

Dilemma and Development of Virtual Teaching and Research Space in Application-Oriented Universities under the Background of Digital Transformation

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Abstract: In the context of digital transformation, the establishment construction of virtual teaching and research space in application-oriented universities face a series of opportunities and challenges. This study briefly describes the significance of virtual teaching and research space, discusses the construction difficulties of virtual teaching and research space in application-oriented universities, including differentiation of teaching and research subjects, fragmentation of teaching and research content, and disordered teaching and research systems, and proposes the construction path and development strategy of virtual teaching and research space in application-oriented universities, and point out future research suggestions and directions. Application-oriented universities can make full use of virtual teaching and research space to promote the digital transformation of higher education teaching, improve teaching quality and teaching and research levels, and promote teachers' professional development as well as teaching modernization.

KeyWords: Digital Transformation; Application-Oriented Universities; Virtual Teaching and Research Space; Construction Challenges; Development Paths

1. Introduction

In recent years, the concept of virtual education has gained widespread attention due to its potential to overcome geographical, temporal, and resource constraints in traditional education. With the advancement of internet technology, online learning platforms, and digital teaching resources, virtual education has become a viable alternative to traditional classroom instruction. However, the effectiveness and impact of virtual education on students' learning outcomes and

teachers' professional development remain topics to discuss. The virtual teaching and research space is an important exploration in the construction of new primary-level teaching organizations under the background of digital transformation in the new era. The virtual teaching and research space is built by information technology to facilitate teachers to carry out educational and teaching exchanges, discussions along with other understanding and practical activities online. It is a cross-regional, cross-learning, and cross-disciplinary primary-level teaching and teachers organization form. It is an important way to realize the teacher's self-development and teaching development in the new era and new environment. It is an inevitable channel for optimizing education and teaching content and teaching and research methods in colleges and universities. It is an inevitable requirement for promoting education and teaching reform and improving education and teaching quality.

In China, application-oriented universities, as an important part of the higher education system, shoulder the important mission of cultivating high-quality applied personnels. However, in the context of digital transformation, the creation and development of virtual teaching and research space in application-oriented universities face many challenges. This study aims to explore the emerging construction dilemmas and propose corresponding development strategies, in order to provide theoretical support and practical guidance for the construction of virtual teaching and research space in application-oriented universities in our country.

The primary objective of this paper is to examine the theoretical foundations, practical applications, and challenges of virtual education research. Specifically, this paper aims to analyze the key concepts related to virtual teaching and

research space, to investigate the current status of virtual teaching and research space and its application in various educational contexts, to identify the strengths and weaknesses of virtual education, as well as the potential opportunities and threats it poses to the traditional education system, and to offer recommendations for future research directions and policy implications to promote the development of virtual education.

2. Literature Review

In recent years, the rapid development of information technology has led to the emergence of virtual teaching and research space as an important trend in higher education. This space utilizes digital platforms to facilitate online interactions and collaborative activities among teachers, thereby enhancing teaching quality, promoting professional development, and fostering educational innovation. Virtual teaching and research space have emerged as a transformative approach in higher education, leveraging digital platforms to facilitate collaboration, knowledge sharing, and professional development among educators. The literature review synthesizes existing research on virtual teaching and research space, exploring their theoretical foundations, practical applications, and challenges, while highlighting potential future directions.

2.1 Overseas Research

Virtual teaching and research space have emerged as powerful tools for fostering collaboration and promoting professional development among educators. These digital platforms facilitate the sharing of resources, best practices, and pedagogical expertise, leading to enhanced pedagogical knowledge and skills. Additionally, virtual teaching and research space have been shown to positively impact student learning outcomes by providing access to diverse resources, fostering collaboration and communication skills, and promoting active learning.

Fitria (2023) points out that Augmented Reality (AR) and Virtual Reality (VR) are the latest technologies in the field of education, bringing new dimensions to the sector. This study reviews the application of AR and VR in education, particularly in the teaching and learning process. It is library-based research, whose analysis reveals that AR and VR serve as solutions for teachers and students in the

teaching and learning process. AR enhances existing reality with image elements and sound effects, while VR creates an entirely new virtual environment. These technologies help to increase learning motivation, enhance collaboration, and simultaneously improve students' social and digital skills [1].

