Back Propagation Neural Network-based Assessment Methods on IPE in Tertiary Education

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Abstract. The application of multimedia in the stage of ideological and political educations IPE) in colleges and universities (IPECU) fully reflects the regularity, times and innovation of tertiary education. Aiming at the problems in the current IPECU, such as information feedback lag, imperfect IPE assessment mechanism and weak risk management and control ability, this article proposes an IPE assessment model based on DL and computer-aided design. The feasibility of the algorithm is verified by simulation experiments, and then the influence of multimedia teaching on IPECU is analyzed. When the quantity of test samples began to increase, the instructional assessment accuracy of different assessment methods showed a downward trend. But compared with the traditional FCA and ID3, the instructional assessment accuracy of proposed method is obviously higher, reaching more than 90%. In the scoring results under the deep integration of multimedia teaching, it can be seen that although the assessment of learners' innovation ability and adaptability did not change obviously in the early stage, the scoring showed an obvious accelerating trend when the cycle was prolonged. Therefore, multimedia instructional methods are of positive significance to the cultivation of university learners' innovative ability and adaptability.

Keywords: Multimedia Teaching; Ideology Education; Deep Learning; Computer Aided Design.
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1 INTRODUCTION

IPE is an important part of the tertiary education system, which aims at cultivating university learners' world outlook and values, and is of great significance for promoting learners' all-round and lifelong development. With the growth of modern computer and communication technology, in modern university learners' political classroom, in order to get rid of the boring classroom atmosphere, educators began to use multimedia technology more and more in the classroom [1].

The application of multimedia in the stage of IPECU fully reflects the regularity, times and innovation of contemporary university education in China [2]. Moreover, it also makes IPECU teaching closer to life, reflects life, and attracts learners better. At present, IPE is no longer faced with the traditional material environment, but the information-based teaching environment integrated by Internet technology [3]. Facing the new environment, educators should set up new thinking, adopt new methods and promote teaching innovation by means of information technology (IT) [4]. In order to better attract the audience and improve the communication effect, the traditional media, mainly newspapers and magazines, began to transform and develop into digitalization and networking, and gradually formed a new media format in which the traditional media and the new online media were integrated and developed [5]. It is an important means and effective way to promote the work of IPECU to scientifically assess the IPE work in universities.

The quality of education is the most important thing in schools, which not only relates to the survival and growth of schools, but also directly affects the future and destiny of learners. With the intensification of social changes, especially the rapid growth of self-media technology, the social environment has become rich and diverse, and university learners' autonomy has been continuously enhanced. It is urgent for university learners' IPE to respond and innovate. Through the construction of IPE teaching platform with integrated media, universities can effectively connect educators and learners, theory and practice, content and technology and other elements. IPE assessment is to judge the value of IPE stage and its results by a scientific method combining qualitative and quantitative methods according to certain assessment criteria. Although the current assessment system of university learners' IPE has been continuously improved, which can reflect the growth of IPECU to a certain extent, there are still some problems, such as imperfect assessment indicators, single assessment methods and insufficient combination of qualitative assessment and quantitative assessment. In this article, aiming at the problems of information feedback lag, imperfect IPE assessment mechanism and weak risk management and control ability existing in the current work of IPECU, an IPE assessment model based on DL and computer-aided design is proposed, and the influence of multimedia teaching on IPECU is analyzed.

The correct application of multimedia in university learners' IPE not only provides learners with a wide range of instructional materials and expands their knowledge, but also highlights the focus of IPECU in the stage of multimedia teaching, which can effectively solve problems for learners and improve their learning efficiency. The quality of tertiary education will directly affect the growth of tertiary education in China. The instructional level of universities is reflected by the instructional level of various majors or departments. The instructional level of departments and departments is reflected by the quality of various courses, and the quality of courses is reflected by the instructional level of educators who undertake courses. At present, the instructional level and instructional assessment system need to be improved simultaneously, and it is necessary to construct a instructional assessment system suitable for the actual situation of universities. The positioning of universities determines that the assessment of educators' instructional level can not only be assessed through theoretical teaching, but also more attention should be paid to the cultivation of learners' practical skills, so that learners have a solid theoretical foundation, as well as innovative ability and adaptive ability that meet the requirements of social growth. Judging from the current research results of university learners' IPE assessment system, the assessment system of university learners' IPE is not perfect enough, and the assessment methods used in the stage of evaluating university learners' IPE are relatively single.

