ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

Research on the Teaching Evaluation System and Path of Diversified Courses in Blended Teaching Based on Knowledge Graph under the Background of Artificial Intelligence

Zhangliang Chen, Junwei Shi*, Hongzhu Jin

School of Management Science and Engineering, Shandong Technology and Business University, Yantai, China
Corresponding author

Abstract: *In the era of artificial intelligence, knowledge graphs have become pivotal for enhancing knowledge management in education. This paper explores the development of a teaching evaluation system for diversified curricula within hybrid teaching models, utilizing knowledge graphs. The study aims to improve the evaluation of teaching effectiveness by integrating knowledge graphs, which offer a structured representation of educational entities and their interrelationships. The proposed evaluation system leverages knowledge graphs to assess various dimensions of teaching quality, such as student engagement, instructional effectiveness, and alignment with educational objectives. By organizing and analyzing data through knowledge graphs, the system provides comprehensive and actionable insights for continuous improvement. The research identifies practical pathways for implementing this evaluation system, including AI-driven analytics for real-time monitoring, automated feedback mechanisms, and adaptive evaluation criteria. Empirical results from pilot implementations show that this system enhances evaluation precision and adaptability, leading to more effective and responsive teaching practices. In conclusion, the integration of knowledge graphs into teaching evaluation frameworks offers significant advantages, including improved precision, relevance, and the ability to tailor teaching strategies to individual needs, ultimately contributing to better learning outcomes and higher teaching quality.*

Keywords: *teaching evaluation system; path of diversified courses; blended teaching; artificial intelligence*

1. Introduction

1.1 Research Background

On a global scale, the development of Artificial Intelligence (AI) technology is changing the way various industries operate at an unprecedented speed, and the education sector is no exception. The rapid development of artificial intelligence technology has led to a shift in the field of education from traditional teaching models to more intelligent, personalized, and flexible blended learning models. Blended Learning combines traditional face-to-face teaching with online learning, providing teachers and students with richer teaching resources and flexible learning methods[1]. With the widespread application of blended learning models, how to effectively evaluate their teaching effectiveness, especially for different learners' needs and learning methods, has become an important topic in educational research[2].

Knowledge Graph, as an emerging tool for knowledge management and organization, can integrate dispersed and heterogeneous knowledge points into a systematic knowledge network through semantic association, providing strong support for the organization and retrieval of educational resources. The application of knowledge graphs in the field of education not only promotes personalized learning path recommendations, but also helps teachers dynamically adjust teaching content and strategies based on learners' knowledge mastery. However, despite the broad application prospects of knowledge graph in education, how to effectively support the construction of curriculum teaching evaluation system in blended learning mode has not been deeply studied[3].

In blended learning mode, due to the diverse forms of teaching activities and the complexity of

ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

learners' learning paths and outcomes, traditional teaching evaluation methods are difficult to comprehensively and accurately reflect teaching effectiveness. Traditional evaluation methods often focus on a single dimension, such as exam scores or classroom performance, ignoring the comprehensive performance and personalized needs of learners in different teaching forms. Therefore, there is an urgent need for a diversified evaluation system that can comprehensively measure the multidimensional learning outcomes of learners in blended learning[4].

Based on this, this study intends to combine knowledge graph in artificial intelligence technology to construct a diversified curriculum teaching evaluation system suitable for blended learning mode. By integrating learners' learning data, teachers' teaching behaviors, and the use of course resources, knowledge graphs are used to model and analyze the teaching process, thereby achieving a comprehensive evaluation of teaching effectiveness. Meanwhile, this article will use the Structural Equation Modeling (SEM) method to verify the effectiveness of the evaluation system and explore its application path in practical teaching. Structural equation modeling is a statistical analysis method that can simultaneously handle multiple causal relationships and reveal complex relationships between latent variables through model validation. It is suitable for empirical research in the field of education.

1.2 Research Purpose and Significance

1.2.1 Improve teaching quality and promote personalized learning

In the context of artificial intelligence, blended learning models have gradually become an important component of higher education. Compared with traditional teaching models, blended learning can provide more flexible and diverse learning methods to meet the needs of different learners. However, the complexity of blended learning also places higher demands on teaching quality. By constructing a diversified curriculum teaching evaluation system based on knowledge graph, this study can help educational institutions comprehensively understand teaching effectiveness, thereby providing scientific basis for improving teaching content and teaching strategies. This not only helps improve the quality of teaching, but also promotes innovation in teaching methods to meet students' personalized learning needs.

