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Research on the Path of Ideological and Political Design and Quality Improvement of Online and Offline Hybrid Teaching Course Based on Knowledge Graph and Artificial Intelligence

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Abstract: *Based on knowledge graph and artificial intelligence technology, this paper discusses the design and quality improvement of online and offline hybrid teaching curriculum. In order to realize the accurate matching and personalized recommendation of the teaching content, the knowledge map technology is used to systematically sort out and structuralize the content of curriculum ideological and political education. Firstly, based on the customer satisfaction theory and structural equation model, this paper puts forward the student satisfaction theory model of mixed teaching and carries on fitting revising and testing to the model. The mixed teaching student satisfaction index model includes student expectations, offline teaching, online learning, perceived value, student satisfaction five factors, each variable on the mixed teaching satisfaction path. Then, the introduction of system dynamics method, and use Vensim-PLE to build online and online mixed teaching satisfaction factor chart and stock flow chart, to dynamic simulation of the complex relationship between the factors. Finally, the model is validated and optimized by data analysis. The research shows that knowledge graph can significantly improve the organization and systematicness of curriculum ideological and political content, and artificial intelligence technology can effectively enhance the interaction and feedback of teaching. Affect the satisfaction of online and offline mixed teaching and whether to give full play to students' expectations, Whether to improve the teaching efficiency of teachers and whether to enhance the cohesion of online and offline teaching and whether there is a good external atmosphere and environment are the four factors that students are satisfied with the hybrid teaching model. The following policy proposals are proposed from four levels, namely, to play the role of students' expectations, improve the compatibility of online and offline teaching content, focus on life and create a good external atmosphere and environment to improve the quality and effectiveness of mixed teaching in courses and promote mixed satisfaction.*

Keywords: *Knowledge graph, artificial intelligence, structural equation model, online and offline hybrid teaching, simulation*

1. Introduction

1.1. Research status

With the rapid development of information technology and the continuous change of educational needs, the traditional teaching mode can no longer fully meet the requirements of modern education. As a new teaching mode that combines the advantages of online and offline teaching, hybrid teaching mode has attracted more and more attention from educators. Especially in higher education, how to effectively integrate ideological and political education (curriculum ideological and political education) into hybrid teaching has become an important topic to improve the quality of education. Curriculum ideological and political education is not only the indoctrination of ideological and political theories, but also the subtle cultivation of students' values, outlook on life and world through course teaching. Therefore, how to improve the teaching effect of curriculum ideological and political education through modern technical means has become the focus of current research.

As a new information organization and representation technology, knowledge graph can effectively support the retrieval and analysis of complex information by constructing the structured representation of domain knowledge. In the design of ideological and political education in courses, knowledge graph

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can help sort out course content, build a knowledge system, and accurately analyze the learning situation of students. Artificial intelligence technology, especially machine learning and natural language processing technology, can provide real-time feedback and improvement suggestions through data analysis of the teaching process, thus improving the quality of teaching. Since 2003, when Professor He Kekang introduced the concept of "hybrid learning" into China, hybrid teaching has experienced three stages: technology application, technology integration and "Internet +" [1].With the continuous integration of information technology and teaching, "Internet +" online and offline blended teaching based on the intelligent teaching environment has gradually become the "new normal of future teaching." [2]. At present, online and offline hybrid teaching is developing rapidly, and many achievements have been made in concept, application and technology[3]. At the same time, it was found that in hybrid teaching, students lack deep interaction with others, have weak autonomous learning ability, and have poor learning results; students have a low overall satisfaction with hybrid teaching that combines face-to-face teaching and online learning. Therefore, it is necessary to study the satisfaction of hybrid teaching in depth and explore the influencing factors and internal relationship of satisfaction.

