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Linear Algebra Teaching Reform for Artificial Intelligence Major

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Abstract: The rapid development of the information technology industry, especially artificial intelligence, poses new challenges to undergraduate linear algebra teaching. This paper focuses on the reform of linear algebra teaching of artificial intelligence major under the background of new engineering. Under the background of new engineering, by analyzing the current situation of the disconnection between linear algebra teaching in information disciplines and professional applications, this paper summarizes the demands for linear algebra teaching of artificial intelligence major. Teaching reform measures are proposed from multiple perspectives, including combining theory with coding practice, introducing application cases and project practices in various fields of artificial intelligence, and building an interdisciplinary course teaching team. The aim is to improve the teaching effect of linear algebra for artificial intelligence majors and lay a solid theoretical learning foundation and application innovation interest for students. This reform is expected to significantly enhance students' ability to flexibly apply linear algebra knowledge in complex artificial intelligence tasks, increase the students' application accuracy of linear algebra knowledge in course assessments and subsequent professional learning, and build a solid foundation for the cultivation of high-quality artificial intelligence professionals.

Keywords: new engineering,linear algebra teaching, artificial intelligence major, teaching reform

1. Introduction

China's higher engineering education faces new opportunities and challenges (Wei, Guo, Sun, et al.,2023; Sun, Yin, Yang, et al., 2024) Universities need to accelerate the construction and development of new engineering, which requires strengthening teaching research and practice (Huang, 2013; Buchbinder, Chazan, & Capozzoli, 2019). In the booming environment of new engineering, artificial intelligence, as a frontier and key field, has put forward higher requirements for the knowledge structure and practical ability of talents. Linear algebra, as an important branch of mathematics, is the cornerstone of information technology, especially artificial intelligence (Zhang, 2017). It provides core mathematical tools and methods for the design of artificial intelligence algorithms, data processing, and analysis. However, in the current teaching of linear algebra in information disciplines, especially in the education process of artificial intelligence majors, there is a serious problem of disconnection from practical applications. In traditional teaching mode, only about 30% of students can spontaneously apply linear algebra knowledge to solve practical problems in subsequent artificial intelligence courses, while in actual industry applications, about 80% of the core technical links of artificial intelligence rely on linear algebra support. For example, in the process of machine learning model training and optimization, matrix operations and eigenvalue decomposition in linear algebra run through it. However, students often fail to establish such a close connection in classroom learning, which greatly affects students' understanding of subsequent professional knowledge

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and the cultivation of application ability, and cannot meet the needs of the artificial intelligence industry for professional talents under the background of new engineering (Zhu, Li, & Zhang, 2019). How to organically connect the theoretical knowledge of linear algebra with the knowledge of advanced professional courses in artificial intelligence is one of the ways to improve students' theoretical knowledge and application ability.

For linear algebra teaching, the requirements of new engineering mean that teaching content and method need profound changes (Ma, 2021). Teaching should not be limited to the teaching of theoretical knowledge but should closely revolve around the application needs of information technology, especially the artificial intelligence major, combining linear algebra with professional application problems or knowledge, and cultivating students' ability to use linear algebra to solve artificial intelligence problems (Yang, Wang, He, et al., 2023). This will enable students to use the relevant knowledge to learn and understand subsequent advanced courses. At the same time, it is necessary to focus on cultivating students' learning and innovation abilities in an interdisciplinary environment, making linear algebra a powerful tool to connect mathematics with information technology and promote disciplinary integration, driving students to have a deeper understanding of related technologies (Wang & Liu , 2021). This study deeply analyzes the problems in the linear algebra teaching of the artificial intelligence major under the background of new engineering and proposes targeted teaching reform plans, enhancing the integration of linear algebra teaching with the application of the artificial intelligence major, and improving students' ability to use linear algebra knowledge to solve practical problems in artificial intelligence, providing strong support for the cultivation of high-quality artificial intelligence professional talents.

2. Current Status of Linear Algebra Teaching in Information Disciplines

Linear algebra knowledge is the foundation of information technology, especially in the field of artificial intelligence (Cao & Xu, 2024). It is usually a basic course for related disciplines. However, the teaching of linear algebra is currently disconnected from professional applications, and classroom teaching focuses on the teaching of theoretical knowledge, with a lack of explanation of its applications in artificial intelligence technology (Chen, 2023). New engineering has put forward new requirements for the linear algebra course of the artificial intelligence major (Wu, 2024).