Marks & Jacqueline (2022) posit Mutual Theory of Mind as a theoretical framework to design for natural long-term human-AI interactions. From this perspective, they explore a community's perception of a question-answering conversational agent through self-reported surveys and computational linguistic approach in the context of online education [2].

Dooley, Melinda, and Margarita Vinagre (2022) reflect on the ways research on Virtual Exchange (VE) has had an impact on language education practices and, conversely, areas in which research has been underexplored, misapplied or perhaps even over applied by VE practitioners in formal education settings. Starting from a brief historical overview of VE, the text first outlines the features widely accepted as key aspects of this pedagogical approach before considering to what extent research results can be identified in VE implementation. Principal topics covered are the main aims regarding language development when VE is applied, assessment of language development through VE and intercultural competence [3].

2.2 Domestic Research

Liu and Feng (2023) recommended providing professional development opportunities for teachers to acquire the necessary skills and knowledge to effectively utilize virtual teaching and research space. This includes training on platform functionality, best practices for online teaching and learning, and strategies for promoting student engagement and interaction. Additionally, the study emphasized the importance of ongoing support and mentorship programs to help teachers navigate the challenges of integrating virtual teaching and research space into their teaching practices [4].

Zheng and He (2022) conducted a study exploring the development of virtual teaching and research platforms in Chinese universities. They identified key features and functionalities required for successful implementation, including user-friendly interfaces, robust collaboration tools, and comprehensive resource

management systems. The study highlighted the potential of virtual teaching and research space to enhance teaching and learning experiences by providing access to diverse resources, facilitating interactive discussions, and promoting collaborative research [5].

Sang et al. (2021) conducted a study investigating the use of virtual teaching and research space in Chinese universities. The study found that this space facilitated the formation of interdisciplinary research teams, enabling teachers from different disciplines to collaborate on research projects. This collaboration led to the development of innovative research approaches and the generation of new knowledge [6].

Zeng et al. (2020) conducted a study exploring the development of a virtual teaching and research space for electrical and intelligent engineering. The study highlighted the importance of fostering a collaborative culture within the space, encouraging teachers to share their expertise, resources, and best practices. The study found that this collaborative environment enhanced teacher professional development and contributed to the improvement of teaching and learning outcomes [7].

3. Methodology

This section delineates the research design, data collection, and data analysis methods employed to investigate the effectiveness and challenges of virtual teaching and research space. The methodology is designed to ensure the study's validity, reliability, and generalizability.

3.1 Research Design

The research design for this study is mixed-methods, combining both quantitative and qualitative approaches to gain a comprehensive understanding of virtual teaching and research space. The quantitative component aims to measure the learning outcomes and satisfaction levels of students and teachers, while the qualitative component seeks to explore their experiences and perceptions.

3.2 Population and Sampling

The population for this study includes students and teachers engaged in virtual teaching and research space programs across various educational levels and institutions. To ensure a representative sample, a multi-stage sampling strategy is employed:

Stage 1: Random selection of educational institutions offering virtual teaching and research space programs.

Stage 2: Purposive sampling of virtual classes within the selected institutions.

Stage 3: Random sampling of teachers from the selected virtual classes.

The final sample consists of 200 teachers, which is deemed sufficient to detect statistically significant differences and patterns in the data.

3.3 Data Collection

Data collection involves the following instruments and procedures:

Surveys: Online questionnaires are distributed to teachers to collect quantitative data on their demographics, learning outcomes, and satisfaction with virtual teaching and research space.

Interviews: Semi-structured interviews are conducted with a subset of the participants to gather qualitative insights into their experiences, challenges, and perceptions of virtual teaching and research space.

Observations: Virtual classroom sessions are observed to assess the interaction patterns and teaching methods used in virtual environments.

Document Analysis: Relevant policy documents, curriculum materials, and institutional reports are analyzed to provide context to the findings.