With the development of educational informatization, personalized learning has become an important direction of educational reform. The application of knowledge graphs in education makes personalized learning path recommendations more accurate. However, how to evaluate the effectiveness of personalized learning remains a major challenge in educational research. The traditional teaching evaluation system often overlooks the diversity and complexity of personalized learning. This study constructs a diversified evaluation system to comprehensively assess the effectiveness of personalized learning and provide data support for further optimizing personalized learning programs. This will promote the in-depth development of personalized learning, enhance learners' learning effectiveness and learning experience.

1.2.2 Optimize the allocation of educational resources and promote educational equity

The application of knowledge graph technology makes the organization and management of educational resources more efficient. However, further exploration is still needed on how to organically integrate these resources with teaching evaluation to maximize their effectiveness. Through the diversified curriculum teaching evaluation system constructed in this study, educators can optimize resource allocation based on evaluation results and invest limited educational resources into areas that can best promote learning outcomes. This can not only improve the efficiency of utilizing educational resources, but also ensure the sustainable development of teaching activities.

Educational equity has always been a focus of social attention, especially in the information age, where how to achieve educational equity through technological means has become an important issue. The blended learning model can to some extent break the limitations of time and space, providing high-quality educational resources for more learners. However, the performance of different learners in blended learning is often influenced by various factors such as their background and learning style. This study constructs a diversified evaluation system to more fairly and comprehensively evaluate the learning outcomes of different learners, providing a basis for developing targeted teaching strategies and promoting the realization of educational equity.

1.2.3 Enrich educational research methods and expand the application of knowledge graphs in education

Structural equation modeling is a powerful statistical analysis tool widely used in social science research. However, its application in the field of education, especially in the research of teaching

ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

evaluation system combined with knowledge graph, is still rare. This study introduces structural equation modeling into the construction of a knowledge graph based hybrid teaching evaluation system, which not only provides new ideas and methods for educational evaluation research, but also provides practical experience for the application of structural equation modeling in educational research. This will further enrich the methodology of educational research and lay the foundation for future educational research.

In summary, this study has significant theoretical value and practical significance. By constructing a diversified curriculum evaluation system for blended learning based on knowledge graph and validating it using structural equation modeling, this study provides new ideas and methods for solving the current difficulties in blended learning evaluation, and also makes positive contributions to improving education quality and promoting educational equity.

2. A diversified curriculum evaluation system for blended learning based on structural equation modeling

2.1 Overview of Structural Equation Modeling

2.1.1 Origin and Development of Structural Equation Modeling

Structural Equation Modeling (SEM) originated in the 1950s and was developed by social scientists and statisticians to address complex relationships between multiple variables. SEM is a multivariate analysis method based on statistical theory that can simultaneously handle multiple causal relationships and reveal the underlying structure between variables. SEM is widely used in fields such as education, psychology, sociology, etc. due to its powerful modeling and validation capabilities.

The earliest development of SEM can be traced back to the combination of multiple regression analysis and path analysis. At the beginning of the 20th century, Charles Spearman proposed the "single factor" model to explain the correlation between different cognitive tests, which became the basis of modern factor analysis. Subsequently, Sewall Wright introduced the concept of path analysis in 1921, which allowed researchers to construct multiple interrelated regression equations to explain complex causal relationships. SEM has developed into a comprehensive analysis tool by combining factor analysis, path analysis, regression analysis, and other methods based on this foundation[5,6].(table 1)

Table 1: Convergence validity and combination reliability test of various dimensions of the online offline blended learning effectiveness scale

Path relationship			**Estimate**	AVE	CR
HJ1	<---	learning effect	0.314	0.667	0.90
HJ2	<---	learning effect	0.719		
HJ3	<---	learning effect	0.978		
HJ4	<---	learning effect	0.795		
HJ5	<---	learning effect	0.220		
ZY1	<---	Teaching resources	0.995	0.7009	0.93
ZY2	<---	Teaching resources	0.330		
ZY3	<---	Teaching resources	0.957		
ZY4	<---	Teaching resources	0.900		
ZY5	<---	Teaching resources	0.566		
HD1	<---	Teacher student interaction	0.879	0.7314	0.91
HD2	<---	Teacher student interaction	0.024		
HD3	<---	Teacher student interaction	0.705		
XG1	<---	Assessment of Learning Effectiveness	0.767	0.6873	0.87
XG2	<---	Assessment of Learning Effectiveness	0.896		
XG3	<---	Assessment of Learning Effectiveness	0.922		
XG4	<---	Assessment of Learning Effectiveness	0.872		
SJ1	<---	Instructional design	0.345	0.6667	0.88
SJ2	<---	Instructional design	0.885		
SJ3	<---	Instructional design	0.833		

ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

2.1.2 Basic Concepts and Theoretical Framework of Structural Equation Modeling

Structural equation modeling is a generalized statistical modeling technique that combines measurement models and structural models to analyze the relationship between observed variables and latent variables. SEM consists of two parts: measurement model and structural model. Measurement models are used to define the relationship between latent variables (also known as factors) and observed variables; The structural model is used to define the relationships between latent variables. Potential variables are concepts or structures that cannot be directly measured, such as learning motivation, teaching quality, etc. Observational variables are indicators that can be directly measured, such as exam scores, classroom attendance rates, etc. In SEM, latent variables are represented by a set of observed variables, which are typically obtained through surveys, tests, or other data collection methods. Factor loading refers to the strength of the relationship between observed variables and latent variables. In SEM, factor loading represents the degree to which an observed variable explains a latent variable. A high factor load value indicates that the observed variable represents the latent variable well. A structural path is a causal relationship path established between latent variables. In the SEM model, these paths represent the influence relationships between different latent variables. For example, a teacher's teaching performance (latent variable) may affect learning outcomes (latent variable) through student participation (latent variable). The path coefficient is an estimated value of the structural path, representing the degree of influence of one latent variable on another latent variable. The path coefficient can be positive or negative, indicating a positive or negative relationship between variables. Multiple fitness metrics are used in SEM to evaluate the fit of the model, such as chi square statistics, comparative fit index (CFI), root mean square residuals (RMSEA), etc. These indicators help researchers determine whether the model is suitable for observational data, and the higher the model fit, the better the fit between the model and the data.

2.1.3 Application advantages of structural equation modeling

The main advantage of SEM is its ability to simultaneously handle complex causal relationships and multidimensional data, which has broad application potential in educational research. Specifically, SEM has the following advantages: SEM can simultaneously analyze the relationship between multiple observed variables and latent variables, which enables researchers to comprehensively consider multiple factors in one model. For example, in the study of blended learning models, multiple dimensions such as curriculum design, teacher performance, student engagement, and learning outcomes can be analyzed simultaneously. Many key factors in educational research cannot be directly measured, such as students' learning motivation, course satisfaction, etc. SEM can quantify these abstract concepts through latent variable modeling and link them with observable data. This enables researchers to gain a deeper understanding and explanation of educational phenomena. SEM allows researchers to verify the causal relationship of hypotheses through path analysis. Unlike traditional regression analysis, SEM can simultaneously handle multiple causal relationships and evaluate the overall fit of the model. This makes SEM a powerful tool for verifying complex causal relationships. SEM can not only build and verify a single model, but also allow researchers to compare the fitness between different models and modify the model based on data. For example, researchers can improve the fit of the model by modifying the path or adding latent variables. In actual data, measurement errors are inevitable. SEM can improve the accuracy of the model by processing and correcting measurement errors in the observed variables through the measurement model. SEM can integrate data from different sources, including questionnaire surveys, experimental data, observational data, etc. This makes SEM particularly suitable for multi-source data analysis in educational research[7].(figure 1)

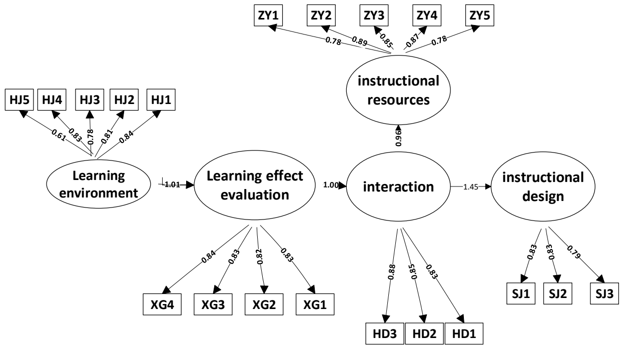

Figure 1: Evaluation System for Diversified Courses in Blended Teaching Based on Structural Equation Modeling

ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

2.1.4 Typical Applications of Structural Equation Modeling in Educational Research

Structural equation modeling has a wide range of applications in educational research, especially in the following fields:

SEM is widely used to evaluate teaching effectiveness, and researchers can construct teaching evaluation models that include multiple dimensions, such as teaching quality, student participation, curriculum design, etc. Through SEM analysis, the interactions between various dimensions and their impact on the overall teaching effectiveness can be revealed. Students' learning motivation and behavior are important factors that affect learning outcomes. SEM can link learning motivation, learning behavior, and learning outcomes, and study their interrelationships. This helps to reveal the causal relationship between motivation, behavior, and academic performance, providing a basis for educational interventions. Course satisfaction is an important indicator for measuring teaching quality. Through SEM, researchers can analyze the relationship between student satisfaction and instructional design, teacher performance, and course content, in order to identify key factors that affect satisfaction. SEM is also used to study the relationship between teacher professional development and teaching effectiveness. By modeling the relationship between teachers' teaching abilities, teaching attitudes, and teaching outcomes, researchers can evaluate the impact of different teacher training programs on teaching effectiveness. At the macro level, SEM can be used to evaluate the effectiveness of education policies. For example, researchers can use SEM models to analyze the impact of a certain education reform policy on multiple aspects such as student performance, teacher satisfaction, and school management, providing data support for policy formulation and adjustment[8].

2.2 Blended Teaching Diversified Curriculum Teaching Evaluation System

2.2.1 Construction of evaluation index system for diversified courses in blended learning

Firstly, the determination of evaluation dimensions is a crucial step in building an evaluation system. The characteristics of blended learning require a comprehensive consideration of multiple factors in its evaluation system. Traditional classroom teaching evaluation usually focuses on teachers' teaching skills, the quality of textbook content, and students' learning outcomes. However, in blended learning mode, in addition to the above factors, attention also needs to be paid to the functionality of online learning platforms, accessibility of teaching resources, and interactive effects during the learning process. Therefore, when determining the evaluation dimensions, it should cover aspects such as the quality of teaching content, the effectiveness of teaching methods, students' learning experience, the improvement of learning outcomes, and teachers' teaching abilities.

The quality of teaching content is a core dimension in the evaluation system. Blended learning typically consists of two parts: online courses and traditional classroom teaching, each part of which needs to meet teaching objectives and have high academic value and practicality. The quality of teaching content is not only reflected in the accuracy and authority of course materials, but also in whether they can effectively support students' learning goals. To evaluate the quality of teaching content, it can be done by analyzing whether the course design and content meet academic standards, whether it can stimulate students' interest and participation, and other aspects.

The effectiveness of teaching methods is another important evaluation dimension. In blended learning mode, teachers need to adopt multiple teaching methods and strategies to adapt to different learning needs. These teaching methods may include face-to-face lectures, group discussions, online interactions, video teaching, etc. Each method has its unique advantages and limitations, and evaluating its effectiveness requires considering whether the teaching method can promote students' active learning, improve their learning outcomes, and effectively integrate online and offline learning experiences. In addition, it is necessary to evaluate the flexibility and innovation of teachers in adopting these methods.

The learning experience of students is an important indicator for evaluating the quality of blended learning. The satisfaction of students with the course, their perception of the learning process, and the effectiveness of learning support are all key aspects in evaluating the learning experience. By systematically analyzing students' feedback, we can understand their real experiences in blended learning environments. This includes students' acceptance of course content, their experience using online learning platforms, and their satisfaction with teaching interactions. These pieces of information can reveal potential problems in the teaching process and provide a basis for improving teaching strategies.

ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

2.2.2 Construction of Structural Equation Model for Teaching Evaluation of Diversified Courses in Blended Teaching

When designing a structural equation model, it is necessary to consider the fit and path relationship of the model. The fitting degree of a model reflects the degree of conformity between the model and actual data, and is a key indicator for judging whether the model is reasonable. Common fit indicators include chi square test, goodness of fit index (GFI), adjusted goodness of fit index (AGFI), etc. When setting path relationships, it is necessary to determine the causal relationships between latent variables based on theoretical and empirical data, and quantify the strength and direction of these relationships through path coefficients. These path relationships can help reveal how different factors collectively affect teaching effectiveness, providing a basis for optimizing teaching.