2.1. The Importance and Course Positioning of Linear Algebra

Linear algebra knowledge is one of the foundations of information technology and plays an indispensable role in the field of artificial intelligence. It runs through all levels of artificial intelligence, from data representation, model construction to algorithm optimization. In the curriculum system of related disciplines, linear algebra is usually a basic course for the category, laying a mathematical theoretical foundation for the study of subsequent professional courses. Its concepts and operations such as vectors, matrices, and linear transformations are key elements in understanding and developing artificial intelligence algorithms.

2.2. The Disconnection between Linear Algebra Teaching and Artificial Intelligence Applications

In the core algorithm field of artificial intelligence, linear algebra plays an indispensable role. Taking the neural network in deep learning as an example, matrix operations in linear algebra run through the entire forward propagation and backward propagation processes. In each layer of the neural network, the input data is multiplied by the weight matrix to achieve a linear transformation of features, which is the basic step for the model to extract information and learn patterns. For example, in a simple multi-layer perceptron, assuming that there are n neurons in the input layer and m neurons in the hidden layer, the input data is represented as a $1\times n$ vector $\boldsymbol{x}$, and the weight matrix is $\boldsymbol{W}_{n\times m}$. Then the output h of the hidden layer can be calculated by $\boldsymbol{h}=\boldsymbol{xW}+\boldsymbol{b}$ (where $\boldsymbol{b}$ is the bias vector). The matrix multiplication and vector addition operations here are the basic operations of linear algebra. By continuously adjusting the weight matrix and bias vector, the neural network can fit complex functional relationships and achieve data classification or prediction tasks. In traditional teaching, such application scenarios closely combined with actual artificial intelligence algorithms are often ignored. Teaching usually focuses on the derivation and proof of theoretical knowledge, such as the explanation of linear algebra knowledge such as matrix multiplication, but lacks detailed case analysis and practical guidance on its practical applications in data processing, especially in the field of artificial intelligence. Students often only mechanically master the mathematical calculation methods without understanding their importance and specific operation processes in solving practical data processing problems.

Therefore, the current disconnection between linear algebra teaching and professional applications is mainly reflected in the classroom teaching link. The traditional classroom teaching mode focuses on the explanation of theoretical knowledge, and teachers spend a lot of time on theorem proofs and formula derivations. Although this teaching method helps students master the basic knowledge of linear algebra, it neglects its application scenarios in the artificial intelligence discipline. In today's rapidly developing information discipline, especially facing a professional with a strong application orientation like artificial intelligence, students' understanding of the application of linear algebra in the actual professional field is insufficient, which leads to their inability to effectively use linear algebra knowledge to solve practical problems in subsequent learning of artificial intelligence professional courses. It is difficult to establish a connection between theory and practice, greatly weakening the teaching effect and students' learning enthusiasm, and affecting students' learning and understanding of subsequent artificial intelligence courses.

2.3. Analysis of the Current Situation of Interdisciplinary Research between Linear Algebra and Artificial Intelligence

In recent years, in higher education, many new research achievements have emerged in the interdisciplinary field of linear algebra and artificial intelligence. Some scholars have proposed new teaching models, combining linear algebra knowledge with actual artificial intelligence projects, and guiding students to learn and apply linear algebra knowledge through project-driven methods. In the curriculum design, the proportion of practical links has been increased, allowing students to deeply understand the application of linear algebra in artificial intelligence through practical operations.

Cao et al. (2024) pointed out that the teaching of "linear algebra" did not make full use of software-assisted techniques, which restrict the empowering effect of artificial intelligence, and they proposed some paths for the teaching of linear algebra enabled by artificial intelligence, including visual teaching content (such as demonstrating the matrix operations with Matlab). Chen et al.(2023) advocated combining the application cases of artificial intelligence in linear algebra (such as introducing image recognition into teaching), strengthening the knowledge connection between linear algebra with artificial intelligence, and improving teaching methods. Wu et al.(2024) emphasizes the combination of linear algebra and new technologies to restore the "practical-mathematical-practical" process, such as combining deep learning in matrix operation teaching, realizing students' ability of knowledge application through programming. Han et al.(2024) improved the teaching effect of linear algebra for medical imaging technology majors by building an interdisciplinary fusion case library (covering multiple fields of medical imaging), introducing Python programming, using animation and interactive web display concepts, and adopting hybrid teaching.