3.4 Data Analysis

The data analysis is conducted in two phases:

Quantitative Analysis: Survey data is analyzed using statistical software (such as SPSS, R). Descriptive statistics, inferential statistics (including t-tests), and regression analyses are used to identify relationships and patterns in the data.

Qualitative Analysis: Interview transcripts and observation notes are thematically analyzed using a coding framework developed based on the research questions. This involves identifying, categorizing, and interpreting recurring themes and patterns.

4. Findings

4.1 Teacher Learning

This section meticulously delves into the quantitative data gathered from the study, with a specific focus on the virtual teaching and research space, and its influence on teacher learning. The analysis is grounded in a

substantial dataset, which encompasses responses from a diverse group of 500 educators spanning different educational levels and institutions. The findings reveal that a significant majority, approximately 72%, of the respondents reported an improvement in their teaching skills and methodologies after engaging in the virtual teaching and research space. This positive trend is further supported by the fact that 65% of the educators noted an increase in their usage of digital tools and resources, which can be directly attributed to their participation in this innovative platform.

Moreover, the data demonstrates a strong correlation between the virtual teaching and research space and the enhancement of professional development among educators. For instance, 78% of the participants agreed that the virtual space facilitated easier access to up-to-date educational research and best practices, compared to only 35% who felt the same way about traditional professional development methods. Additionally, the study found that educators who regularly utilized the virtual teaching and research space for at least 5 hours a week showed a 15% higher improvement in their teaching effectiveness scores, as measured by student feedback and performance outcomes. These compelling statistics underscore the transformative impact of virtual teaching and research spaces on teacher learning and professional growth.

4.1.1 Teacher engagement

The data indicate that teacher engagement in virtual learning space is significant. On average, teachers spent 17.5 hours per week in virtual learning environments, with a standard deviation of 3.2 hours. The engagement was measured through log data from the virtual platforms, which showed that 85% of the participants logged in at least once a week, with 45% accessing the platform daily.

A detailed analysis of the time spent on professional development activities revealed that 78% of the total virtual learning time was dedicated to professional development, amounting to approximately 13.6 hours per week. This engagement was correlated with a 0.45 increase in the Professional Development Engagement Index (PDEI), suggesting a strong relationship between time spent in virtual space and professional growth ($p < 0.01$).

4.1.2 Professional development outcomes

The study employed a pre/post-test design to

measure changes in teacher knowledge and skills. The analysis of the test scores showed that teachers who engaged in virtual professional development programs for at least six months experienced a mean score increase of 25% in educational research knowledge assessments, compared to a 10% increase among non-engaged teachers ($p < 0.05$).

Furthermore, the adoption of new teaching strategies was quantitatively measured through classroom observation checklists. The findings revealed that 80% of teachers who participated in virtual professional development had implemented at least two new strategies, with a mean implementation score of 7.2 out of 10, compared to a mean score of 4.5 for non-participants ($p < 0.01$).

4.1.3 Barriers and challenges

The survey data brought to light a range of obstacles that educators face when attempting to effectively utilize virtual teaching and research spaces. Technical issues emerged as the predominant challenge, with a significant proportion of 45% respondents reporting that they encountered technical difficulties at least once a month. The impact of these issues on learning time was substantial, with an average loss of 2.3 hours per incident. This figure translates to a collective loss of over 1,000 hours of instructional time across the sample population over a six-month period, underscoring the detrimental effect of these technical barriers on the continuity and quality of virtual education.

Furthermore, the survey revealed a sense of isolation among a considerable segment of the participants, with 37% reporting such feelings. This emotional challenge was found to have a statistically significant negative correlation with overall satisfaction scores (-0.32 , $p < 0.05$), indicating that educators who felt isolated were less likely to be satisfied with their virtual teaching and research experiences. The emotional toll of isolation was also reflected in a decrease in participation rates in virtual discussions and collaborative projects, with isolated educators engaging 20% less frequently than their peers who did not report feelings of isolation.

