Exploring the Digital Impact of Big Data-Enhanced Flipped Classroom Instruction in University English

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Abstract. English language teaching (ELT) flip classroom is different from the traditional English language instructional mode, and its student-centered instructional method brings great challenges to the assessment of learning results. There are many factors that affect the results of instructional assessment. The grading criteria are complex and it is difficult to give an appropriate mathematical model with analytical expressions, which are mostly nonlinear classification problems. This paper discusses the instructional mode and instructional effect of "flipped classroom" in university ELT driven by big data, establishes a mathematical model with genetic algorithm neural network (GA-NN) model structure, trains the neural network with expert samples, and uses the trained neural network for data processing, thus obtaining a good assessment result. Compared with the traditional ELT assessment system, the assessment accuracy of the assessment algorithm in this paper has increased by 25.47%, and all the training samples are close to the expert assessment results. Therefore, the student assessment model based on GA-NN is a reasonable and feasible assessment model. In the simulation results of cultivating university students' writing ability and reading ability in university ELT, the students' writing ability and reading ability are obviously improved after implementing digital flipped classroom teaching.

Keywords: English language teaching; Flipped classroom; Big data; Genetic algorithm neural network;
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1 INTRODUCTION

Flip classroom advocates students as the main body, so that students can watch teaching videos at home according to their actual situation and control the learning rhythm. By flipping the classroom, teachers can present classroom teaching contents in various styles and novel forms to meet the

learning needs of different students [14]. ELT flip classroom is different from the traditional English language instructional mode, and its student-centered instructional method brings great challenges to the assessment of learning results [10]. Instructional level assessment is an important link in teaching management, which helps school leaders and managers to understand the realization degree of teaching objectives, comprehensively and accurately grasp the situation of school teaching, and thus improve instructional level [22]. There are many factors that affect the results of instructional assessment. The grading criteria are complex and it is difficult to give an appropriate mathematical model with analytical expressions, which are mostly nonlinear classification problems. Artificial neural network (ANN) is an active interdisciplinary subject, which has the functions of self-organization, self-adaptation and self-learning, can analyze complex nonlinear systems, and has high flexibility and high-speed computing ability, so it can be used in a series of prediction and modeling problems [13].

Flipping teaching is a student-centered learning mode that emphasizes active learning, and it is a blended learning mode. In this learning mode, students actively participate in and construct their own learning process, and the roles of teachers and students are reconstructed [7]. The flip classroom in higher education encourages students to become excellent autonomous learners, and helps students to really apply what they have learned to their future jobs. Because of the nonlinearity and complexity of the assessment model, there are some problems in evaluating and forecasting only by using ANN, mainly the slow convergence or no convergence of network training [24]. In the flipped classroom instructional mode, the digital technology is used to convert the classroom teaching time into screen capture video, so as to introduce new concepts. Constructing a scientific, systematic and effective instructional level assessment system and operating mechanism plays a very important role in strengthening instructional level management and improving instructional level in universities [11]. This paper discusses the instructional mode and instructional effect of "flipped classroom" in university ELT. GA is used to optimize ANN, and a mathematical model of ELT assessment is established. The neural network is trained by expert samples, and the trained neural network is used for data processing, so a good assessment result is obtained.

In the process of students' daily life and communication, communication on social networking sites and related data in online learning become important statistical basis for students' learning situation and learning problems. Big data-driven can promote the diversified development of teaching resources and means, and greatly challenge the traditional classroom teaching [23]. Flip teaching is a instructional mode in which the roles of teachers and students are redefined in the flip environment. Assessment should be student-centered, use assessment as a learning tool, and encourage continuous assessment of students' learning by layering and building a framework in the learning process in the flip context, so as to form formatted feedback and improve the final result [17][18]. It is also very effective to apply ANN to classroom instructional level assessment. According to the learning characteristics driven by big data, this paper establishes a new instructional mode by flipping the classroom, and analyzes the teaching practice effect. The research includes the following innovations: (1)an English nonlinear assessment model based on GA-NN is established, and expert samples are used to train neural networks. The results show that the system is easy to use, with high accuracy and portability; and GA and ANN are combined to optimize the topology and learning parameters of the network, and the assessment factors participating in the training are screened to find the best combination of input parameters and network structure parameters participating in the training.