Overall, these reform measures have improved students' learning interest, initiative and application ability to a certain extent, but it is still necessary to continue to deepen the integration of linear algebra and artificial intelligence, improve teachers' technical literacy, optimize teaching resources and platforms, and constantly improve the teaching system to meet the new requirements of linear algebra teaching in higher education in the era of artificial intelligence.

3. Linear Algebra Teaching Reform for the Artificial Intelligence Major

In response to the problems existing in traditional linear algebra teaching, the course reform for the artificial intelligence major is carried out from multiple perspectives. First, a teaching strategy that combines theoretical teaching with code writing practice is proposed, making the theory class vivid and perceptible, and improving learning effectiveness. Then, the application of artificial intelligence discipline is introduced into the linear algebra course, allowing students to understand the importance of its basic theory in the field of artificial intelligence while learning linear algebra, stimulating learning interest. Finally, a teacher team with mathematical and artificial intelligence backgrounds is constructed, so that the advantages of interdisciplinary teachers can complement each other, thereby achieving continuous improvement in teaching.

3.1 Combination of Theoretical Teaching and Code Writing Practice

Combining linear algebra theory with programming practice is an important way to improve teaching quality. Taking powerful programming tools such as *MATLAB* and *Python* as examples, they provide a vivid and operable platform for linear algebra teaching. In *MATLAB*, matrix operations are extremely convenient, and its rich function library allows students to intuitively feel the results of linear algebra operations. For example, by writing simple code to perform matrix multiplication, inversion, and other operations, students can gain a deeper understanding of the rules and significance of matrix operations. *Python*, with its concise syntax and wide application field, has unique advantages in data processing and visualization. Using *Python*'s *NumPy* and *SciPy*, students can easily handle large-scale matrix data and display the results in the form of graphics through visualization libraries such as *Matplotlib*, making abstract linear algebra concepts concrete and perceptible.

For example, the process of multiplying two matrices $\boldsymbol{A}=\begin{pmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \end{pmatrix}^T$, $\boldsymbol{B}=\begin{pmatrix} 5 & 6 & 7 & 8 \\ 7 & 8 & 9 & 10 \end{pmatrix}$ can be carried out using the *NumPy* for matrix operations and the *Matplotlib* for visualizing results, with the flow and visualization results shown in Figures 1 and 2, respectively. The color distribution in the heat map in Figure 2 represents the magnitude distribution of the values in the matrix multiplication result. The lighter color area indicates that the element values in this area of the matrix are smaller, and the darker color area indicates that the element values are larger. In addition, by observing the rows and columns of the heat map, the characteristics of the matrix multiplication result in the row and column directions can be analyzed. For example, if the color of the first row is generally darker, it indicates that the element values of this row are larger, which may mean that in the matrix multiplication operation, there is a strong correlation between the row vector of the original matrix $\boldsymbol{A}$ and the column vector of matrix $\boldsymbol{B}$ in this row. In addition, according to the heat map, mathematical property analyses with special or regular characteristics such as symmetry can be performed.

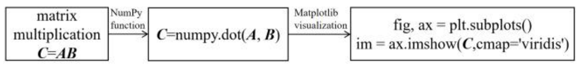

Fig. 1. Flowchart of the programming implementation for matrix operations.

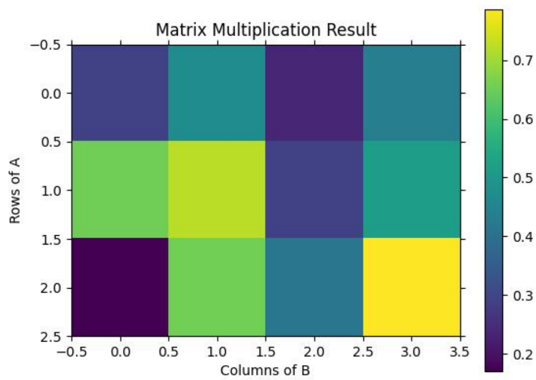

Fig. 2. Heatmap visualization of the matrix multiplication results.

In the early stage of curriculum planning, according to the teaching syllabus and knowledge point distribution of linear algebra, such as matrix operations, linear equation solving, vector space, eigenvalues and eigenvectors, linear transformations, etc., systematically design teaching links combined with programming tools. Programming practice can run through the entire teaching cycle of linear algebra.