The application of knowledge graph in the field of education is mainly reflected in knowledge organization and recommendation systems. For example, knowledge graph technology has been used for the structured representation of course content and the association analysis of knowledge points. However, in the specific application of course ideology and politics, relevant research is still limited. The application of artificial intelligence technology in education mainly includes intelligent evaluation, personalized recommendation, and teaching assistance. Through artificial intelligence technology, it is possible to achieve real-time monitoring and feedback of students' learning process, and improve the personalization and accuracy of teaching. However, the application of artificial intelligence in course ideology and politics is still in the exploration stage, and further research is needed on its effectiveness and application methods.

1.2. Research methods

1.2.1. Structural Equation Model Research Method

The Structural Equation Model (SEM) is a statistical analysis tool for analyzing the relationship between variables. The relationship between latent variables and latent variables cannot be directly observed, and it needs to be obtained by using a structural model. The relationship between latent variable and measurement variable can be directly observed by using a measurement model. The structural model and the measurement model are the two components of the structural equation model. The structural equation model is a multivariate statistical analysis method. It can not only test some unpredictable abstract concepts, but also design parameters for the causal relationship model between independent variables and dependent variables. The structural equation model has become one of the most significant research methods across multiple disciplines. In addition to being widely used in the fields of management science and social science, it can also be applied in the field of education. This paper applies the structural equation model to the research on the effect of online and offline blended teaching, and explores the important factors that affect the teaching effect.

1.2.2. System Dynamics Research Method

System dynamics (abbreviated as SD - system dynamics) appeared in 1956. Its founder was Professor J. W. Forrester of the Massachusetts Institute of Technology (MIT)[4]. System dynamics is a system simulation method proposed by Professor Forrester in 1958 for analyzing enterprise problems such as production management and inventory management. It was originally called industrial dynamics. It is a discipline that analyzes and studies information feedback systems, and it is also a cross-disciplinary subject that understands system problems and solves system problems. From the perspective of system methodology: system dynamics is the unification of structural methods, functional methods and historical methods. It is based on system theory and absorbs the essence of cybernetics and information theory. It is a cross-disciplinary subject integrating natural science and social science. The research method of system dynamics is a method to understand the dynamic behavior of complex systems. The basis of this method is to recognize that the structure of any system and the many cyclical, interlocking, and sometimes time-delayed relationships between its components are often as important as the individual components themselves in determining its behavior.

1.2.3. Knowledge graph

"Knowledge graph" was first proposed by Google in 2012. It is a network of relationships that connects all kinds of information. It is a method of structuring, organizing and representing knowledge.

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It uses a graphical model to represent the relationship and attributes of things. The use of knowledge graph in education can improve the teaching effect and achieve learning personalization through learning resource recommendation, learning path planning and knowledge point association analysis.

2. Online and offline hybrid teaching course ideological and political model design

2.1. Give variable operation definition

Table 1: Student satisfaction evaluation index system of hybrid teaching

Online and offline blended teaching satisfaction	Student Expectations	Teacher image	The instructors are exemplary and have good professional ethics
		Teaching methods	The teaching methods are richer and more diverse, and learning is not limited by time and space
		Professional Learning & Skills	Blended teaching facilitates professional learning and develops professional skills
		Evaluation of course learning	Pay attention to the process evaluation of learning, and implement online and offline comprehensive evaluation
	Offline learning	Blended teaching concept	Teachers have clear ideas for teaching reform, and teaching is forward-looking
		Instructional design	The teaching design is scientific, reasonable, novel, and good at organization and management
		Teaching content	The teaching content focuses on the integration of theory with practice, highlighting the key points and breaking through the difficulties
		Teaching methods	There are a variety of teaching methods that can guide students to take the initiative to learn and think actively
		Teaching activities	The activities are reasonably designed, such as sign-in, group discussions, case analysis, work display, mutual evaluation and evaluation, etc., to meet the different learning needs of students
		Extension and expansion	Guide students to explore and learn after class, work in groups, and communicate
	Online learning	E-learning platform	The platform is simple and easy to use, easy to operate, and clear to navigate
		Platform learning resources	The learning resources on the platform are rich and diverse, which meet the curriculum requirements and closely follow the teaching objectives
		Interactivity	Teacher-student communication, sharing among students, discussion and evaluation, etc
		Timeliness	Teachers upload materials in a timely manner, push information on time, and give feedback on problems in a timely manner
		effectiveness	Learning resources such as texts, videos, and PowerPoint presentations are useful and can help with self-directed learning
	Perceived value	Knowledge Objectives	It helps to better grasp the course content and improves the learning efficiency and effectiveness
		Interests, emotions, attitudes	Increase interest in learning and enhance self-efficacy
		Peer cooperation and socialization	Enhance teamwork awareness and interpersonal communication skills
		Self-directed level of learning	Improve the cultivation of students' self-directed learning
		Problem awareness and ability	Improve the ability to analyze and solve problems independently
	Student satisfaction	Overall satisfaction	Comfortable with blended teaching overall
		Satisfaction with offline teaching	I am satisfied with the offline classroom teaching
		Satisfaction with online learning	I am satisfied with the online self-directed learning
		Compared to expectations	The learning gains of blended teaching are greater than expected
		Compared to the original teaching	The learning effect of blended teaching is better than that of original teaching