2   RELATED WORK

Crothers proposed that English language learners should not only have multiple opportunities, but also have multiple ways to show what they have learned. Therefore, the assessment criteria should

include various items and response types, which can reflect the strength of these English language learners [8]. Kibler believes that learners with different skills and learning backgrounds can cooperate in learning tasks and discussions, thus reaching a consensus in a specific field [12][20]. Alkateeb et al. analyzed the characteristics and existing problems of the current classroom instructional level assessment system, and put forward two important problems that must be solved in the classroom instructional level assessment system: the main body of assessment and the assessment index system [4]. Zitek believes that classroom instructional level assessment is an important means to check teachers' teaching work, which can measure the level of instructional level and the degree of reaching the goal, so as to check out the gap [25]. Llosa also analyzes the current assessment systems of classroom instructional level in universities at home and abroad, and puts forward the main problems and future development trends of the current assessment methods of classroom instructional level [16]. Ahn analyzed the current situation of higher education, put forward that improving instructional level in an all-round way is the focus of current higher education, and put forward that a scientific assessment system of classroom instructional level in universities has good functions of diagnosis, feedback, motivation and guidance, and is an effective way to improve instructional level [1]. Alan et al. established the assessment system of university classroom instructional level by using back propagation neural network (BPNN) theory, formulated a scientific and reasonable assessment index system, then determined the neural network assessment model of university classroom instructional level assessment system, selected the improved BPNN algorithm to train the sample data, obtained the assessment results, and then verified the verification data [3]. Starting from the application of neural network theory, Akbari designed a neural network-based instructional level assessment system in universities, including neural network assessment model, network structure, learning parameters and learning algorithm [2]. Starting from educational theory, Trammell has formulated scientific and reasonable assessment indicators of classroom instructional level, which mainly include all-round assessment subjects and multi-dimensional hierarchical optimization assessment index system, and finally quantify the index system [21].

On the basis of traditional instructional level assessment methods, this paper puts forward an ELT assessment model based on GA-NN, and tests the original school assessment system data with this method. The results show that this method has good performance and can be used as an effective means of instructional level assessment.

3 BIG DATA-DRIVEN ASSESSMENT MODEL OF ELT BASED ON GA-NN

Classroom assessment is an effective way to improve instructional level and promote instructional level. The main purpose of assessment is to test students' learning achievements and help teachers support students' learning in an attractive and stimulating way, but the assessment of learning is not for grading. In this paper, the assessment of ELT is turned over, and it is used as a learning tool to explore the assessment of teaching results and the methods of promoting teaching by assessment.

3.1 Flipped Classroom Instructional Model in University ELT

For some students, the length of class is just right. But for some students who have already understood the classroom materials, course contents and classroom problems, the classroom time is too long. On the other hand, for those students who have difficulties in learning, the short classroom time is not enough for them to understand the classroom content. These students are arranged to receive the teacher's guidance after class or try to understand what the teacher teaches at home by themselves. Flipping the classroom instructional mode helps to improve learners' subjective initiative [19]. Students are the main body of teaching, which is conducive to the

humanization of education. Students can freely control the time to watch teaching videos, and they can quickly watch or even skip the knowledge they have mastered. For those knowledge points that you haven't mastered or haven't mastered well enough, you can watch them repeatedly until you have mastered them. The instructional method of flipping classroom is to use students' scattered time to strengthen students' understanding and mastery of individual knowledge points, that is, by shooting small videos, students can learn or consolidate their knowledge structure by extracurricular practice anytime and anywhere.

Using new teaching strategies, teachers change from presenters of teaching content to co-learners. Teachers have time to communicate with students, discuss together, and truly become good teachers and friends of students. Teachers can also assign suitable inquiry topics according to students' characteristics, so as to be truly student-centered, and students can complete the tasks assigned by teachers in groups. University ELT in the flipped classroom uses students' favorite means of network communication, and uses vivid and interesting teaching videos to guide students' autonomous learning [6]. Under such circumstances, students with weak foundation can choose the learning schedule anytime and anywhere to consolidate their learning knowledge according to their own actual situation, regardless of the limitation of time and space. Teachers can also give special guidance according to different learning characteristics and learning situations of different students, so as to strengthen students' learning ability. In the flip class, students learn each lesson by learning the pre-recorded learning video of the teacher. Students with higher level can finish it easily; Some students need to watch the teaching videos over and over again until they fully understand the relevant course contents. The ready availability of video allows students to preview or review the course content according to their own level, so that students can control their learning progress by themselves.