(1) When teaching matrix operations, arrange 2 class hours of *Python* practical courses. In the first class hour, introduce in detail the basic functions and usages of the *NumPy* and *Matplotlib* used for matrix operations in Python, such as the functions *numpy.array*(), *numpy.add*(), *numpy.dot*(), etc. for creating matrices, matrix addition, multiplication and other operations, and demonstrate their applications in actual calculations through simple examples. In the next class hour, students conduct practical operations under the guidance of teachers. Students are required to use the *NumPy* to write code to implement matrix transposition, inversion, eigenvalue decomposition and other operations, and observe the changes in results by changing the elements of the matrix to deeply understand the properties and laws of matrix operations.

(2) When teaching linear equation solving and vector space related knowledge, arrange 2 class hours. In the first class hour, introduce the function *numpy.linalg.solve*() for solving linear equations in *Python* and the basic operations for handling vectors, such as functions for generating vectors and calculating inner products; and let students use *numpy.linalg.solve*() to solve homogeneous and non-homogeneous linear equations, and use the *Matplotlib* to draw two-dimensional vector space graphics to understand their geometric meanings. In the second-class hour, select an application practice project and explain it to students to deepen their understanding in practical applications. At the same time, corresponding practical projects can be assigned for students to practice after class.

(3) When teaching eigenvalues and eigenvectors and linear transformations, combine them with programming practice and arrange 2 class hours. In the first class hour, introduce the function *numpy.linalg.eig*() to calculate the eigenvalues and eigenvectors of a matrix. Then, taking the linear transformation in a two-dimensional plane as an example, implement matrix transformation, use *plt.quiver*() to draw the original and transformed vectors, and use *plt.show*() to display them. Students can modify the matrix and vectors to observe the results and deepen their understanding. In the second-class hour, select an application practice project and explain it to students to deepen their understanding in practical applications. Corresponding practical projects can be assigned for students to practice after class.

Through such a teaching method, it helps students better understand the concepts of linear algebra, transform abstract mathematical knowledge into specific programming operations and visualization results, and let them intuitively see the powerful power of mathematics in practical applications.

3.2 Introduction of Artificial Intelligence Discipline Applications in Linear Algebra Courses

The integration of linear algebra and core concepts of artificial intelligence. The basic theory of linear algebra has a wide and in-depth application in the field of artificial intelligence. Taking the combination of linear algebra and learning rate as an example, the learning rate is a key parameter in the gradient descent algorithm, which determines the speed and effect of the algorithm's convergence. The adjustment of the learning rate is closely related to matrix operations and vector norms in linear algebra. By analyzing the impact of the learning rate on the gradient descent algorithm, students can understand how linear algebra plays a role in optimization algorithms. Another example is the combination of linear algebra and deep learning; the core of neural networks is a large number of matrix operations. From the initialization of the weight matrix in neural networks, the matrix multiplication in the forward propagation process, to the gradient calculation in the backward propagation process, linear algebra is indispensable. Explaining these contents in detail in the course can make students understand that linear algebra is the foundation for the construction and training of deep learning models.

Combining scientific research cases with teaching practice. Combining artificial intelligence scientific research cases with linear algebra theoretical is a key link in teaching reform and can improve students' practical ability and innovative thinking. For example, when explaining the solution of linear equations, image compression problems can be introduced. By treating images as matrices and performing linear algebra operations such as singular value decomposition, images can be compressed and decompressed using programming. In this process, students not only learn the solution method of linear equations but also understand its application in image data processing. This kind of practice case can stimulate students' interest in learning, allowing them to deeply understand linear algebra theory while writing code, improving their ability to use theoretical knowledge to solve practical problems, making the originally boring theory class lively and interesting, and enhancing students' learning enthusiasm and initiative.

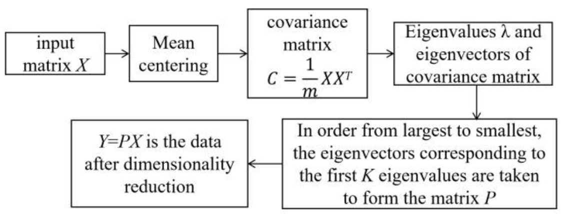

Fig.3 flow chart of PCA

The following is an example. The core of the Principal Component Analysis (PCA) algorithm indeed lies in finding a transformation matrix that maps high-dimensional data to a lower-dimensional space while retaining as much of the original data's variability as possible. This process involves several key concepts in linear algebra, including feature decomposition, orthogonal transformation, and variance maximization:

The specific steps of PCA are shown in Fig. 3:

(1) Data standardization: Ensure that the mean of each feature is 0 and the standard deviation is 1 to eliminate the influence of different dimensions and magnitudes. This can be regarded as a linear transformation of the original data vector, translating (by subtracting the mean) and scaling (by dividing by the standard deviation) it to make it distributed in a more "uniform" space.