Based on relevant research results, pre-surveys and project analysis were conducted, and finally a mixed teaching student satisfaction evaluation index system (see Table 1) was established [5], and a questionnaire was formed. Among them, student expectations, offline teaching, online learning, perceived value and student satisfaction are the latent variables of the student satisfaction index model; 25 evaluation indicators are observed variables.

2.2. Reliability and validity testing

This study discusses the mutual influence of five factors, namely, students' online learning, offline

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learning, students' expectations, students' perceived value and students' satisfaction, on the satisfaction of online and offline blended teaching, so the corresponding model is constructed to fit.

2.3. Model Fit Test

Five latent variables and their satisfaction paths were drawn in the Amos 24.0 software modeling area, and 25 observed variables and their errors e1 ~ e30 were introduced to establish and identify the initial model. The survey data results of SPSS24.0 were imported into Amos 24. 0 to obtain the path coefficient and significance test of this model. See Table 2 for details.

Table 2: Fit Index

index	Reference standard	Measured results
CMIN/DF	1-3 is excellent,3-5 is good	1.939
RMSEA	<0.05 is excellent,<0.08 is good	0.061
IFI	>0.9 is excellent,>0.8 is good	0.885
TLI	>0.9 is excellent,>0.8 is good	0.869
CFI	>0.9 is excellent ,>0.8 is good	0.883
AGFI	>0.8 is good	0.831

2.4. Model adjustment and correction

Amos 24.0 was used to test the hypothesis of the model path after introducing new variables, and the impact relationship between variables in the online and offline blended teaching satisfaction model was analyzed. The hypothesis test of the model path was determined by analyzing the significance level ($p < 0.05$). The results showed that the path coefficients were significant, and no path relationship needed to be deleted. At the same time, according to the test results, reasonable correlation and other correction operations were carried out on the model variables, and the final modified online and offline blended teaching Satisfaction Influencing Factors Structural Equation Model is shown in Figure 1.