Teachers play an important role in students' study, and face-to-face communication is very valuable. More importantly, teachers can form teams according to their needs, and students can solve problems through teamwork, and gradually cultivate the spirit of cooperation instead of competition with each other. In the specific process of ELT, teachers can let students choose English topics to be studied independently according to their interests, and then think and solve some English problems independently through preview [5]. Then, teachers divide the tasks into groups according to the different characteristics of students, and conduct topic discussion and research by establishing English interest groups. Finally, teachers participate in the topic summary on the basis of students' mutual assistance and communication. This not only enables students to learn the contents of classroom teaching materials, but also effectively improves their autonomous learning ability. After the implementation of the flipped classroom, teachers and students can witness students' learning difficulties together. At this time, students' learning problems are obvious, and similar mistakes can be prevented before they happen. If a student has difficulty in understanding a certain concept when watching a teaching video, he can watch the video courses of other teachers who teach the same course instead of obsessing over his teacher's explanation. Students find that watching videos of different teachers is helpful for them to review or understand a difficult concept from different angles.

3.2 GA-NN Based ELT Assessment Model

Learning assessment in ELT integrates three processes: teaching, learning and assessment. A series of formats are used to evaluate students' performance to prove that they can construct meaning and use language skills appropriately. Any assessment that can produce accurate results needs a well-designed purpose and verified scoring criteria and criteria. Assessment criteria play an important role in evaluating the success of learning. Assessment criteria support learning by setting clear expectations and standards, and promote feedback, peer assessment and self-assessment [9]. The strategy of learning assessment is to construct task framework and make assessment stratification. Teachers may be familiar with the concepts of hierarchy and framework, but they may

not know why these techniques are effective. What is a specific framework to help English learners better evaluate their learning?

The appearance of ANN provides a new way for instructional level assessment in universities. Through continuous learning and training, ANN can discover its regularity from a large number of complex data with unknown patterns, especially can handle any type of data. The mathematical model of classroom instructional level assessment system based on neural network theory is an effective method for evaluating instructional level. The steps of building an assessment model of ELT based on GA-NN are shown in Figure 1.
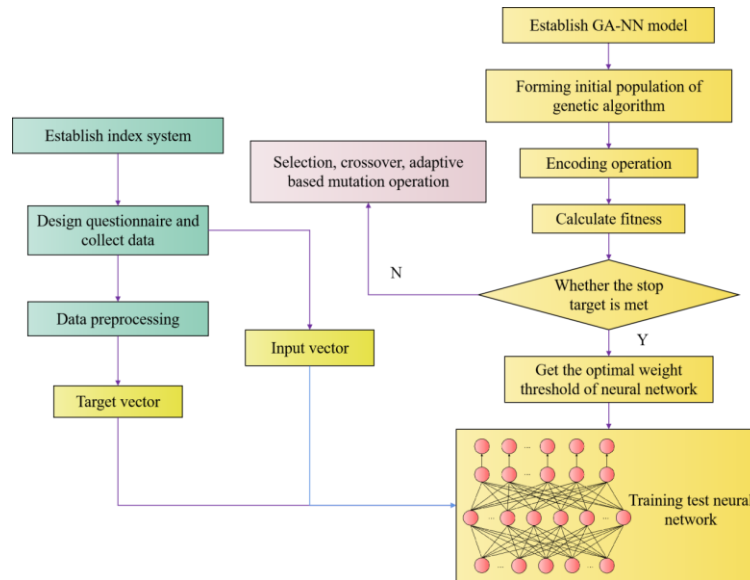

Figure 1: Steps of establishing an ELT assessment model based on Ga-Nn.

In the known P learning samples, first input the first training sample as the input value of the input layer unit:

$$x = x_1, x_2, x_3, \cdots, x_{12}$$

(1)

Hidden layer output:

$$O_j = f\left(\sum_{i=1}^{n+1} v_{ij} x_i\right) x_n = 1, v_{i,n+1} = -\theta_j$$

(2)

Output layer output:

$$y = f\left(\sum_{j=1}^{n+1} \omega_{jk} x_j\right) x_{n+1} = 1, \omega_{j,n+1} = -\theta_k$$

(3)

Output layer error:

$$d_{jk} = y(1-y)(y-Y)$$

(4)

Hidden layer error:

$$d_{ij} = O_j(1-O_j)\sum_{k=1}^{m}d_{ij}\omega_{jk}$$

(5)