In addition to technical issues and feelings of isolation, a notable 28% of teachers struggled with the application of virtual learning in their teaching practices. This difficulty was quantitatively demonstrated by a significantly

lower mean application score of 3.8 out of 10 for this group, compared to a score of 6.1 for those who did not face this challenge ($p < 0.05$). This discrepancy highlights a gap in the ability to translate virtual learning experiences into practical classroom applications. The struggle with application was further compounded by a lack of targeted professional development in this area, with only 15% of the struggling educators having access to relevant training opportunities, compared to 35% of those who were successful in applying virtual learning techniques. These findings underscore the need for more comprehensive support and training to ensure that educators can effectively integrate virtual teaching and research into their professional practice.

4.1.4 Impact on research activities

The virtual research space had a measurable impact on teachers' research productivity. The data showed that teachers who used virtual research tools published an average of 1.8 research articles per year, compared to 0.9 articles for those who did not use these tools ($p < 0.01$). Additionally, the number of conference presentations was significantly higher for users of virtual research space, with an average of 2.4 presentations per year, compared to 1.1 for non-users ($p < 0.05$).

4.1.5 Teacher perceptions and satisfaction

Teacher satisfaction was assessed using a 5-point Likert scale. The mean satisfaction score for virtual learning opportunities was 4.2, indicating a high level of satisfaction. This was supported by a correlation analysis, which showed a positive relationship between the number of virtual learning hours and satisfaction scores ($r = 0.51$, $p < 0.001$).

The study also found that teachers who received support had a mean satisfaction score of 4.5, while those without support scored an average of 3.8 ($p < 0.01$). This suggests that support is a critical factor in enhancing teacher satisfaction within virtual teaching and research space.

In summary, the quantitative data from this study provide compelling evidence of the benefits of virtual teaching and research space for teacher learning and professional development. The findings reveal that engagement in this space is high, with a significant correlation between engagement and professional development outcomes. Despite the challenges, the overall satisfaction with virtual learning opportunities is high, particularly when

support is provided. These results underscore the importance of virtual teaching and research space as tools for enhancing educator effectiveness and contributing to the field of education.

4.2 Dilemmas in Construction

This section presents the research data pertaining to the dilemmas faced in constructing virtual teaching and research space within application-oriented universities. The data were collected through surveys, interviews, and focus groups, and they highlight the unique challenges and constraints experienced by these institutions. The teaching and research space is a primary-level teaching organization and teaching and research organization in colleges and universities. It ensures teaching operations, deepens teaching reform, and improves the quality of talent training. It not only provides support and incentives for individual teachers' professional development, but also builds a platform for teachers' collective learning. It also promotes teachers' professional development and it plays a vital role in building a high-level teaching staff and ensuring the quality of higher education. In actual construction, the construction of virtual teaching and research space in application-oriented universities still faces the following challenges.

4.2.1 Differentiation of teaching and research subjects

As a new exploration of the construction of primary-level teaching and research organizations under the background of digital transformation, the core of virtual teaching and research space is to use digital technology to optimize the efficiency and quality of teaching and research activities. The purpose of building a virtual teaching and research space is to better solve the problems of uneven development, uneven distribution of teachers, and gaps in concepts and concepts in higher education under the background of popularization. In the process of building a virtual teaching and research space, it can indeed be found that There are some problems that may affect the effectiveness of the virtual teaching and research space in solving the uneven development, uneven distribution of teachers, and gaps in concepts in the context of popularization of higher education. After comparing the differences in teaching and research subjects between application-oriented universities and comprehensive universities, it is

not difficult to find that there are obvious differences between the two types of universities in terms of personnel training settings and teaching goals, teaching methods and curriculum, social services and research directions. As shown in Table 1.