(2) Covariance matrix $\boldsymbol{C}$ calculation: Calculate the covariance matrix $\boldsymbol{C}$ of the data to determine the correlation between data features. The covariance matrix $\boldsymbol{C}$ is a quadratic form representation of the data matrix $\boldsymbol{X}$, which reflects the distribution of data in different dimensions. It is a symmetric matrix, and its properties are closely related to the theory of symmetric matrices in linear algebra. For example, it must be diagonalizable, and its eigenvectors are orthogonal.

(3) Eigenvalue and eigenvector calculation: When dealing with data dimensionality reduction, solve the eigenvalues and corresponding eigenvectors of the covariance matrix $\boldsymbol{C}$. PCA uses this to determine the projection direction of the data and the dimension of the new space. The eigenvalue represents the variance of each principal component, and the eigenvector represents the direction of the principal component. The eigenvectors corresponding to different eigenvalues of the matrix are orthogonal, which is the basis for using orthogonal transformation in PCA. Because we hope that the principal components found are independent and non-redundant, and orthogonal vectors just meet this requirement.

(4) Principal component selection: Select the eigenvectors corresponding to the first k largest eigenvalues as the principal components according to the size of the eigenvalues. From the perspective of linear algebra, it is a rank-k approximation of the matrix. We only retain the k dimensions that best represent the information of the matrix and discard the relatively unimportant dimensions, which is equivalent to a low-rank approximation of the original data space. This approximation finds a balance between data compression and information retention.

(5) Data projection: It is the process of

projecting the original vector ***x*** from the original high-dimensional space to the k-dimensional subspace spanned by ***P***. Through matrix multiplication, a linear transformation is realized, compressing the high-dimensional information into a low-dimensional space while retaining the most important information.

The result of image compression using PCA is shown in Figure 4.

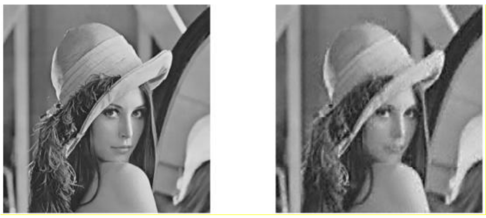

Fig. 4 Image compression results using PCA. (a) Original image; (b) Compressed image with k=20.

The principle of PCA involves concepts such as linear algebra, such as feature decomposition, orthogonal transformation, which enable PCA to effectively perform data dimension reduction and feature extraction in practice. PCA is a typical example of applying a vast amount of knowledge from linear algebra to practical cases. By introducing practical case, students can more intuitively feel the significance of eigenvalues, eigenvectors, and orthogonal transformations, deepening their understanding and mastery of the theoretical knowledge of linear algebra.

In addition, more artificial intelligence application practices can be introduced into linear algebra teaching. Teachers can select application practice projects for teaching according to their own knowledge fields.

Applications in machine learning

(1) Linear regression: The linear regression model solves the regression coefficients by the least squares method, involving matrix transposition, multiplication, and inversion, and can be understood from the perspective of geometric projection.

(2) Logistic regression: Used for binary classification problems, mapping the output of linear regression between 0 and 1, and calculated by linear algebra.

(3) Neural networks: The weights and biases in neural networks are matrices or vectors, and the forward propagation and backward propagation involve a large number of matrix multiplications and vector operations. For example, in a convolutional neural network, the convolution operation is essentially a linear transformation, and the image is convolved with a convolution kernel to extract features.

Applications in image processing

(1) Image transformation: Realize image rotation, scaling, translation and other transformations through matrix operations in linear algebra. Linear transformations such as discrete cosine transformation and wavelet transformation can also be performed to convert the image from the spatial domain to the frequency domain for convenient feature extraction.

(2) Image filtering: For example, using a Gaussian filter for smoothing processing can be realized through matrix operations in linear algebra.

(3) Image compression: Commonly used matrix decomposition techniques to reduce the size of image data, such as singular value decomposition, decompose the matrix into the product of two smaller matrices to achieve compression.