Data collection and analysis are important steps in building an evaluation system. The collection of data usually includes various forms such as questionnaire surveys, course grades, and teaching feedback. A questionnaire survey can collect students' opinions and suggestions on course content, teaching methods, learning experience, and other aspects; Course grades can reflect students' learning outcomes; Teaching feedback provides a direct evaluation of teachers' teaching abilities and strategies. By systematically analyzing these data, the effectiveness of the structural equation model can be verified and problems in the teaching process can be revealed.

In the data analysis stage, structural equation modeling tools are used for statistical analysis to test the fit of the model and the significance of the path relationship. Common SEM tools include AMOS, Mplus, and LISREL. These tools can assist researchers in conducting detailed testing and adjustments of the model to ensure the scientific and practical nature of the evaluation system. By interpreting the analysis results, detailed information about various dimensions of blended learning can be obtained, and teaching can be optimized and improved based on this information.

3. Improvement Path of Blended Teaching in Engineering Drawing and CAD Course Based on Knowledge Graph

3.1 Construction and Optimization of Knowledge Graph for Course Content

In the course of Engineering Drawing and CAD, building a knowledge graph of the course content is an important step in improving teaching quality. Firstly, the construction of the course content knowledge graph requires a comprehensive organization of the course outline, textbook content, and teaching resources. For the course of Engineering Drawing and CAD, this includes content on drawing specifications, CAD operation skills, and the use of drawing tools. After collecting this information, organize it into structured data, determine the nodes of knowledge points, and define the relationships between these knowledge points, such as the hierarchical relationship between basic concepts and advanced applications, or the causal relationship between tool functions and actual operations.

When constructing a knowledge graph model, drawing specifications, view transformations, engineering drawing symbols, etc. can be used as the main nodes, while tool operation steps, common problems, and solutions can be used as auxiliary nodes. Knowledge graph can help teachers clarify the logical relationships between knowledge points in curriculum design and optimize the arrangement of teaching content. At the same time, students can visually see the interrelationships between various knowledge points through the knowledge graph, understand the overall structure of the course content, and thus more systematically master the knowledge of the "Engineering Drawing and CAD" course.

3.2 Knowledge Graph Support for Personalized Learning Paths

The development of personalized learning paths in the course of Engineering Drawing and CAD can significantly improve students' learning outcomes. By utilizing knowledge graph technology, personalized learning plans can be developed for each student. Firstly, teachers need to collect students' learning data, including their basic knowledge level, learning progress, homework completion status, and feedback on different teaching modules. These data can help construct students' knowledge graphs, reflecting their learning status and knowledge mastery.

By analyzing students' knowledge graphs, teachers can identify their strengths and weaknesses and develop targeted learning paths. For example, for students who perform well in CAD software operations, teachers can recommend more challenging projects or advanced learning materials. For students who have difficulties in drafting standards, more basic knowledge supplementary resources and practice

ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

questions can be provided. The development of personalized learning paths can ensure that each student can learn in the most suitable way according to their own learning pace, thereby improving overall learning effectiveness.

In addition, knowledge graphs can also support dynamic adjustment of learning paths. Based on students' feedback and progress during the learning process, teachers can update and optimize their learning plans in real-time to meet students' changing needs. This flexible adjustment mechanism can ensure that students maintain a high level of learning motivation and effectiveness throughout the learning process.

3.3 Optimization of Knowledge Graph for Teaching Interaction and Feedback

In the course of Engineering Drawing and CAD, the effectiveness of teaching interaction and feedback is crucial for students' learning experience. By constructing a knowledge graph of teaching interaction and feedback, the teaching interaction mechanism and feedback process can be optimized, thereby improving student participation and learning outcomes. Firstly, it is necessary to collect and organize data on teaching interactions, including classroom discussions, online communication, student questions, and teacher responses. At the same time, collect feedback from students on the course, such as satisfaction with classroom activities and understanding of teaching content.

Organizing these data into a knowledge graph can help teachers identify key issues and areas for improvement in teaching. For example, by analyzing the knowledge graph, teachers can identify which teaching activities have received positive feedback from students and which interactive aspects have problems. Based on these analysis results, teachers can optimize teaching strategies and interactive modes, such as adjusting the form of classroom discussions and improving online communication methods. The feedback mechanism can also be optimized through knowledge graphs, for example, by analyzing students' feedback data, teachers can adjust teaching content and methods in a timely manner to better meet students' needs[9].