GA is used to modify the weights and thresholds of each layer to accelerate the convergence speed of network learning:

$$\omega_{jk} = (n_0+1) = \omega_{jk}(n_0) + \eta \cdot d_{jk}x_j + \alpha\Delta\omega_{jk}(n_0)$$

(6)

$$\omega_{ij} = (n_0+1) = \omega_{ij}(n_0) + \eta \cdot d_{ij}x_i + \alpha\Delta\omega_{ij}(n_0)$$

(7)

Check whether the total network error E meets the accuracy requirements. If so, stop, otherwise go to formula (1). Calculate the global error value. When the global error is lower than the preset precision value, or the number of network training iterations is greater than the maximum number of times, this round of iterative learning is completed.

Warm-up study before face-to-face teaching can ensure that students actively exercise their language skills and critical thinking in conversation. In addition, the formative feedback provided by flipping classroom time online can help teachers clarify their understanding and misunderstanding, thus ensuring that students can organize their newly learned knowledge in a way that is easier to use later [15]. English learners need both traditional assessment and performance assessment to show their language skills. In order to ensure the success of face-to-face teaching and students' active participation in the assessment materials in class, the video content before class should include a small task or classroom assessment. Student-led discussion can urge students to use online materials before class. The misunderstanding can be clarified in the early stage of the instructional process, and the teacher can easily identify the areas that need renovation, whether it is need to repeat a certain point in grammar or emphasize a certain language skill. The assessment process of university ELT quality is shown in Figure 2.
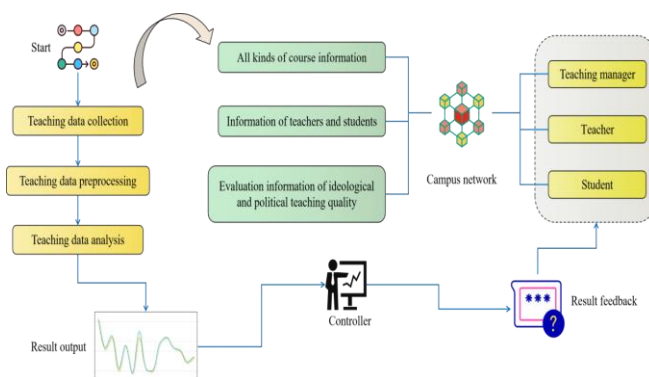

Figure 2: The quality assessment process Of ELT in universities.

Through continuous learning and training, ANN can discover its regularity from a large number of complex data with unknown patterns, especially can handle any type of data. Generally, when determining the number of neurons in the hidden layer, it usually needs to meet the following requirements:

$$m = \sqrt{x+y} + R(10)$$

(8)

Where m is the number of neurons in the hidden layer, x is the number of neurons in the output layer, and y is the number of neurons in the input layer. The roughness calculation process of the set X is:

$$R^-(X) = \{x \in U | R(x) \subseteq X\} = \{U_2, U_3, U_4, U_5, U_7\}$$

(9)

$$R_-(X) = \{x \in U | R(x) \cap X \neq 0\} = \{U_2, U_4, U_5\} \neq \varnothing$$

(10)

Therefore:

$$\rho(X) = 1 - \frac{|POS_C(X)|}{|R^-(X)|} = 0.6$$

(11)

If $X = \{U_2, U_3\}$, it is not definable because:

$$R^-(X) = \{x \in U | R(x) \subseteq X\} = \{U_2, U_3, U_5, U_7\}$$

(12)

$$R_-(X) = \{x \in U | R(x) \cap X \neq \varnothing\} \neq \varnothing$$

(13)

It is need to reduce the attributes of the original data to improve the efficiency of the algorithm. When GA is used to optimize the parameters in the "generalized mean" operation, the fitness function f is set as:

$$f = 1 - \sqrt{\frac{\sum_{j=1}^{l} \sum_{k=1}^{m} (desired_{jk} - actual_{jk})^2}{l \cdot m}}$$

(14)

$$actual_j = \left[\sum_{i=1}^{n} w_i x_i^p \right]^{1/p}$$

(15)

Where m represents the number of training patterns required by GA, and n represents the number of classes in the classification problem.