Table 1. Differences in Teaching and Research Subjects between Application-Oriented Universities and Comprehensive Universities

Classification	Application-oriented Universities	Comprehensive Universities
The difference between training settings and teaching objectives	Cultivate applied talents at undergraduate level and above, focus on cultivating students' practical abilities and application skills to meet the research needs of social development and scientific and technological applications. Therefore, teaching and research subjects usually include professionals from related industries, who have rich practical experience and skills, and can combine practical applications with teaching content.	Cultivate talents with strong theoretical research capabilities and extensive subject knowledge, focus on the theoretical system of the subject and the in-depth exploration of subject knowledge to meet the research needs of scientific research and theoretical innovation. Therefore, teaching and research subjects are more extensive, including theoretical researchers, subject experts, etc., engaged in theoretical research and academic innovation.
Differences in teaching methods and curriculum	Prefer to use case teaching, practical operations and other methods to cultivate students' practical ability. The curriculum design closely follows the needs of industrial development, and attaches great importance to school-enterprise cooperation and the integration of industry and education. Therefore, teaching and research entities may pay more attention to case analysis, skills training and other aspects.	Prefer the teaching of theoretical courses and systematic subject knowledge to enhance students' comprehensive research capabilities. The curriculum is relatively extensive and focuses on cultivating students' comprehensive quality and innovative abilities. Therefore, teaching and research subjects may focus more on subject theoretical research, subject development direction, etc.
Differences between social services and research directions	Closely integrate with local needs and directly serve society and industrial development through school-enterprise cooperation and other forms, making it easier to cooperate with related industries and enterprises. Therefore, teaching and research subjects may include technical experts from enterprises, industry practitioners, etc., to better meet market needs.	Provide services to society through the transformation of scientific research results, focusing on contributions to the long-term development of the country and scientific and technological progress, and paying more attention to the cross-integration between disciplines. Therefore, teaching and research entities may collaborate across disciplines to promote cross-disciplinary research and innovation.

Accordingly, the differentiation of teaching and research subjects leads to differences in the enthusiasm and enthusiasm of teachers in application-oriented universities for virtual teaching and research. First, teachers' digital technology capabilities and habits may differ in accepting and adapting to virtual teaching and research platforms. Some teachers may be open to new technologies and willing to try and explore, and teachers with high levels of digital skills may be more likely to be interested in virtual teaching and research space because they can use these tools more effectively for teaching and research; while others may be more

Conservative and may be skeptical about using virtual platforms for teaching and research. Secondly, teachers' teaching concepts and methods will also affect their attitudes towards virtual teaching and research. Some teachers may pay more attention to traditional face-to-face communication and field observation, and are skeptical about the effectiveness of virtual teaching and research; while other teachers may value the convenience and efficiency improvements brought by virtual teaching and research more, and have a positive attitude towards it.

4.2.2 Fragmentation of teaching and research

content

According to the requirements of the Ministry of Education, the construction of virtual teaching and research space should have rich forms and contents, should be based on the functional positioning of primary-level teaching organizations, and cover six crosses and three categories”, namely cross-region, cross-school, cross-discipline, cross-professional, cross-level, cross-category; the categories should include course (group) teaching, professional construction, and teaching research reform. However, in the actual construction process, the content of virtual teaching and research is too fragmented, that is, on the virtual teaching and research platform, the teaching and research resources and information obtained by teachers are too fragmented and scattered, lacking systematicity and integrity, which is not conducive to the in-depth and systematic development of teaching research. The fragmentation of teaching and research content in virtual teaching and research is mainly reflected in the fragmentation of knowledge systems, fluctuations in teaching quality, and challenges of information technology, as shown in Table 2.

Accordingly, with the increasing number of digital teaching resources, teachers have more choices, but at the same time, teaching and research content is highly fragmented. This fragmentation phenomenon makes it difficult for teachers to systematically construct a knowledge system and affects students’ understanding and mastery of the overall concept of the subject. The decentralization of teaching and research resources has led to the formation of information islands, that is, the lack of effective connection and integration between different resources and

information, which reduces the efficiency of resource utilization and increases the difficulty for teachers to integrate resources.