In this article, the assessment model of IPECU is constructed by combining DL and computer-aided design, which mainly includes the following innovations:

(1) This article analyzes the problems in the current assessment mechanism of ideology courses in universities, and tries to find out practical solutions by deeply analyzing the causes of the existing problems.

(2) In this study, a large log database based on user behavior is built, and the IPE effect assessment model is established by introducing DL and computer-aided design.

2 RELATED WORK

The analysis and assessment of instructional level is a very complicated nonlinear process, which involves many influencing factors and dynamic variables. Therefore, the traditional instructional level model is no longer fully competent to solve such vague problems. When Zhang et al. studied the assessment of IPE, based on the category of modern IPE, they pointed out that IPE has the characteristics of orientation, dynamics, contrast, systematicness and comprehensiveness.

Nissen et al. [6] supports teachers' objective assessment of their curriculum effects, and these services can motivate teachers to change the curriculum to improve students' performance. We investigated the extent to which the RBA conducted by the online learning STEM student outcomes (LASSO) platform outside the classroom provided the same data as the paper tests conducted in the classroom, regardless of student participation or performance. High quality and effective vocabulary teaching is essential to support the academic success of all students, especially for disabled students. The challenge for teacher preparation programs is not only to train pre service teachers to provide effective vocabulary. Peeples et al. [7] tested the impact of performance feedback of multimedia teaching and evidence-based effective vocabulary teaching practice on participants' knowledge and practical application. Computer based learning media use computers to help students present learning materials, monitor learning progress, or select other learning materials independently according to students' learning needs to provide students with learning exercises. Rachmadtullah et al. [8] developed an interactive multimedia computer with the theme of civic education in basic education. This research method adopts a phased research and development method: requirements analysis, design and verification experts. The results of this study found that computer-based interactive multimedia applications are effective and suitable for primary school teaching activities. The results of Shute and Rahimi [9] show that using CBAfL in the classroom, via the Internet or embedded games usually improves A series of learning achievements are analyzed, that is, the useful contents of learning classification feedback are effectively used. The purpose of Wahabi et al's. [10] evaluated the relevant diagnostic learning contents of skills and patients. By improving the doctors' face-to-face medical control over patients, the digital model of patients has been comparatively improved.

3 METHODOLOGY

3.1 The Role of Multimedia Teaching in IPECU

To a great extent, the efficacy of contemporary university learners' IPE is influenced by the use and choice of carriers in university learners' ideological education, while today's university learners' IPE is largely influenced by the growth of the latest educational carriers such as Internet technology, digital IT and multimedia communication technology. As a special group of contemporary university learners, they have a high cultural level, and the application of multimedia has brought positive influence to university learners' IPE. The purpose of university IPE is that educators can improve learners' ideology level by interpreting teaching materials. There is no doubt that multimedia plays a positive role in university learners' IPE, but there are still some problems in the actual use. How to make multimedia really a good helper for university learners' IPE has become an urgent problem to be solved. Educators can also rely on multimedia to get to know the truest thoughts and feelings of university learners more smoothly. In the process, they can find some problems and bad tendencies exposed by learners in their study and life, and take correct methods to give them counseling.

The emergence of multimedia instructional methods provides a brand-new environment for the growth of university learners' IPE activities, which is incomparable to the traditional environment. Face-to-face communication is the main way adopted by the traditional IPE, but under the limitation of time and space, it doesn't produce a good educational effect. The application of modern multimedia in ideology theory class not only provides fast and convenient conditions for ideology teaching in universities, but also greatly improves the effect of political theory teaching.