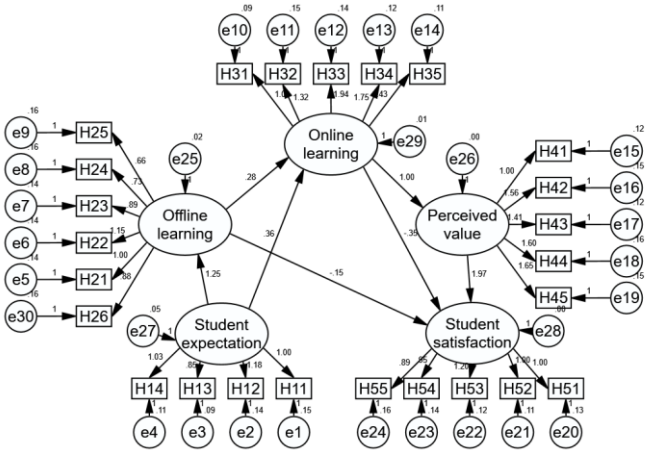

Figure 1: Modified Online and Offline Mixed Teaching Satisfaction Index Model

2.5. Path coefficient analysis

In the structural equation model, the relationship between variables is usually represented by an arrow. The number on the arrow is the standardized path coefficient, which is valued between 0 and 1, indicating the strength of the relationship among the variables. The greater the coefficient, the stronger the relationship within the two variables. The results showed that student expectations were positively predicting teacher image, teaching style, professional learning and skills, and course learning evaluation (βs 0.509, 0.577, 0.536, 0.581, respectively); Offline learning is positively predicting mixed teaching concepts, teaching design, teaching content, teaching methods, teaching activities and extension and expansion (βs, respectively 0.655, 0.702, 0.617, 0.505, 0.477, 0.58); Online learning is positively

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predicting network learning platforms, platform learning resources, interactivity, timeliness, and effectiveness (βs, respectively, 0.536, 0.551, 0.708, 0.695, 0.636, respectively); Perceived value positively predicted knowledge goals, interests and attitudes, peer cooperation and interaction, independent learning levels, problem awareness and ability (βs 0.5, 0.639, 0.677, 0.627, 0.654). Student satisfaction positively predicted overall satisfaction, offline teaching satisfaction, online learning satisfaction, compared to expectations, compared with the original teaching (βs 0.64, 0.665, 0.719, 0.6, 0.552) as detailed in Table 3.

It can be seen from the path coefficient that the 20 path coefficients between the variables are significant at the 0.001 level.

Table 3: Convergent validity

Route			SP	Standard posterior factor loadings	P	CR	AVE
H11	<---	Student Expectations		0.509		0.6355	0.3042
H12	<---	Student Expectations	0.187	0.577	***		
H13	<---	Student Expectations	0.151	0.536	***		
H14	<---	Student Expectations	0.176	0.581	***		
H21	<---	Offline learning		0.655		0.7632	0.3536
H22	<---	Offline learning	0.124	0.702	***		
H23	<---	Offline learning	0.109	0.617	***		
H24	<---	Offline learning	0.106	0.505	***		
H25	<---	Offline learning	0.104	0.477	***		
H26	<---	Offline learning	0.115	0.58	***		
H31	<---	Online learning		0.536		0.7639	0.3959
H32	<---	Online learning	0.195	0.551	***		
H33	<---	Online learning	0.242	0.708	***		
H34	<---	Online learning	0.223	0.695	***		
H35	<---	Online learning	0.193	0.636	***		
H41	<---	Perceived value		0.5		0.75	0.377
H42	<---	Perceived value	0.222	0.639	***		
H43	<---	Perceived value	0.196	0.637	***		
H44	<---	Perceived value	0.229	0.627	***		
H45	<---	Perceived value	0.232	0.654	***		
H51	<---	Student satisfaction		0.64		0.7727	0.4067
H52	<---	Student satisfaction	0.112	0.665	***		
H53	<---	Student satisfaction	0.129	0.719	***		
H54	<---	Student satisfaction	0.118	0.6	***		
H55	<---	Student satisfaction	0.118	0.552	***		

Note: *** indicates P < 0.001

2.6. Hypothesis testing and conclusion analysis

2.6.1. Student expectations only have a positive indirect impact on student satisfaction

Research has shown that students' expectations of blended learning do not have a direct impact on student satisfaction, but have an indirect impact on student satisfaction through offline teaching, online learning, and perceived value, that is, offline teaching, online learning and perceived value play an intermediary role between student expectations and student satisfaction. Among them, the first impact path is student expectations → offline teaching → student satisfaction, and the standardized indirect effect value is 0.87x0.16=0.139; the second impact path is student expectation → offline teaching → online learning → student satisfaction, and the standardized indirect effect value is 0.87X0.47x0.23=0.0899; the third impact path is student expectation→ offline teaching → online learning→ perceived value → student satisfaction, and its standardized indirect effect value is0.87X 0.47x 0.97X 1.33=0.527. Therefore, the standardized total effect of student expectation on student satisfaction is 0.755.

