and strengthens the interaction between teachers and students. However, when comparing and discussing with other colleges and universities, there are certain limitations and the scope of the survey is limited. At the same time, some studies may not be able to fully understand the real situation of the students, so the design research in this area needs further improvement.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors state that this article has no conflict of interest.

Acknowledgments

This work was supported by the Key research base of Humanities and Social Sciences in Sichuan colleges and Universities-key project of Sichuan Research Center for early development and education of 0-3-year-old children "Research on the construction of diversified and integrated infant care service

system" (SCLS19-01) and a doctoral innovation fund project of School of Educational Sciences of Xinjiang Normal University—Research on the development of education in Xinjiang (XJNUJKYA2015).

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