Applications in recommendation systems

(1) Collaborative filtering: Analyze the user-item rating matrix and use matrix decomposition to predict the user's rating of unrated items. For example, by singular value decomposition, the original matrix is decomposed into the product of the user feature matrix, the singular value matrix, and the item feature matrix, and the approximate rating matrix is reconstructed to generate a recommendation list for the target user.

(2) Latent semantic model: Find the latent features of users and items for more accurate recommendations. These latent features can be obtained by matrix decomposition methods in linear algebra.

Applications in natural language processing

(1) Word vector representation: Models such as Word2Vec represent words as high-dimensional vectors, and the semantic relationship between words can be reflected by the linear relationship of vectors.

Its calculation involves a large number of matrix operations and linear algebra knowledge.

(2) Sentiment analysis: Use vector space operations in linear algebra for sentiment analysis.

3.3 Interdisciplinary Course Teaching Team Construction

A multi-directional teacher team can achieve complementary advantages. Building a teacher team with mathematical and artificial intelligence backgrounds is an important guarantee for achieving high-quality linear algebra teaching reform. Teachers with mathematical backgrounds have a deep foundation in theoretical explanation and can clearly explain the concepts, theorems, and derivation processes of linear algebra, laying a solid theoretical foundation for students. Teachers with artificial intelligence backgrounds are familiar with the practical application of linear algebra in the field and can integrate actual cases and engineering experience into teaching, helping students establish a connection between theory and practice. The complementary advantages of the two can make the teaching content richer and more comprehensive, the teaching methods more flexible and diverse, and better meet the requirements of linear algebra teaching for the artificial intelligence major under the background of new engineering.

Collaboration and teaching implementation of team members. The interdisciplinary teaching team can work closely together to design teaching outlines, teaching content, and practical links. In the teaching process, team members can impart their professional knowledge and application experience to students through joint teaching, special lectures, and other forms. For example, when explaining the application of linear algebra in machine learning algorithms, a mathematics teacher can first explain the relevant linear algebra theory, and then an artificial intelligence teacher can introduce the principles and application scenarios of machine learning algorithms, and demonstrate how to use linear algebra knowledge to implement algorithms through application cases. In addition, the team can also guide students' course projects and practical assignments together, providing guidance and suggestions from different disciplinary perspectives for problems students encounter in the learning process, promoting the comprehensive development of students.

3.4 Evaluation Framework for Teaching Reform

Regarding the effectiveness of teaching reform of linear algebra in the discipline of artificial intelligence, the following points can be used for evaluation.

Set clear quantitative standards. During the whole semester of teaching, two process tests are set. The first test can focus on theoretical testing, covering the core knowledge of linear algebra. By comparing the average scores, score distributions, and knowledge point scores of students before and after the reform, their theoretical mastery can be judged. The second test can appropriately increase the proportion of questions about applying linear algebra knowledge to solve practical artificial intelligence problems, for example, increasing from the original 0% to 30%, and counting the score rates of students on these questions. If the score rate increases by more than 20% after the reform, it indicates that students have made significant progress in application ability.

Use project practice for reasonable evaluation. Assign comprehensive project tasks, such as image recognition or machine learning model building projects based on linear algebra. Evaluate students' performance in the projects, including the completion degree of the projects, the innovation of the code, and the depth of application of linear algebra knowledge. For example, whether students can correctly use matrix operations for data preprocessing, feature extraction, and model training, and whether they can reasonably select and adjust linear algebra algorithms to improve model performance. According to the complexity and completion quality of the projects, corresponding scores or grade evaluations are given to measure students' comprehensive application ability of linear algebra concepts.

Real-time tracking of the learning process.

Classroom participation reflects students' enthusiasm. Record the number of times students speak, the number of questions asked, and the participation in group discussions to evaluate students' classroom participation and the effect of teaching methods on stimulating learning initiative. The completion of homework is also crucial. Analyze the quality of homework, the timeliness of submission, and the situation of error correction to understand students' knowledge consolidation and learning attitude.

Student satisfaction evaluation. Feedback can be provided from the perspective of students. Regularly conduct questionnaires to collect students' satisfaction evaluations of teaching content, methods, teacher levels, and course arrangements, understand students' needs and the degree of recognition of the reform. Select some students for in-depth interviews to understand their learning difficulties, gains, and opinions and suggestions on the reform, and obtain valuable feedback.

