

Exploring Models for Virtual Teaching and Research in Higher Education Institutions Amidst Digital Transformation

Xiaoyu Liu¹, Feng Qin¹, Chongzhen Duan²

¹Taishan University, Tai'an, Shandong, 271000, China

²The Tibet Sales Branch of China National Petroleum Corporation, Lhasa, Xizang, 850000, China

ABSTRACT

The deep integration of digital technology drives transformative changes in the form of higher education, placing faculty teaching and research activities under pressure for adaptation and innovation. This study aims to clarify the core connotations of digital transformation and virtual teaching and research, systematically analyzing the organizational structures and operational characteristics of several typical virtual teaching and research models in the current university context. The research establishes an analytical framework encompassing theoretical review, model comparison, and pathway design, proposing that advancing virtual teaching and research practice requires transcending the tool-level dimension to focus on the synergistic evolution of technology, organization, and culture. This inquiry provides theoretical reference and practical guidance for universities to construct a new cross-temporal and high-quality teaching and research ecosystem leveraging digital technology.

KEYWORDS

Digital transformation; Higher education institutions; Virtual teaching and research rooms; Teaching and research models

1 Introduction

The digital transformation of higher education institutions has expanded from infrastructure to the core processes of teaching and research, reshaping traditional pathways of knowledge production and dissemination. As a key pillar of educational quality, teacher professional development urgently requires innovative research and teaching models in the digital era to address new pedagogical challenges. Virtual teaching and research leverage online platforms and digital tools to overcome physical constraints, creating flexible spaces for collaborative inquiry, experience sharing, and collective wisdom generation. Examining and exploring its effective models holds immediate practical significance for unleashing the potential of digital technologies, empowering the teaching community, and thereby enhancing overall educational outcomes, which forms the fundamental starting point of this study.

2 Core Conceptual Definitions: Digital Transformation, Virtual Teaching and Research, and Their Models

The digital transformation of universities is not merely about introducing digital tools, but involves optimizing and adjusting the processes and platforms of traditional teaching and research to align with practical teaching needs, ensuring that digital technology truly serves the daily activities of teaching and research, and meets the genuine requirements of university faculty in lesson preparation, discussions, and exchanges. Virtual teaching and research is a concrete implementation of digital transformation in the field of university teaching and research. By leveraging conventional digital communication and resource-sharing tools, it breaks the spatial and temporal constraints of teaching and research, enabling teachers from different departments and regions to conveniently engage in collective discussions, lesson refinement, and other activities without the need for physical presence. The virtual teaching and research model is a standardized framework for such regular virtual teaching and research activities, tailored to the characteristics of various disciplines in universities, forming replicable and scalable specific approaches that align with the practical scenarios of university teaching and research, avoiding formalistic designs detached from teaching practice ^[1].

3 Analysis of Primary Models for Virtual Teaching and Research in Higher Education

3.1 Community-Based Collaborative Teaching and Research Model

The collaborative teaching and research model based on community is the most common application in virtual teaching and research in universities. Teaching and research communities are usually spontaneously formed by university teachers in the same discipline, similar majors, or the same teaching and research topic, without the need for complex technical support. They can carry out activities in an orderly manner based on conventional online communication and resource sharing platforms. Universities will take the lead in forming a teaching and research community with similar institutions within and outside the province based on their own teaching and research needs, implementing a rotating and coordinated approach. Each semester, fixed teaching and research topics will be determined, and different

institutions will take turns hosting activities such as preparatory lectures, seminars, and analysis of teaching difficulties. The teaching and research community breaks the limitations of a single university's teaching and research, allowing teachers from different universities to exchange experiences and share resources around practical teaching problems. It allows each school to supplement personalized content on the basis of unified teaching and research, which not only fits the daily teaching and research scenarios of teachers, but also realizes the complementarity of inter school teaching and research forces, and connects with the differentiated analysis of other virtual teaching and research models in the future.

3.2 Project-Based Task-Driven Teaching and Research Model

The project-based task driven teaching and research model takes concrete and real teaching reform or curriculum construction tasks as the core carrier. The construction project of a course ideological and political demonstration course or the new form textbook development plan often become the key opportunity to start this model. Interdisciplinary or cross institutional teacher teams are formed around clear project objectives, and team members undertake different sub tasks such as case writing, resource development, or teaching experiments based on their respective expertise. The digital project collaboration platform provides necessary support for the operation of this model. Teams share documents, manage progress, and conduct asynchronous discussions on the platform. Difficulties and phased achievements in the project process are recorded and discussed in a timely manner. This model naturally gives teaching and research activities a clear problem orientation and expected output of results. Teachers naturally complete experience exchange and ability improvement in the process of jointly solving practical problems. The promotion of results after project completion may also trigger new teaching and research needs and cooperation networks.