The emergence of multimedia has greatly broken through this limitation. IPECU workers can select instructional contents in the widest space through multimedia technology, carry out educational activities in time, and build a broad platform for educational work. For university learners, relying on multimedia enables them to acquire more knowledge and information through digital TV, Internet and other new media forms, which is not limited by time and space, thus fundamentally improving the efficiency of information dissemination and enhancing the timeliness of IPE for university learners.

3.2 IPE Assessment Algorithm

Multimedia can reproduce, simulate and create relevant scenes, and can freely transition and switch, making teaching comprehensive and creative. The multimedia teaching in the ideology theory course enhances the instructional effect with its vividness and intuition. The use of multimedia in teaching will break the traditional teaching mode. Educators can take full advantage of multimedia in class and play songs, videos, etc., so as to convey more vivid and concrete content to learners, and also increase the interest of class, so that learners can receive education more happily. From the learners' point of view, under the influence of multimedia, they can get more educational resources and more effective information, which also facilitates the communication between learners and stimulates their learning enthusiasm.

The appearance of ANN provides a new way for instructional assessment in universities. Through continuous learning and training, ANN can discover its regularity from a large quantity of complex data with unknown patterns, especially can handle any type of data. The BPNN of learner IPE assessment is shown in Figure 1.

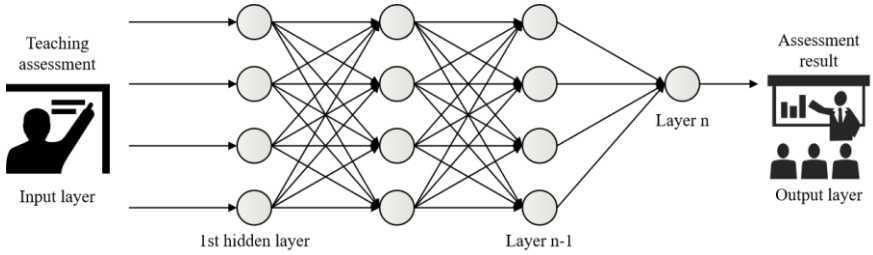

Figure 1: BPNN for IPE assessment of university learners.

The BPNN improved by adaptive learning rate adjustment method is adopted:

$$\Delta X = lr \cdot \frac{\partial E}{\partial X} \tag{1}$$

$$\Delta X(k+1) = mc \cdot \Delta X(k) + lr \cdot mc \cdot \frac{\partial E}{\partial X} \tag{2}$$

Using a scientific and reasonable assessment method to conduct a fair assessment is crucial to mobilize the enthusiasm of educators to do well in teaching, constantly improve the instructional level, and even improve the instructional Level of the whole school.

Since the linear relationship between the input vector $X(x_1, x_2, \ldots, x_n)$ and the output vector is not satisfied, the unipolar sigmoid function is chosen as the excitation function:

$$f(x) = 1/(1+e^{-x}) \tag{3}$$

At present, the instructional level and instructional assessment system need to be improved simultaneously, and it is necessary to construct a instructional assessment system suitable for the actual situation. The positioning of universities determines that the assessment of educators' instructional level can not only be assessed through theoretical teaching, but also more attention should be paid to the cultivation of learners' practical skills, so that learners have a solid theoretical foundation, as well as innovative ability and adaptive ability that meet the requirements of social growth. These variables have a certain dependence on each other, that is, there is often a certain degree of correlation between them, sometimes even quite high correlation, which makes the information in the observed data overlap to some extent. The establishment steps of IPE assessment model are shown in Figure 2.