In addition, teachers can use knowledge graphs to conduct detailed analysis of teaching interactions and understand the impact of different teaching activities on students' learning outcomes. Through in-depth analysis of interactive data, teachers can develop more effective teaching strategies, improve the quality of classroom interaction, and enhance students' learning enthusiasm and participation.

3.4 Knowledge Graph Support for CAD Software Operation Skills

The cultivation of CAD software operation skills is one of the key objectives in the course of Engineering Drawing and CAD. Knowledge graphs can help students better grasp the usage methods and skills of CAD software. Firstly, it is necessary to construct a knowledge graph of CAD software operation skills, including commonly used tools, commands, functional modules, and operation steps. Knowledge graph can present these contents in the form of nodes and relationships, helping students systematically understand the operation process and functions of CAD software.

In teaching, teachers can use knowledge graphs to provide students with operational guidelines and practice materials. For example, for a specific CAD function, its usage steps and application scenarios can be displayed in a knowledge graph, and relevant exercises and case studies can be provided. Students can learn the specific operation methods of each function through knowledge graphs, while also understanding the application of these functions in practical projects. Teachers can also provide real-time operational guidance through knowledge graphs, so that when students encounter problems in the actual operation process, they can quickly find solutions and improve learning efficiency[10].

In addition, knowledge graphs can also support self-learning and supplementation of software skills. During the process of self-directed learning, students can refer to the resources and learning paths provided in the knowledge graph to conduct targeted learning according to their own needs, thereby improving their mastery of software operation skills.

3.5 Knowledge Graph Support for Teacher Professional Development

The professional development of teachers has a direct impact on the teaching quality of the course "Engineering Drawing and CAD". Knowledge graphs can provide strong support for teachers' professional development. Firstly, construct a knowledge graph of teachers' professional development, including their teaching experience, professional skills, research fields, etc. By organizing and analyzing

ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

teacher information, it is possible to identify the strengths and weaknesses of teachers in teaching and research, and develop corresponding training plans and development paths.

For example, by analyzing teachers' knowledge graphs, it can be found that some teachers have knowledge gaps in the use of new features in CAD software. To address these shortcomings, relevant training resources and learning opportunities can be provided for teachers to help them improve their professional skills. At the same time, knowledge graphs can also help teachers understand the research results and teaching experience of other peers, draw inspiration and experience from them, and improve their own teaching level and research ability.

3.6 Knowledge Graph Application for Course Evaluation and Improvement

Course evaluation and improvement are important aspects to ensure the quality of the Engineering Drawing and CAD course. Knowledge graphs can support the evaluation and improvement process of courses, helping teachers identify problems in the curriculum and make improvements through systematic evaluation and data analysis. Firstly, construct a knowledge graph for course evaluation, including students' exam scores, homework completion status, classroom participation, and other data. By organizing and analyzing these data, a comprehensive evaluation of various aspects of the course can be conducted.

When using a knowledge graph for course evaluation, students' academic performance can be compared with the knowledge graph of the course content to analyze their mastery of different knowledge points. Based on the evaluation results, teachers can identify weak areas in the curriculum and make targeted improvements. For example, if it is found that the mastery of certain knowledge points is poor, the arrangement of course content can be adjusted or relevant teaching resources can be added. In addition, knowledge graphs can support continuous improvement of courses by dynamically analyzing evaluation data, updating and optimizing course content and teaching methods in a timely manner, thereby continuously improving the quality and effectiveness of courses[11].

4. Conclusion and Suggestions

4.1 Conclusion

4.1.1 Through research, it has been found that knowledge graphs play a key role in enhancing the systematic and effective content of blended learning courses

Knowledge graph can systematically organize and display course content, making the knowledge structure of the course clearer. Specifically, by constructing a knowledge graph of course content, teachers can clarify the relationships between various knowledge points, arrange teaching content reasonably, and avoid omissions or duplications of knowledge points. In addition, the application of knowledge graphs makes course design more scientific and structured, thereby improving the pertinence and effectiveness of teaching. In practical applications, knowledge graphs help teachers identify and integrate core knowledge points in the curriculum, ensuring that each knowledge point is adequately explained and practiced. For students, the visual display of knowledge graphs enables them to intuitively understand the connections between various knowledge points, enhancing their overall grasp and understanding of the course content. This systematic way of organizing knowledge is particularly important in complex and diverse courses, as it can help students establish a systematic knowledge framework and improve the systematicity and efficiency of learning. However, in the actual operation process, the complexity and challenges of knowledge graph construction have also been discovered.