3.3 Data-Driven Precision Teaching and Research Model

The precision teaching and research model based on data breaks the limitations of traditional teaching and research relying on experience judgment, and is a further innovation based on the project driven model. The data management team relies on the existing digital teaching platform of universities to collect basic data such as classroom interaction records, work feedback, and student learning status in teachers' daily teaching. These data do not require complex technical processing and are naturally generated and easily accessible content in the teaching process. The data management team will conduct a simple sorting and classification of the collected data, remove invalid information, and organize it into a clear list of basic data, which will be synchronized with the teachers participating in virtual teaching and research. Universities will explicitly require teachers to combine their own teaching reality and compare the data list to find specific problems in their own teaching. For example, some teachers who find that their classroom interaction data is insufficient will actively seek practical methods from other teachers in virtual teaching and research communication. Teachers engage in in-depth discussions around specific issues reflected by data, breaking down and analyzing the teaching problems behind the data one by one. The data management team supplements and improves relevant data dimensions based on the content of the teachers' discussions, making subsequent teaching and research more targeted and in line with the real needs of frontline teaching in universities^[2].

3.4 Hybrid Routine Teaching and Research Model

The hybrid normal teaching and research mode is a supplement and improvement to the precise data teaching and research mode, and is also an innovative form that is more in line with the daily teaching rhythm of universities. The virtual teaching and research group will combine online discussions with offline centralized communication in accordance with the teaching arrangements of universities, avoiding the problems of lack of interaction between single line online teaching and research, and single offline teaching and research being limited by time and space. Universities will allow virtual teaching and research groups to flexibly arrange teaching and research forms based on the teaching characteristics of different disciplines. For example, humanities disciplines mainly rely on online regular communication, organizing brief offline centralized discussions every two weeks, while science disciplines will increase the frequency of offline practical communication appropriately to facilitate teachers' presentation of specific problems in experimental teaching. The teaching staff will accumulate various teaching and research materials in their daily teaching. During online communication, they will synchronize to the virtual teaching and research platform for everyone's reference. During offline concentration, they will bring the practical difficulties encountered in teaching to face other teachers to break down problems and exchange practical skills. The virtual teaching and research group will make records of each teaching and research, sort out effective ideas in the discussion, and synchronize them with all teaching staff, so that teaching and research can be integrated into every aspect of daily teaching without deliberately occupying too much teaching time, and can effectively solve various practical problems encountered by teachers in the classroom.

3.5 Comparative Analysis and Feature Summary of Various Models

All types of virtual teaching and research models in universities are in line with the actual teaching and research under digital transformation, with core differences concentrated in the logic of implementation, implementation focus, and adaptation scenarios. Specific characteristics can be visually presented in a table (see Table 1). When selecting a mode for

universities, it is necessary to flexibly choose based on their own teacher size, research pain points, and existing conditions. Some universities may combine multiple modes according to their research tasks. Different modes have their own focuses, collaborative teaching and research adapt to multi school cooperation, task driven adaptation to specific teaching problems, precise teaching and research rely on data accumulation, and hybrid adaptation to normal teaching and research. These differences and commonalities constitute the virtual teaching and research mode system of universities, which will be connected to the subsequent deepening path analysis^[3].

Table 1 Comparison of Various Models of Virtual Teaching and Research in Universities

Teaching and research mode	Core features	Adaptation scenario
Collaborative teaching and research based on community	Inter school/departmental collaboration, broad themes, relying on shared platforms	Joint teaching and research across multiple schools and departments
Task driven teaching and research based on projects	Project centered, task breakdown, strong targeting	Specific teaching pain points and course optimization solutions
Accurate teaching and research based on data	Based on daily teaching and research data, focus on weak links	Teaching diagnosis, personalized teaching and research improvement
Hybrid Normal Teaching and Research	Combining online and offline, in line with the daily pace of teaching and research	Regular lesson preparation and discussion on key and difficult points in universities

4 Deepening Pathways for Virtual Teaching and Research in Higher Education Amid Digital Transformation

4.1 Integrated Development of Platforms, Technical Tools, and Resources

The deepening promotion of virtual teaching and research in universities needs to break the current reality of scattered platforms, disconnected tools, and chaotic resources. Universities can rely on existing campus smart teaching platforms to optimize and upgrade, eliminate redundant functional modules, focus on core teaching and research needs, and achieve seamless connection with commonly used online teaching and research tools, no longer requiring teachers to switch back and forth between multiple platforms to increase their burden. Universities can select basic tools with strong adaptability and easy operation to incorporate into a unified platform, such as integrating and embedding online seminars, courseware sharing, collective lesson preparation and other tools. At the same time, they can work together with similar universities in the same region to build cross campus teaching and research resource sharing channels, avoiding resource waste caused by redundant construction. The virtual teaching and research room can take the lead in organizing high-quality teaching and research resources in various disciplines on campus, classify and archive them according to the curriculum system and teaching and research themes, label the sources and applicable scenarios of resources, and then connect with enterprises to introduce real project cases to supplement practical resources. A dedicated person will be arranged to regularly update and review resources to ensure that they are in line with teaching reality and practical, so that the integrated platform, tools, and resources can truly serve daily teaching and research activities, and solve the practical problems of tools not being useful and resources not being found in the teaching and research process of frontline teachers^[4].