In the face-to-face teaching session, you can share the assessment criteria with students and explain the descriptors to them, so as to reach a consensus on performance standards. Assessment criteria is a tool to help students determine their own advantages and areas to be improved. According to these assessment criteria, both students and teachers can find out corresponding remedial strategies that can cultivate and improve their language ability. The assessment framework includes content support, task support and material support. Assessment framework includes modeling and practice. It is important to know how and why to guide students to successfully complete tasks, and to detect and correct modeling errors. Performance assessment reduces emotional barriers, so the learning environment has less pressure on English learners. Flipping the classroom can provide more face-to-face time to manage performance assessment and form feedback.

4   RESULT ANALYSIS AND DISCUSSION

4.1   Performance Simulation of Assessment Method

In this paper, GA-NN, which is obtained by coupling GA and BPNN, is used to optimize the network topology and learning parameters, and to screen the assessment factors involved in training. Through GA, the best combination of training parameters and network parameters can be searched out, and a model with better assessment effect can be established. The initial value of GA-NN connection weight and threshold has a great relationship with whether the network reaches the local minimum and converges in the process of network learning. The error curve of the network is shown in Figure 3.
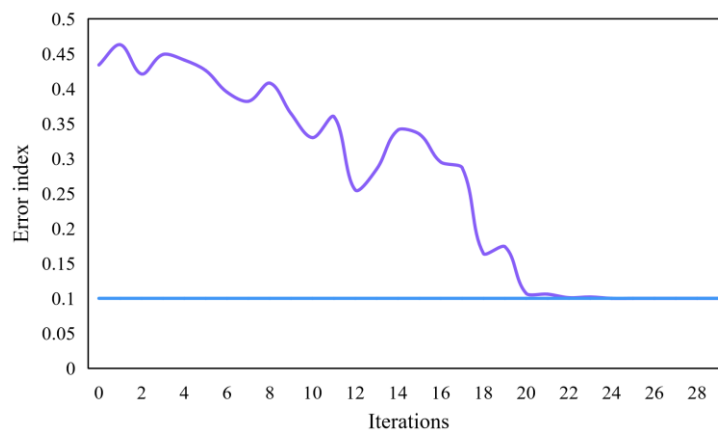

Figure 3: Training results.

It can be seen from the above error curve that the trained network quickly meets the error requirements. According to the format, the training samples are successively input into two instructional assessment models for learning, and then the test samples are respectively input into two assessment models for testing. The scatter diagram of the predicted value and the actual value of the test samples tested by traditional BPNN is shown in Figure 4. The scatter diagram of the predicted value and the actual value of the test sample tested by GA-NN assessment model is shown in Figure 5. The dots on the graph indicate the ratio of the predicted value to the actual value. The closer the predicted value is to the actual value, the closer the point is to the straight line. Similarly, the farther the point on the graph is from the straight line, the greater the gap between the predicted value and the actual value.
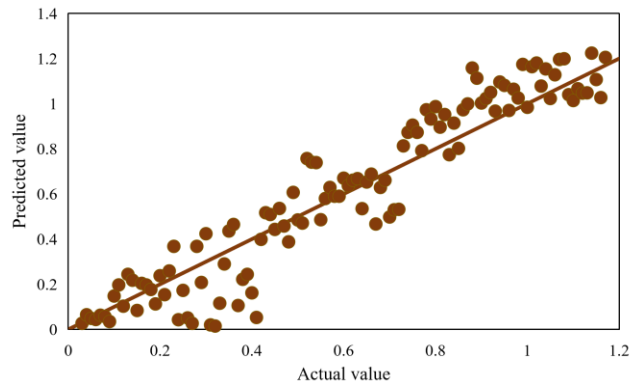
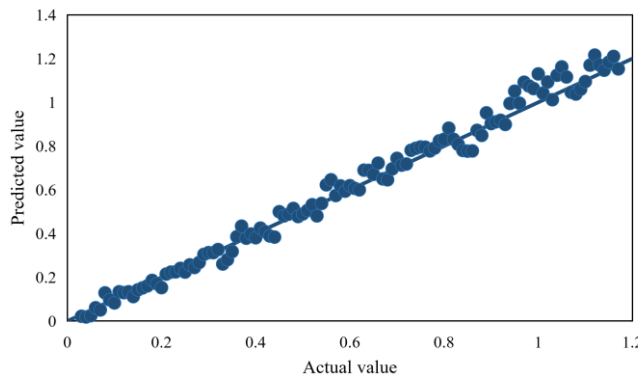**Figure 4:** Scatter plot of actual value and predicted value of traditional Bpnn.