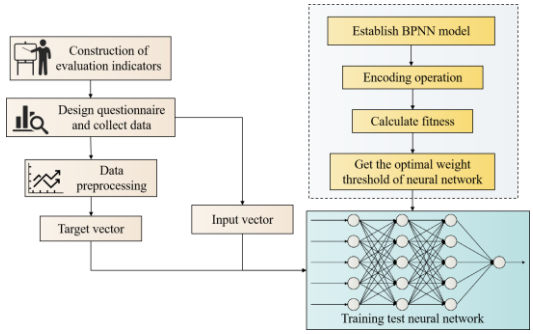

Figure 2: Establishment of IPE assessment model.

Assessment is an important means to achieve teaching goals. Through the feedback function of assessment, the teaching effect can be improved. Based on the development of ideology classroom instructional assessment thought, it not only meets the requirements of the characteristics of ideology courses, but also meets the requirements of high school students' psychological characteristics and learning characteristics. Through instructional assessment, teachers can analyze and reflect on whether their teaching objectives are reasonable, whether teaching methods are used properly, whether teaching methods are used flexibly, and whether the important and difficult points in teaching are explained thoroughly. Because a three-layer BPNN can approximate the mapping relationship with arbitrary accuracy, this article adopts the three-layer BP structure. The assessment indexes of university learners' IPE are divided into 8 first-class indexes and 16 second-class indexes. Because the magnitude of each component is very different, it needs normalization:

$$X = \frac{I - I_{\min}}{I_{\max} - I_{\min}} \tag{4}$$

Where X is the normalized neural network input value, I is the untreated neural network input value, and $I_{\max}$ is the minimum neural network input value.

The BPNN improved by adaptive learning rate adjustment method is adopted:

$$\Delta X = lr \cdot \frac{\partial E}{\partial X} \tag{5}$$

$$\Delta X(k+1) = mc \cdot \Delta X(k) + lr \cdot mc \cdot \frac{\partial E}{\partial X} \tag{6}$$

Let $x_i(t)$ represent the input information at t time and $o_j(t)$ represent the output information at t time j, then the state of neuron j is expressed as:

$$o_j(t)=f\left\{\left[\sum_{i=1}^{n}\omega_{ij}x_i\left(t-\tau_{ij}\right)\right]-T_j\right\} \tag{7}$$

Where τ_{ij} is the synaptic delay of; T_j is the threshold of neurons, and the weights of ω_{ij} neurons i to j; $f(\cdot)$ is the transfer function.

The error signal propagates forward layer by layer from the input end, which is the reverse propagation of the working signal. Weight adjustment formula with additional momentum factor:

$$\Delta W(t)=\eta\delta X+\alpha\Delta W(t-1) \tag{8}$$

The learning rate is:

$$\Delta w=-\eta\frac{\partial E}{\partial w} \tag{9}$$

If the learning rate is too high, the convergence rate can be improved. If the learning rate is small, the training can converge steadily, but the learning speed will be slow.

The error function is:

$$E=\frac{1}{2}\sum_{p=1}^{p}\sum_{k=1}^{m}\left(d_k^p-o_k^p\right)^2 \tag{10}$$

If the quantity of learning increases, then $\left|d_k^p-o_k^p\right|$ will become smaller and smaller, which may lead to slower function approximation.

$$E=\frac{1}{2}\sum_{p=1}^{p}\sum_{k=1}^{m}\ln\left[1+\left(d_k^p-o_k^p\right)^2\right] \tag{11}$$

$$E=\frac{1}{2}\sum_{p=1}^{p}\sum_{k=1}^{m}\left(d_k^p-o_k^p\right)^2+\frac{1}{2}\sum_{p=1}^{p}\left(\sum_{k=1}^{m}\left(d_k^p-o_k^p\right)^2\cdot\sum_{j=1}^{H}\left(h_{rj}-0.5\right)^2\right) \tag{12}$$

$$E=\frac{1}{2}\sum_{p=1}^{p}\sum_{k=1}^{m}\left(d_k^p-o_k^p\right)^2+p(w) \tag{13}$$

$$p(w)=\frac{\lambda}{n}\sum_{ij}\left|w_{ij}\right|^2 \tag{14}$$

Use u_{ij} to represent the results of the IPE classroom comparison. After comparing all elements at each level pairwise, a pairwise comparison judgment matrix is obtained, and the matrix is expressed as follows:

$$U=\left(u_{ij}\right)n*n=\begin{bmatrix} u_{11} & u_{12} & \ldots & u_{1n} \\ u_{21} & u_{22} & \ldots & u_{2n} \\ \ldots & & & \\ u_{n1} & u_{n2} & \ldots & u_{nn} \end{bmatrix} \tag{15}$$