4.2 Refinement of Organizational Mechanisms and Operational Support

Universities can incorporate the construction of virtual teaching and research rooms into their medium - and long-term development plans, set up special construction funds, establish separate positions related to virtual teaching and research rooms in teacher staffing and performance evaluation, form cross departmental working groups coordinated by the Academic Affairs Office and secondary colleges, regularly hold joint meetings to coordinate and promote related work, and avoid virtual teaching and research construction becoming a formality. The virtual teaching and research room can develop standardized activity manuals, clarify specific requirements for monthly online group lesson preparation and cross school research every semester, take the lead in recruiting enterprise engineers as part-time mentors, pair up with on campus teachers to carry out teaching and research workshops, and solve the problem of frontline teachers lacking practical teaching and research materials. Enterprises can sign cooperation agreements with universities and virtual teaching and research rooms to clarify the responsibilities of both parties in providing teaching and research resources, teacher practical training, and other aspects. Key technical personnel will be selected to participate in the design of teaching and research activities, and a portion of the cooperation funds will be extracted as incentives to reward outstanding teachers and enterprise mentors in the construction of virtual teaching and research. This will enable the three parties to work together to improve the organizational and operational system of virtual teaching and research, and solve the current problems of lack of long-term guarantee and low enterprise participation in virtual teaching and research.

4.3 Innovative Design of Teaching-Research Activities and Evaluation Systems

Universities can combine the characteristics of teaching and research in different disciplines, guide virtual teaching and research rooms to abandon the traditional single online discussion mode, focus on the key and difficult points of courses and practical teaching problems, and design theme based teaching and research activities. For example, a series of normalized seminars can be held around the difficulties of blended online and offline teaching. An interdisciplinary teaching and research salon can be organized every quarter, inviting frontline teachers from different majors to share their virtual teaching and research practical experience and break down disciplinary barriers. The virtual teaching and research room can take the lead in building a channel for displaying and exchanging teaching and research results, encouraging frontline teachers to upload their own virtual teaching and research cases, teaching design plans, and other achievements, organizing teachers to evaluate and modify each other, while optimizing evaluation indicators, abandoning the practice of simply measuring effectiveness based on the number of activity participation, and including the application of teaching and research results, the improvement of teaching quality, and teacher feedback in the evaluation scope. Frontline teachers can propose personalized teaching and research activity suggestions to the virtual teaching and research room based on their own teaching needs, actively participate in the discussion and revision of evaluation standards, actively optimize their virtual teaching and research abilities in the process of participating in teaching and evaluation, make teaching and research activities more in line with teaching reality, and make the evaluation system more fair and practical, thus solving the current dilemma of single form and unscientific evaluation of virtual teaching and research activities^[5].

4.4 Cultivation of Teaching-Research Culture and Community Building

The virtual teaching and research room needs to cultivate an open and shared culture through in-depth and institutionalized activities, such as setting up monthly "digital teaching and research workshops" as a fixed brand. These workshops focus on in-depth discussions on real issues such as "classroom interaction design in blended learning", promoting stable collaboration expectations among cross school teachers. On the basis of continuous communication, the teaching and research department can organize members to collaborate in developing a modular teaching case library or a knowledge graph of a core course, transforming individual wisdom into iterative collective resources. Teachers gradually establish trust and recognition based on professional contributions in this collaborative sharing around specific tasks. In the end, a teaching innovation community guided by problem-solving and continuously accumulating resources can naturally form, and its cohesion comes from the practical results created together and the professional interaction of high-frequency interaction.

5 Conclusion

The exploration and practice of virtual teaching and research mode marks a new stage of open, collaborative and precise professional development activities for university teachers under the empowerment of digital technology. Various modes are showing an evolutionary trend from resource sharing to knowledge co creation, and their deepening path calls for the systematic integration of technology platforms, operational mechanisms, and educational research culture. The vitality of future virtual teaching and research will depend on whether it can truly be embedded in the daily practice of teachers, become an organic soil to support teaching reflection, stimulate academic enthusiasm, and cultivate community, thus continuously promoting the substantial improvement of higher education teaching quality in the wave of digital transformation.

About the Author

Xiaoyu Liu, Male, Chinese, Weihai, Shandong, Doctorate, Lecturer, Research Direction: Basic Teaching and Research.

Feng Qin, Female, Chinese, Linyi, Shandong, Master's degree, Lecturer, Research Direction: Foreign Language.

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