4.1.2 Knowledge graphs have shown significant effectiveness and flexibility in supporting personalized learning paths

By constructing and applying a knowledge graph of personalized learning paths, tailored learning resources and support can be provided based on each student's learning needs and progress. The development of this personalized learning path can help students better grasp knowledge points, overcome difficulties in learning, and thus improve learning outcomes. Research has shown that knowledge graphs can accurately reflect students' learning status and knowledge mastery, and provide personalized learning recommendations based on this data. For example, by analyzing students' learning history and performance, knowledge graphs can identify their strengths and weaknesses, and then develop targeted learning plans. This personalized learning support can effectively enhance students' interest and initiative in learning, and promote the improvement of their self-directed learning ability.

ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

4.1.3 The knowledge graph has demonstrated significant effectiveness and practicality in optimizing teaching interaction and feedback

By constructing a knowledge graph of teaching interaction and feedback, it is possible to systematically analyze and optimize the teaching interaction process, improve student participation and learning outcomes. Knowledge graph can help teachers identify key issues and improvement points in teaching, optimize teaching strategies and interactive modes, thereby improving overall teaching quality. Research has found that knowledge graphs can record and analyze in detail the interactions between teachers and students, including classroom discussions, online communication, and student questioning. Meanwhile, knowledge graphs can also integrate students' feedback information, helping teachers understand students' true feelings and needs towards the curriculum. The comprehensive analysis of this information provides specific basis for teachers to improve teaching, thereby achieving targeted teaching adjustments and optimizations. However, there are also some challenges in the application of knowledge graphs for teaching interaction and feedback. For example, how to effectively integrate and analyze interactive data, how to handle the diversity and complexity of teaching feedback, and other issues need to be continuously explored and improved in practice. Therefore, it is recommended to further improve the knowledge graph application method of teaching interaction and feedback in future teaching, and enhance its applicability and effectiveness in practical teaching.

4.2 Suggestions

4.2.1 Establish a comprehensive knowledge graph construction and maintenance mechanism

Firstly, the comprehensive collection and organization of course content is the foundation for building an effective knowledge graph. It is necessary to systematically sort out all the core knowledge points in the course of "Engineering Drawing and CAD", including drawing specifications, CAD software functions, and the use of drawing tools. These knowledge points should be comprehensively integrated based on the curriculum outline, textbook content, teaching videos, and actual teaching experience. To ensure the accuracy and coverage of the knowledge graph, it is recommended to form an expert team to conduct in-depth analysis and classification of these knowledge points, and verify and revise node information through expert review and peer review. Secondly, the establishment of a dynamic update mechanism is equally important. With the advancement of technology and the updating of course content, the information in the knowledge graph also needs to be adjusted and maintained in a timely manner. It is possible to regularly review and update the knowledge graph by establishing a dedicated update team or using automated tools. This not only ensures the timeliness of the knowledge graph, but also adapts to changes in course content and students' learning needs. The effective implementation of dynamic update mechanism can help teachers and students obtain the latest teaching resources and information, thereby enhancing the overall effectiveness of the curriculum. Finally, in order to ensure the smooth progress of knowledge graph construction and maintenance, necessary technical support and training need to be provided.

4.2.2 Optimizing the design and implementation of personalized learning paths

Firstly, establishing a comprehensive mechanism for collecting student learning data is the foundation for designing personalized learning paths. By systematically collecting data on students' academic performance, homework completion, online behavior, etc., accurate basis can be provided for the development of personalized learning paths. These data can reflect students' learning status, knowledge mastery, and learning progress, providing detailed information for teachers to develop targeted learning plans. The comprehensive collection and accurate analysis of data will help develop personalized learning paths that better meet students' needs and improve learning outcomes. Secondly, optimizing personalized recommendation algorithms is the key to improving the effectiveness of personalized learning paths. By introducing advanced machine learning and data analysis techniques, the accuracy and practicality of personalized recommendations can be improved. These technologies can analyze students' learning data, identify weak links and strengths in learning, and provide the most suitable learning resources and activity recommendations. The optimization of personalized recommendation algorithms will help students better grasp course content, overcome learning difficulties, and improve learning efficiency.