2.6.2. Offline teaching has a direct and indirect positive impact on student satisfaction

Offline teaching has a direct impact on student satisfaction, with a standardized direct effect value of 0.160. There are two paths of indirect impact: the first is Offline teaching → Online learning → Student satisfaction, with a standardized indirect effect value of 0,23 x 0.47 = 0.108; the second is Offline teaching →Online learning → Perceived value → Student satisfaction, witha standardized indirect effect value of0.47 x 0.97 x 1.33 = 0.606. Therefore, the standardized total effect of Offline teaching on student

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satisfaction is 0.874. It can be seen that the latent variable Offline teaching consists of six indicators, and the largest factor loading is the blended teaching concept. This shows that students are most concerned about the blended teaching concept in offline teaching, which suggests that teachers should clarify the direction of teaching reform and establish the new concept of "Internet +" blended teaching.

2.6.3. Online learning has a direct and indirect positive impact on student satisfaction

Online learning has a direct impact on student satisfaction, with a standardized direct effect value of 0.230. At the same time, online learning has a positive indirect impact on student satisfaction through the path of perceived value, with a standardized indirect effect value of 097x1.33 = 1.290. The standardized total effect of online learning on student satisfaction is 1.520. It can be seen that the latent variable online learning consists of five indicators, and the largest factor loading is interactivity. This shows that students are most concerned about multi-directional interactivity in the process of online learning. It suggests that teachers and students should enhance interaction and communication in online learning, and feedback should be timely.

3. Analysis of the System Dynamics Model of Online and Offline Hybrid Teaching

3.1. Determination of system boundaries

The system boundary refers to the set boundary of time and space of the change of elements and their attributes. If the boundary is too large, the behavior of the system cannot be fully displayed; if the boundary is too small, the feedback loop of the system cannot be formed. Therefore, it is necessary to determine a reasonable system boundary according to the research problem.

Time boundary, 2020 ~ 2035, the initial time is 2020, the main historical data period is 2021 ~ 2023, the simulation simulation period is 2019 ~ 2031, and the time step is 1 month.

The system boundary is determined as the relevant subjects that affect the satisfaction of blended teaching, including student expectations, perceived value, online teaching, offline teaching and student satisfaction, which jointly affect the satisfaction of teaching, and the specific role relationship.

3.2. Model construction and data processing

Online and offline blended teaching satisfaction can be seen as an independent system, affected by both the potential impact of each aspect of the system internally, such as changes in the teaching environment, and the uncertainty generated by the system externally, suchas changes in teaching environment. The assumption is that online-offline hybrid teaching is subject only to external shocks such as offline teaching, online teaching, student expectations, perceived value, and student satisfaction, regardless of the impact of abrupt changes in various elements within the system. Exogenous variables refer to variables determined and input entirely from outside the system, which only affect the system and are not affected internally, and external shocks are considered uniformly as exogenous changes. System dynamics can simulate the extent to which factors contribute to satisfaction under external shocks of mixed online and offline teaching and the changing trends in satisfaction. This paper uses Vensim-PLE to construct the cause and effect relationship diagram of online mixed teaching satisfaction, as shown in Figure 2. On the basis of the cause and effect relationship diagram, we set the four satisfaction variables as the status variables, the corresponding variation amount is the rate variable, and the remaining variables are the auxiliary variables or constants. We add the Time shadow variables to the time-related factors, and the stock flow is shown in Figure 2. In the evolution of online and offline hybrid teaching satisfaction, the elements are related to each other and there is no absolute quantitative relationship. The subsystems are directly connected to the secondary indicators they contain, which are designed in a questionnaire using a matrix scale, with relationship strengths assigned from weak to strong by 1 to 4, and ultimately as the product of the proportion of people and the ratings and as the coefficient of impact between the two elements. The content of online and offline hybrid teaching is the sum of five subsystem state variables, and the unit is set to month.