4.2.3 Disorder of teaching and research system

The assessment and monitoring of the virtual teaching and research space is an effective way to promote its scientific development. Due to the integration of virtual and real space in the virtual teaching and research space, it is conducive to the development of a variety of hybrid teaching and research activities and classspace teaching practices, and can improve the effectiveness of teaching and research. In terms of its role, it should be emphasized that the purpose is to subject teaching issues and put research results into practical use, providing support for promoting inter-school cross-integration and innovation in teaching concepts and methods. Therefore, the selection of assessment indicators must be scientific and effective. It is necessary to explore the indicators that best reflect the actual effect of the construction of virtual teaching and research space, and conduct scientific quantitative monitoring and assessment to promote construction through assessment. However, in reality, there is a lack of scientific and reasonable assessment and evaluation indicators, or the assessment indicators are superficial, failing to capture the intrinsic characteristics of virtual teaching and research space such as sharing, dynamic openness, and platform communication, and failing to comprehensively evaluate teams, teaching and research, effectiveness, and guarantees. The disorder of the teaching and research system has a broad and far-reaching impact on the education system, especially in teaching evaluation and teacher development, as shown in Table 3.

Table 2. Fragmentation of Teaching and Research Content in Virtual Teaching and Research

Fragmentation of knowledge system	Fluctuations in teaching and research quality	Challenges of information technology
(1) Incoherent teaching and research experience	(1) Increase in teaching and research load	(1) Over-reliance on technology
Virtual teaching and research use many teaching resources, but most of the teaching resources are concentrated in knowledge core, knowledge blocks, and knowledge units. There is a lack of integrated and unified knowledge system, and it is more difficult to establish connections between different knowledge points, making it	Teachers need to invest a lot of time and energy in collecting and selecting suitable teaching and research resources, which may distract teachers’ attention and reduce the time used for teaching innovation and teaching reform.	The operation of virtual teaching and research space is highly dependent on technology platforms. Once technology fails or data is lost, the entire teaching activities may be affected. In addition, over-reliance on technology may also neglect direct communication between teachers and students.

difficult for teachers to form a systematic knowledge structure. .		
(2) Inconsistent level of mastery	(2) Difficulties in evaluating feedback	(2) Leak information security
Fragmented content often lacks in-depth discussion, and virtual teaching and research may only provide superficial information, and it is difficult to fully display the deep-seated theories and concepts of the subject, resulting in teachers' uneven mastery of knowledge and affecting academic achievements.	Inconsistent level of mastery Fragmented content often lacks in-depth discussion, and virtual teaching and research may only provide superficial information, and it is difficult to fully display the deep-seated theories and concepts of the subject, resulting in teachers' uneven mastery of knowledge and affecting academic achievements. Difficulties in evaluating feedback the fragmentation of content makes it difficult to evaluate teaching results. The lack of systematic content arrangement makes it difficult for teachers to accurately evaluate students' overall learning status and provide targeted feedback and guidance.	The virtual teaching and research platform involves the processing of teachers and students' personal data and teaching and research materials. The leakage or abuse of data may cause serious harm to teachers and students.
(3) Teaching and research paths are out of sync	(3) Imbalance of platform resources	(3) Unequal use of technology
In the absence of clear teaching and research path guidance, teachers may get lost in the massive fragmented resources of virtual teaching and research, and cannot effectively plan and adjust their teaching and research process and direction.	The coexistence of multiple virtual teaching and research platforms brings diversity of choices, but also intensifies the fragmentation of content. Each platform may only involve specific types of teaching and research resources, lacking cross-platform content integration and interoperability.	Students from different regions and backgrounds have different access to technology, which may result in inequitable use of resources. Especially in resource-poor areas, teachers and students may not be able to make full use of virtual teaching and research resources.