4.2.3 Systematic management to enhance teaching interaction and feedback

Firstly, it is crucial to establish a comprehensive mechanism for teaching interaction and feedback data collection. By systematically recording and analyzing interactive data such as classroom discussions, online communication, and student questioning, it is possible to comprehensively understand the

ISSN 2522-6398 Vol. 7, Issue 10: 21-30, DOI: 10.25236/FER.2024.071004

situation of teaching interaction and student learning feedback. These data can help teachers identify key issues and improvement points in teaching, thereby optimizing teaching strategies and interactive modes. When establishing a data collection mechanism, it is necessary to consider how to comprehensively record various forms of interactions and ensure the accuracy and reliability of the data. Secondly, introducing intelligent analysis tools for in-depth analysis of teaching interaction and feedback data will help improve the pertinence and effectiveness of teaching strategies. By applying data mining and analysis techniques, valuable information can be extracted from a large amount of interactive data, identifying problems and improvement points in teaching. Intelligent analysis tools can automatically analyze data, generate analysis reports and recommendations, and provide teachers with scientific decision-making basis. The introduction of this analytical tool will help improve the management level of teaching interaction and feedback, and optimize teaching effectiveness. Finally, strengthening the training of teachers in the application of knowledge graphs will help improve the quality of teaching interaction and feedback.

This paper was supported by the Visiting Scholar Research Fund for Teachers from Shandong Provincial Ordinary Undergraduate Universities. Meanwhile, this work is financially supported by the Teaching Reform Research Project:

(1) 2022 Shandong Province Undergraduate Teaching Reform Research Project (M2022099): Research on the Construction, Evaluation, and Quality Improvement Path of Online and Offline Hybrid Teaching System in Universities.

(2) 2023 Shandong Province Higher Education Curriculum Ideological and Political Education Reform Research Project (SZ2023074): Digital Empowerment Integration Innovation - Research on the Ideological and Political Education Model, Evaluation Mechanism, and Improvement Path of Higher Education Curriculum under the Background of Education Informatization.

References

[1] Marcos C M . Teaching Innovation Experience for COVID-19 Times: A Case Study on Blended Learning of Television Journalism Courses with Moodle [J]. Asia Pacific Media Educator, 2021, 31 (2): 178-194.

[2] Pischetola , Magda . Teaching Novice Teachers to Enhance Learning in the Hybrid University [J]. Postdigital Science and Education, 2021, (prepublish): 1-23.

[3] Guoqin L , Wen Z ,Sai L . The exploration of PBL mixed teaching mode in secondary vocational classes [J]. Journal of Physics: Conference Series, 2021, 1976 (1):

[4] Zhaoxia D . Research on the Application Status and Countermeasures of College English Blended Teaching Model under Big Data [J]. Journal of Physics: Conference Series, 2021, 1955 (1):

[5] Sascha H , Sven D ,Lennart H . Urgent need hybrid production - what COVID-19 can teach us about dislocated production through 3d-printing and the maker scene [J]. 3D Printing in Medicine, 2020, 6 (1): 37-37.

[6] Firouzi F J , Maryam O . Application of a Hybrid Method for Performance Evaluation of Teaching Hospitals in Tehran [J]. QUALITY MANAGEMENT IN HEALTH CARE, 2020, 29 (4): 210-217.

[7] Manuel M A , Anabel A B ,Sebastian G M . From blended teaching to online teaching in the days of Covid19. Student visions [J]. CAMPUS VIRTUALES, 2020, 9 (2): 35-50.

[8] Singh G , Sharma N ,Sharma H . Shuffled teaching learning-based algorithm for solving robot path planning problem [J]. International Journal of Metaheuristics, 2020, 7 (3):

[9] Zhou B , Peng T . Scheduling just-in-time part replenishment of the automobile assembly line with unrelated parallel machines [J]. Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science, 2019, 233 (14): 5113-5130.

[10] Thomas M , Clack L , Plaspohl S . Blending Pedagogical Approaches in Public Health Education: The ADOPT Model [J]. Pedagogy in Health Promotion, 2018, 4 (3): 227-233.

[11] M. T M . A Hybrid Spiral Project Based Learning Model for Microprocessor Course Teaching [J]. Kurdistan Journal of Applied Research, 2017, 2 (3): 125-130.