Calculate the normalization for each column:

$$\overline{u_{ij}}=\frac{u_{ij}}{\sum_{k=1}^{n}u_{kj}} \tag{16}$$

Second, average the normative columns to determine the final weights:

$$\hat{w}=\frac{1}{n}\sum_{j=1}^{n}\overline{u_{ij}} \tag{17}$$

The feature vector is the weight of each factor:

$$\hat{w}=\left(\hat{w}_1,\hat{w}_2,\ldots,\hat{w}_n\right) \tag{18}$$

Compute the consistency metric for the constructed matrix:

$$CI=\frac{\lambda_{\max}-n}{n-1} \tag{19}$$

Compute the largest eigenvalue of the judgment matrix:

$$\lambda_{\max}=\frac{1}{n}\sum_{i=1}^{n}\frac{\left(U\hat{W}\right)_i}{\hat{W}_i} \tag{20}$$

$\left(U\hat{W}\right)_i$ indicates that the W -th element of vector i is used.

Because of the complexity of teaching activities, classroom instructional assessment is also complicated, so it can't be carried out mechanically by using an assessment standard and mode. The idea of new curriculum reform and quality education is for the all-round development of students. Classroom assessment conforms to each individual's physical and mental development needs, respects individuality, and cultivates students with comprehensive knowledge ability, high moral quality, perfect psychological quality and strong social adaptability.

4 RESULT ANALYSIS AND DISCUSSION

4.1 Effectiveness Analysis of Assessment Model

Assessment is a process of judging value, while the classroom instructional assessment advocated at present is a process of judging value with life form. The process of classroom teaching is the process of showing and reflecting teachers' respect and care for students, and it is also the process of life-to-life interaction, paying more attention to the dialogue between culture and life. The process of instructional assessment is essentially a process of interaction between teachers and students, and a two-way flow of information. For teachers, the feedback information provided by instructional assessment can help them diagnose the weak links in their own work, so as to be targeted and constantly revise, adjust and improve their teaching work. Aiming at the problems in the IPECU, such as information feedback lag, imperfect IPE assessment mechanism and weak risk management and control ability, this article proposes an IPE assessment model based on DL and

computer-aided design. In the stage of error signal back propagation, the weight of the network is adjusted by error feedback. Through the constant correction of weights, the actual output of the network is closer to the expected output. The convergence effect is shown in Figure 3. The training error level is shown in Figure 4.

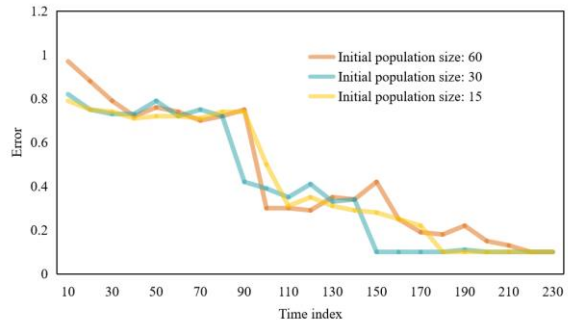

Figure 3: Convergence of initial group size training.