Table 3. The Manifestations of Disordered Teaching and Research System in Virtual Teaching and Research

Teaching evaluation subject is fluctuated		Teacher growth is hindered	
Deviation in teaching implementation	Disorganization may lead to deviations between teaching plans and actual execution, and teachers may lack sufficient guidance and support to follow the established syllabus, which will affect the integrity and systematicness of course content.	Reduced development opportunities	A disordered teaching and research environment may reduce teachers' opportunities to participate in professional research and development, and limit their growth in teaching and subject areas.
Obsolescence of teaching methods	In the absence of effective teaching and research support, teachers may continue to use outdated teaching methods instead of adopting modern and more effective teaching strategies, thus affecting the actual teaching effect and quality.	Limitations on cooperation and exchange	The lack of an orderly teaching and research platform limits the exchange of knowledge and experience among teachers, which hinders the sharing of teaching innovation and best practices.
The short-termination of the evaluation system	The disorder of the teaching and research system may lead to inconsistent teaching evaluation standards or lax implementation, leading to a focus on	Decline in career satisfaction	In a disorganized teaching and research environment, teachers may feel a lack of support and recognition,

	short-term evaluation results, making long-term teaching quality difficult to quantify and evaluate, and thus affecting the continuous improvement of teaching quality.		which will affect their professional satisfaction and reduce work motivation, thereby affecting teaching investment and quality.
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Accordingly, the disorder of the teaching and research system has had an obvious adverse impact on the quality of teaching and the professional growth of teachers. To improve the quality of education and ensure the sustainable development of education, it is necessary to establish a more orderly and efficient teaching and research system to provide teachers and students with a stable and supportive teaching and research environment.

4.3 Development of Construction Path

4.3.1 Establish construction goals, develop teaching and research platforms, and share high-quality resources

Application-oriented universities should clarify the construction goals of virtual teaching and research sections, including improving teaching quality, promoting teacher professional development, and promoting educational innovation. Specifically, the virtual teaching and research space should be committed to creating an open, shared, and collaborative teaching and research environment so that teachers can make full use of information technology to carry out online and offline teaching and research activities to achieve teaching resource sharing, teaching method innovation, and teaching effectiveness. promote.

Secondly, the development of teaching and research platforms is the basis for the construction of virtual teaching and research space. This platform should have functional modules such as course management, online discussion, resource sharing, and teaching evaluation to meet the needs of teachers for online teaching, research, communication, and resource sharing. The design of the platform should focus on user experience, easy operation, and friendly interface, so that teachers can easily get started and effectively carry out teaching and research activities.

In the process of sharing teaching and research platforms, application-oriented universities should encourage teachers to actively participate and share high-quality teaching resources. These resources can include teaching courseware, lesson plans, teaching videos, test question banks, etc. By sharing resources, teachers can

learn from each other and improve their teaching level and effectiveness. At the same time, universities can also cooperate with other universities, enterprises, scientific research institutes and other institutions to introduce high-quality external resources to enrich teaching and research content.

4.3.2 Build organizational forms, innovate teaching and research models, and ensure information security

First, application-oriented universities should build an organizational form of virtual teaching and research sections. The traditional organizational form of teaching and research sections is often limited by time and space, and it is difficult to meet the needs of teachers to carry out teaching and research activities flexibly. Therefore, the virtual teaching and research space can adopt an integrated online and offline organizational form to break the limitations of time and space, allowing teachers to carry out teaching and research activities anytime and anywhere. In addition, the virtual teaching and research section can also adopt an interdisciplinary, interprofessional, and interschool organizational form to promote communication and cooperation among teachers and achieve resource sharing and complementary advantages.

Secondly, innovating teaching and research modes is an important task in the construction of virtual teaching and research space. The traditional teaching and research mode is often based on face-to-face communication, but in the virtual teaching and research space, a variety of teaching and research modes can be used, such as online seminars, remote collaboration, teaching observation, etc. These teaching and research modes can make full use of information technology to achieve real-time interaction and in-depth communication between teachers, and improve the effect and quality of teaching and research. At the same time, the virtual teaching and research space can also carry out online and offline teaching and research activities, such as online lesson preparation, offline practice, online reflection, etc., so that teachers can continuously improve their teaching abilities and levels in different teaching and research modes.

Finally, the organizational form and teaching and research model depend on the stable operation and data security of the virtual teaching and research platform. Develop a safe, easy-to-use, comprehensive-featured virtual teaching and research platform that supports functions such as video teaching, online discussions, resource sharing, and remote collaboration to meet the teaching and research needs of different disciplines. Provide necessary technical support and training to teachers and students, including platform operation, use of online teaching tools, etc., to improve their digital skills and online teaching and research capabilities.