Figure 5: Scatter plot of actual and predicted values of Ga-Nn.

It can be seen that the ratio between the actual value and the predicted value of GA-NN instructional assessment method is closer to the straight line, that is, the actual value and the predicted value of the improved neural network assessment model based on GA are closer.

The performance comparison of the two models for data processing and assessment of test sets is shown in Table 1. It can be analyzed here that the ELT assessment model based on GA-NN is better than that of traditional BPNN in both accuracy and efficiency. Compared with the traditional ELT assessment system, the assessment accuracy of this assessment algorithm has increased by 25.47%. Therefore, it is theoretically feasible to use GA-NN to analyze the application effect of flip classroom in ELT.

Use model	Test accuracy (%)	Training time (s)
GA-NN	96.66	2
BPNN	71.19	3

Table 1: Comparison of the assessment performance of the two models.

To verify the assessment effect of GA-NN model, 15 groups of test data prepared in advance are input into the trained neural network, and the simulation results and expert assessment results are shown in Table 2 and Figure 6. It can be found that all training samples are close to expert assessment results. Therefore, the student assessment model based on GA-NN is a reasonable and feasible assessment model.

Sample number	Expert appraisal	GA-NN assessment
1	0.91	0.915
2	0.76	0.769
3	0.82	0.831
4	0.65	0.662
5	0.78	0.778
6	0.64	0.639
7	0.82	0.852
8	0.66	0.658
9	0.65	0.653
10	0.79	0.789
11	0.82	0.822
12	0.77	0.769
13	0.75	0.755
14	0.69	0.697
15	0.72	0.722

Table 2: Assessment results of experts and neural network assessment results.

The results show that, compared with the non-optimized neural network, GA-NN has the advantages of faster convergence speed, smaller prediction error and higher recognition ability.

4.2 Effectiveness Assessment of Flipped Classroom

Instructional process is a process of information transmission and feedback, and instructional level assessment is an important link of information feedback in instructional process. Through the assessment of instructional level, a smooth information feedback network can be established in the instructional process, which can promote the instructional process to achieve self-regulation and win-win cycle, so as to continuously improve the quality of education and teaching. Portfolio assessment uses strategies to guide students to reflect on their own performance and the need for improvement in follow-up study. In the assessment of classroom instructional level, teachers' teaching work is appraised or graded, so that the teaching management department can better understand the instructional level and level of teachers, which can be used as one of the important bases for teachers' promotion, assessment and use, and prevent the phenomenon that teachers do well and do poorly from being treated unreasonably. Establishing and perfecting the instructional level assessment system is an important measure to strengthen the scientific management of teachers.

All the links of flipping the classroom are based on the network resource environment. Teachers should create an all-round and high-tech communication environment for students, and constantly ensure students' enthusiasm and interest in autonomous learning.
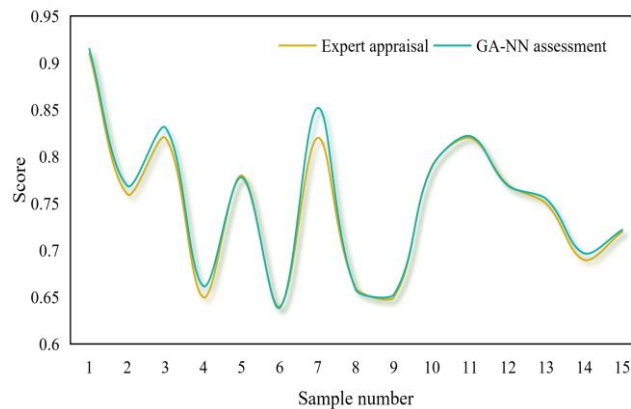
Figure 6: Expert assessment results and neural network assessment results.

Driven by big data, the improvement of university ELT level needs strong new instructional mode support. This paper adopts BPNN to grade students' writing ability and reading ability. Figure 7 and 8 shows the changes of students' writing ability and reading ability scores under the traditional English language instructional mode. Figure 9 and 10 shows the curve of the scores of writing ability and reading ability changing with the orderly advancement of university ELT.
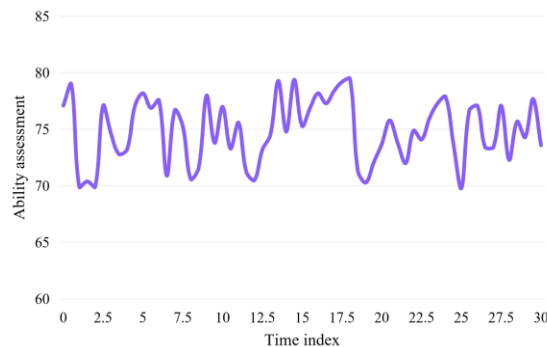

Figure 7: Score of english writing ability in traditional education mode.