The causal loop diagram mainly describes the mutual influence and action path of variables through qualitative analysis, and lacks quantitative description of variables. Therefore, it is necessary to draw the stock flow diagram on the basis of the causal loop diagram. It can not only reflect the action relationship between different types of variables, but also express the cumulative effect of variables, carrying more information. Therefore, the stock flow diagram can more practically reflect the action mechanism of the system.

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Considering the feasibility of simulation and the availability of data, in the process of drawing, the causal loop diagram was simplified as necessary. On the basis of the causal loop diagram, the horizontal variable (the variable in the box in Figure 2, the rate variable (the variable under the double horizontal line in Figure 2) and the auxiliary variable (the other newly added variable) were added. The variable relationship expression between the parameters was input, the variables that are difficult to obtain and collect were ignored, the system boundary range was combined, the quantifiability of the variables was considered, and the stock flow diagram of the online and offline hybrid teaching satisfaction system was drawn using the Vensim software, as shown in Figure 2.

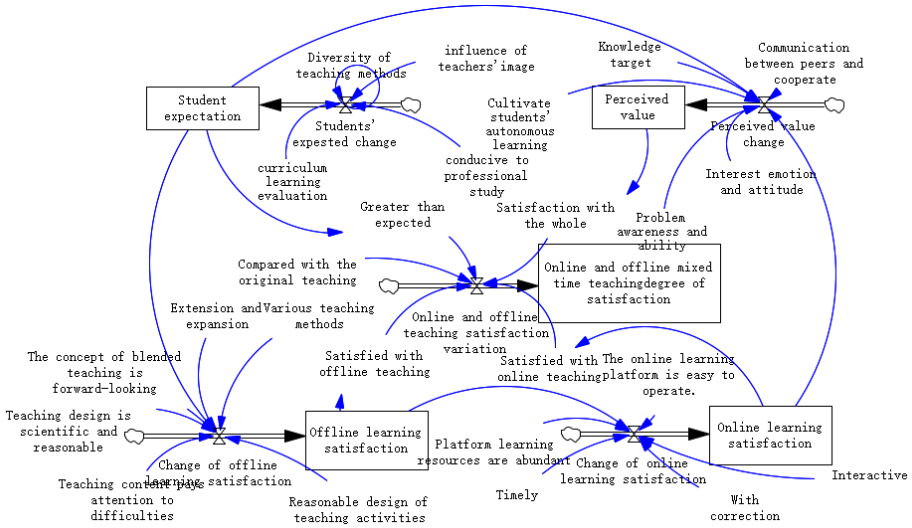

Figure 2: Structure, Stock and Flow Chart of Satisfaction System

4. Conclusions and recommendations

4.1. Main conclusions

(1) The knowledge graph technology can effectively sort out and organize the content of the ideological and political course, establish a complete knowledge system, and make the course content more systematic and structured. Through the knowledge graph, teachers can more clearly plan the course content, and students can also more conveniently access and learn the knowledge.

(2) Artificial intelligence technology can monitor students' learning in real time, provide personalized feedback and suggestions, and help teachers adjust teaching strategies in time. Through artificial intelligence technology, dynamic evaluation of students' learning process can be achieved, thus improving teaching quality and students' learning effect.

(3) The curriculum ideological and political design framework proposed in this paper has shown good results through practical case verification. The framework can effectively integrate knowledge maps and artificial intelligence technology, improve the implementation effect of curriculum ideological and political, and provide a scientific design path and practical guidance for curriculum ideological and political in hybrid teaching.