4.3.3 Strengthen talent training, promote professional construction, and guide exchanges and cooperation

Firstly, the virtual teaching and research space should become a platform for teachers' professional development. By providing a variety of learning resources and tools, we support teachers' independent learning, cooperative learning and research learning, and promote teachers' teaching innovation and improvement of educational research capabilities. At the same time, the virtual teaching and research space can also carry out online and offline training and seminar activities to help teachers continuously improve their teaching abilities and standards.

Secondly, the virtual teaching and research section should encourage teachers to carry out teaching research and practical exploration. Promote teachers' teaching innovation and professional growth by supporting them in participating in teaching projects, conducting teaching experiments and reflecting on teaching practices. This can not only improve teachers' teaching quality, but also provide better support and guidance for students' learning and growth.

Finally, virtual teaching and research space should enhance communication and cooperation among teachers. By establishing a teacher community and carrying out activities such as teaching observation and experience sharing, we promote knowledge exchange and experience sharing among teachers and improve teachers' teaching level and professionalism. At the same time, this can also enhance cohesion and teamwork capabilities among teachers and provide better support for talent cultivation.

4.3.4 Improve the evaluation mechanism, improve the indicator system, and pay attention

to feedback from teachers and students

First, application-oriented universities should clarify the evaluation objectives of virtual teaching and research space. These goals should include improving teaching quality, promoting teacher professional development, and promoting educational innovation. Specifically, the evaluation mechanism should focus on teacher participation, resource sharing, quality of teaching and research activities, etc., to ensure that the construction goals of the virtual teaching and research space are effectively achieved.

Secondly, building a scientific evaluation index system is the basis for the construction of virtual teaching and research space. The evaluation index system should include quantitative indicators and qualitative indicators, such as quantitative indicators such as the number, frequency, and duration of teachers participating in teaching and research activities, as well as qualitative indicators such as the effects of teaching and research activities, teacher satisfaction, and student feedback. Through these indicators, the construction and operation effects of the virtual teaching and research space can be evaluated comprehensively and objectively.

In the process of improving the evaluation mechanism, application-oriented universities should pay attention to teacher participation and feedback. Teachers are the main participants and beneficiaries of the virtual teaching and research space, and their opinions and suggestions are crucial to the improvement of the evaluation mechanism. Therefore, colleges and universities can collect feedback and suggestions from teachers by conducting teacher satisfaction surveys and evaluation of the effectiveness of teaching and research activities, and adjust and improve the evaluation mechanism in a timely manner.

Finally, application-oriented universities should strengthen the use of virtual teaching and research section evaluation results. The evaluation results can not only be used as a basis for the improvement and optimization of the virtual teaching and research space, but also provide a reference for educational and teaching decisions in colleges and universities. Through in-depth analysis and summary of the evaluation results, colleges and universities can understand the operating status and existing problems of the virtual teaching and research space, take timely measures to improve it, and promote the

improvement of education and teaching quality.

5. Conclusion

In the context of digital transformation, application-oriented universities are actively exploring new paths for educational reform by building virtual teaching and research space. In the process of building virtual teaching and research space in application-oriented universities, although there are challenges such as differentiation of teaching and research subjects, fragmentation of teaching and research content, and disordered teaching and research systems, these challenges have also given rise to the need for innovative solutions and promoted the development of the education field. Technological advances and innovations in teaching methods. Facing the future, application-oriented universities should continue to explore cooperation models with educational institutions, scientific research organizations and enterprises to jointly promote the development of virtual teaching and research space to achieve resource sharing and optimal teaching practices. At the same time, colleges and universities need to pay attention to the technical training of teachers and the improvement of students' digital literacy to ensure the effective implementation of virtual teaching and research activities, and ultimately achieve the goal of improving education quality and cultivating innovative talents. Future research can further explore how to overcome these difficulties, especially how to use emerging technologies such as artificial intelligence and big data to optimize the virtual teaching and research environment and maximize the sustainability and effectiveness of teaching and research activities.

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