In the traditional English language instructional mode, university students' writing ability and reading ability basically change in disorder, and the improvement of students' ability is not significant. In the simulation results of cultivating university students' writing ability and reading ability in university ELT, it can be seen that although the assessment of students' writing ability and reading ability did not change obviously in the early stage, the scores of students' writing ability and reading ability showed an obvious accelerating trend after the cycle was extended. Therefore, English flip classroom teaching plays an important role in promoting university students' writing ability and reading ability.

As a guide, teachers should constantly update their educational ideas, not only improve their ability to collect and apply modern network information technology, but also improve their classroom organization ability. In the flipped classroom, teachers not only teach, but also spend more time in classroom teaching and promoting students' understanding of knowledge points.
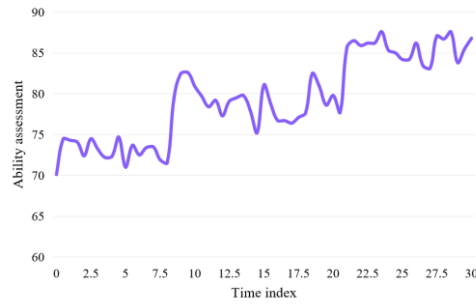
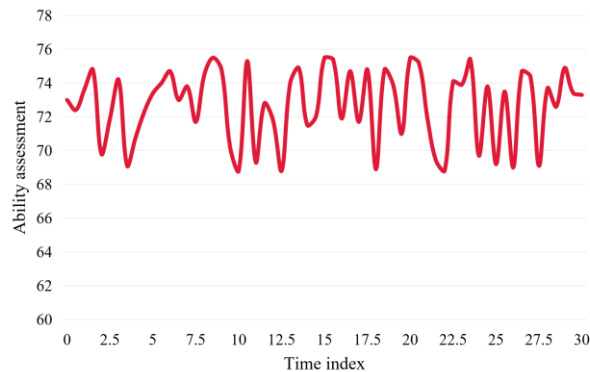**Figure 8:** Score of english writing ability in flipped classroom teaching mode.

Figure 9: Score of english reading ability in traditional education mode.

Figure 10: Score of english reading ability in flipped classroom teaching mode.

In this way, students can acquire knowledge, and in the flip class, students can easily complete their learning tasks with the help of teachers. As far as university students are concerned, they can decide for themselves when and in what way to use the Internet for self-study. Network brings great convenience to self-study. For educators who want to improve the instructional level for a new

generation of learners, these reasons for implementing the flipped classroom provide a guide for them to create a successful classroom.

5   CONCLUSIONS

Driven by big data, the innovation of university ELT method promotes the improvement of teaching efficiency and learning efficiency, provides teachers with large-capacity, diverse, fast-speed and high-value supporting data for teaching research, and at the same time effectively and continuously stimulates students' interest in learning. Flip classroom advocates students as the main body, so that students can watch teaching videos at home according to their actual situation and control the learning rhythm. This paper discusses the instructional mode and instructional effect of "flipped classroom" in university ELT, optimizes ANN with GA, establishes a mathematical model of ELT assessment, and trains neural network with expert samples. The results show that, compared with the non-optimized neural network, GA-NN has the advantages of faster convergence speed, smaller prediction error and higher recognition ability. Compared with the traditional ELT assessment system, the assessment accuracy of this assessment algorithm has increased by 25.47%. Therefore, it is theoretically feasible to use GA-NN to analyze the application effect of flip classroom in ELT. From the simulation results of cultivating university students' writing ability and reading ability in university ELT, it can be seen that although the assessment of students' writing ability and reading ability did not change obviously in the early stage, the scores of students' writing ability and reading ability showed an obvious accelerating trend after the cycle was extended.

In the future study of ELT assessment, the input indicators of classroom instructional level assessment subsystem need to be further studied and discussed, and the main factors that really affect the instructional level should be included in the indicators. Summarize the key findings and insights from your exploration. Emphasize the potential benefits of integrating big data and flipped classrooms in English instruction with a focus on digital cultural heritage.

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