Long-term continuous tracking and evaluation. The long-term effectiveness of teaching reform can be considered. Track students' grades, participation, and practical ability performance in subsequent artificial intelligence-related courses to evaluate the impact of the reform on students' knowledge transfer and continuous learning ability. Interview graduates to understand the application of linear algebra knowledge in employment or further studies and the help of the reform to career development, and evaluate the effectiveness of the reform from a long-term perspective to provide support for continuous optimization of teaching reform.

4. Expected Results of Teaching Reform

Through this teaching reform, it is expected that students can be improved in four aspects: knowledge understanding, ability improvement, learning attitude, and comprehensive quality.

In terms of knowledge understanding and mastery, through this teaching reform, it is expected that students can achieve a more systematic and in-depth understanding of the core concepts of linear algebra. Key knowledge points such as vector space, linear transformation, eigenvalues and eigenvectors are no longer isolated theories, and students will build a complete knowledge system. At the same time, students will clearly understand the internal connection between linear algebra knowledge and artificial intelligence algorithms, data processing, and model construction. In course assignments and exams, when there are questions integrating the two, the score rate of students is expected to increase by 30%, and they can accurately explain the key role mechanism of linear algebra principles in specific application scenarios of artificial intelligence.

From the perspective of ability improvement and practical application, students will proficiently master programming tools such as *Python* and *MATLAB* and can independently complete complex programming projects such as image recognition algorithms based on linear algebra. When encountering practical artificial intelligence problems, students' ability to analyze and solve problems using the learned linear algebra knowledge will be significantly enhanced. In course projects, the proportion of students who propose innovative solutions is expected to increase by 25%.

In terms of learning attitude and interest cultivation, students' enthusiasm for learning linear algebra courses will be significantly improved. It is expected that the proportion of students who actively participate in classroom discussions will increase from 40% to 60%, and the average weekly time spent by students actively learning linear algebra and artificial intelligence-related knowledge in their spare time will increase by more than 3 hours. The number of times of using online learning platforms to independently study course materials and participate in discussions will also increase significantly.

In terms of comprehensive quality and future development, students will gradually cultivate good interdisciplinary thinking abilities and be able to flexibly apply and transfer knowledge in multiple disciplinary fields such as mathematics, computer science, and artificial intelligence. When participating in interdisciplinary projects, students can not only quickly adapt to project requirements but also play a key role. In the long run, this teaching reform will lay a solid foundation for students' future career development in the field of artificial intelligence.

5. Conclusion

Linear algebra is a basic course for majors such as artificial intelligence and is the theoretical and knowledge cornerstone for other advanced professional courses. Under the background of new engineering, the teaching reform of linear algebra for the artificial intelligence major is of great significance. By analyzing the current teaching status and the training requirements of the artificial intelligence major under new engineering, teaching reform measures including the combination of theory and practice, the introduction of artificial intelligence applications, and the construction of interdisciplinary teaching teams have been proposed. These measures can effectively solve the problem of the disconnection between linear algebra teaching and the application of the artificial intelligence major, improve students' understanding and application ability of linear algebra knowledge, enable students to better master the mathematical foundation required for the artificial intelligence major, and lay a solid foundation for training high-quality artificial intelligence professional talents adapted to the development of new engineering. In the future, the interdisciplinary teaching team can be further expanded to the fields of integration with computer science, statistics and other disciplines. Teachers with different disciplinary backgrounds can jointly design teaching cases and practical projects to enable students to more comprehensively master the application of linear algebra in complex artificial intelligence scenarios. In addition, with the rapid development of artificial intelligence technology, new neural network architectures are constantly emerging. Teachers should continuously learn the latest artificial intelligence models and applications to update the teaching of linear algebra courses in real time.

The implementation of the reform may face a series of challenges. First, some teachers may lack knowledge of artificial intelligence frontiers and interdisciplinary teaching methods. Schools should regularly hold professional training sessions, invite industry experts to give lectures and practical guidance, and encourage teachers to participate in online course learning and academic exchange activities. Second, the resistance to change cannot be ignored. Some teachers and students may resist the reform due to their habits of traditional teaching and learning methods. To this end, pilot classes can be set up first, and comprehensive evaluations and tracking can be carried out for the pilot classes and ordinary classes to demonstrate the advantages and expected results of the reform. During the teaching process, feedback should be collected in a timely manner and adjusted and optimized to enhance the sense of participation and recognition of teachers and students.

Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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