4.2. Recommendations

(1)Establish a systematic curriculum ideological and political knowledge map

It is recommended to make full use of knowledge graph technology in the design of curriculum ideology and politics, systematically sort out and structure the ideological and political education content. Based on the teaching objectives of each course, identify and extract the ideological and political education contents related to the course. These contents should cover political theory, social values, laws and ethics, and other dimensions to ensure the comprehensiveness of ideological and political education. The extracted ideological and political contents should be structured by knowledge graph technology to establish the relationship between each knowledge point. The knowledge graph should not only reflect the hierarchical structure of the course content, but also reflect the relationship between ideological and

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political education content and specific teaching knowledge points. Through this relationship, ideological and political education can be better integrated into all aspects of course teaching. The knowledge graph should be updated and maintained regularly to reflect the latest teaching content and ideological and political education requirements. It is recommended to establish a dynamic maintenance mechanism to adjust the content structure of the knowledge graph in time according to changes in educational policies and the emergence of social hot issues.

(2) Implementing personalized teaching and assessment with artificial intelligence technology

In blended teaching, artificial intelligence technology can significantly improve the personalization and accuracy of teaching. Therefore, it is recommended to apply artificial intelligence technology in the following aspects: through artificial intelligence algorithms, analyze students' learning behavior and knowledge mastery, and automatically generate personalized learning paths and content recommendations. This can not only improve students' learning efficiency, but also ensure that ideological and political education content can be accurately delivered according to students' interests and needs. Artificial intelligence can monitor and analyze students' learning data in real time through learning analysis technology, providing real-time feedback. It is recommended to develop specialized teaching evaluation tools to automatically generate personalized feedback reports by analyzing students' learning progress, homework completion, and participation indicators, helping teachers adjust teaching strategies and improve teaching content. Intelligent question answering systems based on natural language processing (NLP) technology can provide online tutoring for students and answer their questions in the process of learning. By integrating into the blended teaching platform, these systems can effectively supplement teachers' teaching work and improve students' learning experience.

(3) Design diversified online and offline hybrid courses to implement the ideological and political path

In order to enhance the effectiveness of the ideological and political course, it is recommended to explore various implementation paths in the teaching design to ensure that the ideological and political education can run through all the teaching links online and offline. It is recommended to reasonably allocate the ideological and political content of the course to the online and offline teaching. In the online part, we can use multimedia resources and interactive teaching tools to increase the attractiveness and appeal of the ideological and political content. In the offline part, we can deepen students' understanding and recognition of the ideological and political education content through classroom discussion, case analysis, field study, etc. By carefully selecting social cases closely related to the course content, we can guide students to analyze and discuss the ideological and political education contained in them. This teaching method can not only enhance the reality and practicality of the course, but also effectively stimulate students' enthusiasm for thinking and participation. Combine the course knowledge with social practice. For example, we can design relevant research topics or social research projects, requiring students to think and solve social practical problems while completing academic tasks. In this way, the ideological and political course can be more deeply integrated into students' learning and life.

Based on the three research methods of knowledge graph, structural equation and system dynamics, this paper proposes corresponding countermeasures, which are helpful to improve the impact of this model on student satisfaction. Nevertheless, we still need to continue to explore and further improve this teaching mode in actual teaching, so as to more effectively improve the teaching level of teachers and students' interest in learning, and cultivate qualified talents for the society. In new teaching methods such as learning, the teaching content should highlight the key points and keep pace with the times, so as to enhance students' sense of classroom teaching. Enrich and improve online learning materials, carefully design and arrange teaching activities, and rely on the smart teaching platform to carry out group discussions, case sharing, online competitions and other activities, so as to improve the interactive experience between teachers and students, students and teachers and students and the platform. Fourth, strengthen the regulation of curriculum teaching and improve the assessment and evaluation system of blended teaching. Blended learning gives students greater autonomy and freedom in learning, while the initiative and self-control of some young students are not strong and affect the effect of blended learning, so it is necessary to strengthen the monitoring, evaluation, incentives, rewards and punishments of student learning, especially online learning. The assessment of blended teaching courses should pay attention to the combination of online assessment and offline assessment, the combination of pre-class and after-class assessment, the combination of process assessment and final assessment, the combination of teacher evaluation and self-evaluation, and peer evaluation.

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