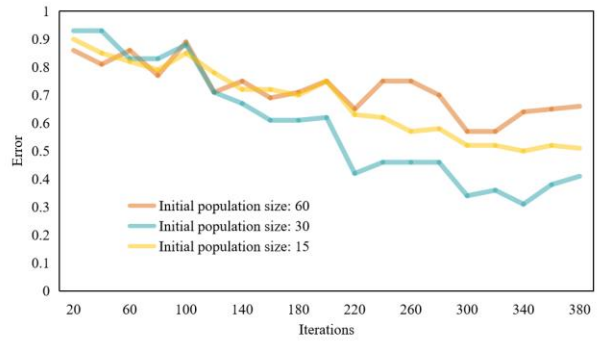

Figure 4: Error of initial population size training.

It can be seen that when IPE assess the initial population size of ANN to be 30, the convergence time is the shortest and the error is the smallest. Therefore, the initial population size is 30.

The assessment results in IPE test sample data are predicted by different algorithms, and then compared with the actual results. The comparison results are shown in Figure 5.

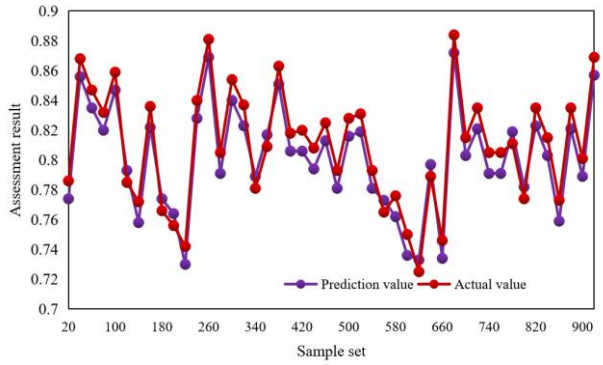

Figure 5: Comparison between predicted results and actual results.

These variables have a certain dependence on each other, that is, there is often a certain degree of correlation between them, sometimes even quite high correlation, which makes the information in the observed data overlap to some extent. Instructional assessment based on students' psychology emphasizes the communication between evaluators, emphasizes the diversity of assessment subjects, pays attention to making more actors become the subjects of instructional assessment, especially promotes the assessment objects to become the subjects of instructional assessment, and advocates the role of self-awareness, self-monitoring, self-reflection and self-reinforcement of instructional assessment objects. The development of instructional assessment emphasizes the embodiment of students' preponderance and teachers' encouragement to students, as well as the dominant position of students' self-assessment.

Taking IPE assessment accuracy as a test index, traditional FCA and ID3 are selected as comparison objects. The experimental results are shown in Table 1, Table 2 and Table 3.

Sample size	*Teaching assessment accuracy (%)*
15	95.79
30	94.71
45	93.55
60	92.59
75	91.78
90	90.66
105	90.01

Table 1: IPE assessment accuracy of proposed method.

Sample size	*Teaching assessment accuracy (%)*
15	91.24
30	85.34
45	82.5
60	78.64
75	72.25
90	68.73
105	65.08

Table 2: IPE assessment accuracy of FCA.

From the experimental data, it can be seen that when the quantity of test samples starts to increase, the instructional assessment accuracy of different assessment methods shows a downward trend. But compared with the traditional FCA and ID3, the instructional assessment accuracy of proposed method is obviously higher, reaching more than 90%. It is feasible to use this model to analyze the influence of multimedia teaching on IPECU. The optimization of instructional assessment of ideology courses in universities can give full play to the guiding and developing function of instructional assessment, establish a comprehensive system of students' instructional assessment, observe the changes of students' thoughts, change the core of assessment from learning results to learning process, effectively adapt to the requirements and

standards of the new curriculum reform for instructional assessment of ideology courses, promote students' all-round development, and cultivate students with sound personality and high sense of social responsibility.

Sample size	Teaching assessment accuracy (%)
15	86.75
30	86.47
45	82.12
60	76.88
75	73.43
90	70.02
105	65.78

Table 3: IPE assessment accuracy of ID3.

4.2 The Influence of Multimedia Teaching on University Learners' Innovation Ability and Adaptability

In order to better attract the audience and improve the communication effect, the traditional media, mainly newspapers and magazines, began to transform and develop into digitalization and networking, and gradually formed a new media format in which the traditional media and the new online media were integrated and developed. The purpose of education is to promote the growth of the educated. The assessment of IPE of university learners should naturally focus on learners' performance and development, and at the same time, the assessment of educators as the leader should be strengthened. This article adopts BPNN to grade learners' innovative ability and adaptability. Figure 6 shows the changes of learners' innovation ability and adaptability scores under conventional education. Figure 7 shows the curve that the scores of innovation ability and adaptability change with the orderly advancement of multimedia teaching.

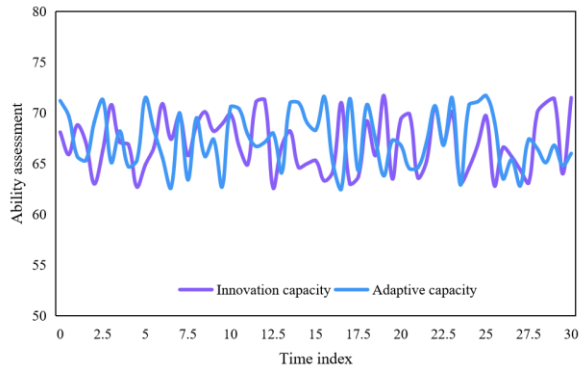

Figure 6: Learners' innovation ability and adaptability score under conventional education.

The innovation ability and adaptability of university learners in routine education are basically disordered, and the improvement of learners' ability is not significant. However, in the scoring results under the deep integration of multimedia teaching, it can be seen that although the

assessment of learners' innovation ability and adaptability did not change obviously in the early stage, the scoring showed an obvious accelerating trend when the cycle was prolonged.

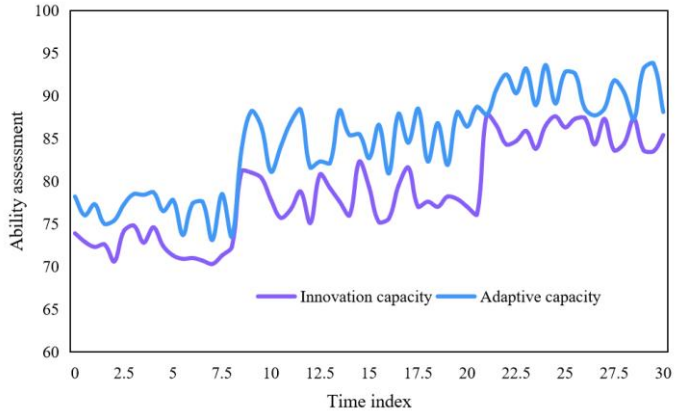

Figure 7: Score of learners' innovation ability and adaptability under the deep integration of multimedia teaching.

Therefore, multimedia instructional methods are of positive significance to the cultivation of university learners' innovative ability and adaptability. The correct application of multimedia in university learners' IPE not only provides learners with a wide range of instructional materials and expands their knowledge, but also highlights the focus of IPECU in the stage of multimedia teaching, which can effectively solve problems for learners and improve their learning efficiency.

5 CONCLUSIONS

Aiming at the problems in the IPECU, such as information feedback lag, imperfect IPE assessment mechanism and weak risk management and control ability, this article proposes an IPE assessment model based on DL and computer-aided design. When the quantity of test samples began to increase, the instructional assessment accuracy of different assessment methods showed a downward trend. But compared with the traditional FCA and ID3, the instructional assessment accuracy of proposed method is obviously higher, reaching more than 90%. Results Grading multimedia instructional method has positive significance for the cultivation of university learners' innovative ability and adaptability. From the perspective of teaching form, innovation in accordance with the information-based teaching environment can make the instructional content show in vivid and diverse forms, break through the traditional time and space limitations, and build a more flexible classroom structure centered on learners. Informatization is one of the most important changes in the world since the end of the last century. IPECU should actively conform to the trend, turn its technological advantages into teaching advantages, and make the teaching situation a new one.

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