

Strategies, methods and problems of online education in China during the epidemic*

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Abstract—The 2019 new coronavirus disease (covid-19) epidemic has caused about 270 million school students in China to be unable to carry out normal education activities. On January 29, 2020, the Ministry of education of China formulated the online education response strategy of “Undisrupted Learning”. During the epidemic period, China's online education has to face a very complex dilemma. On the one hand, there are common challenges encountered by other countries, such as whether the online education network guarantee for large-scale data access and transmission is reliable; the informatization of online education for teachers Ability to meet the requirements of online education. On the other hand, it also involves the unique problems of China, such as how to coordinate the local learning resources with the national education resources. This paper will analyze the online education strategy of “Undisrupted Learning” in 22 provinces, 5 autonomous regions and 4 municipalities directly under the central government except Hong Kong Special Administrative Region, Macao Special Administrative Region and Taiwan Province from the four aspects of media platform, learning tools, educational resources and learning methods of online education.

Keywords—undistracted learning, case study, COVID-19,

I. INTRODUCTION

The 2019 New Coronavirus Disease (COVID-19) outbreak has left some 270 million schoolchildren in China unable to carry out normal educational activities. To this end, on January 27, 2020, the Chinese Ministry of Education issued the Notice on the Postponement of the Start of the Spring Semester in 2020, requiring the Ministry to postpone the start of the spring semester of higher education schools, local colleges and universities, primary and secondary schools, kindergartens, etc., and to suspend offline training activities in many places, and to use the Internet and information technology education resources to provide learning support for students. On 29 January 2020, China's Ministry of Education formulated a strategy to "Undistracted learning" in order to coordinate national and local educational resources. The initiative is based on the educational resources of the National Network Cloud Classroom and the “One Teacher One Excellent Class, One Class One Master” project, providing quality online educational resources that can cover all parts of China. By 2 February 2020, 22 online course platforms had been organized, with more than 24,000 free and open online courses, covering 12 undergraduate disciplines and 18 specialties at the senior level, for schools at all levels to choose from, many of which can accumulate credits; on 4 February 2020, the Chinese Ministry of Education issued the

Guiding Opinions on Improving the Organization and Management of Online Teaching in General Higher Education Schools during Epidemic Prevention and Control, emphasizing the implementation of “one place, one policy” and “one school, one policy” throughout China, and formulating nine measures and arrangements. With the implementation of the strategy to cope with the “undistracted learning” online education, the Ministry of Education of China, starting from the purpose of providing guidance services for summarizing typical experiences and providing reference, issued on 27 February 2020 the Notice on Further Improving the Work on “Undistracted Learning” in Primary and Secondary Schools, proposing six measures for the orderly, effective and in-depth implementation of “Undistracted Learning” co-ordinated use of television and Internet resources" for remote rural areas; “warfare and epidemic” education for curriculum content; “flexible teaching methods” for students' learning characteristics; “co-ordination of national platforms and local resources” for the coordination of educational resources; “division of teachers' work” for instructors; and “guidance on online teaching behavior” for teaching management. On March 13, 2020, the "How to Keep Students Learning during Schools Disruption in COVID-19 Situation" international online research conference was organized by Beijing Normal University's Wisdom Learning Institute and UNESCO International Research and Training Center for Rural Education.

II. METHOD

The discussion on the corresponding strategies for online education mainly focuses on the macro policy interpretation, problems and improvement initiatives; the construction of the online education platform and technical support from a medium perspective; and the three aspects of online education methods, learning methods and education and training from a micro perspective. At the same time, China has divided the audience of online education into two categories: colleges and universities, primary and secondary schools, and young children, and the overall guidance of the state and the “one place, one policy” measures of local characteristics, together form the corresponding strategy of online education in China. In addition, in order to address the realities of online education in remote rural areas, such as those without networks or with weak signals, China has broadened the channels of learning resources, integrated educational resources and incorporated the differences between urban and rural areas in terms of network resources into its corresponding strategies. The dilemma facing online education in China during the epidemic

is extremely complex. On the one hand, there are challenges common to other countries, such as the reliability of the online education network, which is responsible for large-scale data access and transmission, and the informatization of teachers' online education capabilities to meet the requirements of online education. On the other hand, there are also challenges specific to China, such as how to coordinate local learning resources with national education resources. Therefore, in this paper, we will analyze the online education strategies of 22 provinces, 5 autonomous regions and 4 municipalities directly under the Central Government of China, excluding Hong Kong Special Administrative Region, Macau Special Administrative Region and Taiwan Province, from the four aspects of online education media platform, learning tools, educational resources and learning mode.

III. ANALYSIS OF ONLINE PLATFORMS AND LEARNING TOOLS

At present, according to the research of experts and scholars on the response to the "undistracted learning" online education in China, the study of media platforms and learning tools has received great attention. First of all, at the beginning of the epidemic on February 13, 2020, the Chinese Ministry of Education, at the press conference of the State Council's Joint Prevention and Control Bureau to respond to the 12 hot spots of school epidemic prevention and control, explained the response measures of online education in the strategy of "undistracted learning", which is a broad response strategy, not just purely online learning, but also combined with the environment and characteristics of home learning. Therefore, localities in China have been actively exploring online education in combination with their own actual conditions, and have formed many valuable practical attempts.

A. The Online Education Response Measures During the Epidemic

From the perspective of a large-scale Internet education organization, an analysis of the core components of the online education response during the epidemic is an effective way to assess whether it can effectively support the implementation of the strategy of "stopping school". Through case studies, Rong-Huai Huang et al. consider the "fluency" of online education platforms and the "convenience" of learning tools as one of the core components of online education practice activities. Therefore, when choosing online education platforms and tools in the face of regional and urban-rural differences, the "fluency" and "convenience" characteristics of the platforms and tools themselves become a measure.

During the epidemic period, all provinces in China used the fluency of online communication platforms and learning tools as a criterion for selection when conducting online education at all levels and in all types of schools, and fluency became a fundamental guarantee for the successful operation of online education strategies. According to the 44th Statistical Report on the Development of China's Internet, as of June 2019, there were 854 million fixed network users in China, with a penetration rate of 61.2% and an average download speed of 31.34Mbps, while there were 847 million mobile network users with a download speed of 23.01Mbps. Therefore, the development of large-scale online education is bound to be limited by the lack of fluency, which will also affect the effectiveness of online education platforms and teaching tools. To this end, on the one hand, the Chinese Ministry of Education and the Ministry of Industry and

Information Technology jointly organized Internet enterprises, coordinated telecommunications enterprises to adjust bandwidth and SMS resources, focusing on ensuring the smoothness of the national network cloud platform for primary and secondary schools, according to People's Daily, as of March 24, 2020, the online education platform is running smoothly and smoothly, with a cumulative number of 775 million visits, which can meet the simultaneous online learning of 50 million students. To this end, the National Network Cloud Platform for Primary and Secondary Schools has become the platform of choice for all provinces in China. On the other hand, the provinces have also adopted responses tailored to their respective situations. For example, Heilongjiang Province has conducted tests on the Internet data load pressure in Harbin, Qiqihar, Jiamusi, Daqing and other cities in the province, and established a network operation monitoring data system with telecom operators, and launched the exclusive preferential traffic packets for primary and secondary school teachers and students, 0 yuan 20G of free traffic packets for poor families measures. Faced with the limitations of the Internet infrastructure and the absence of networks in remote areas, live and on-demand video courses on cable and satellite television have become an important complement. Through the statistical analysis of the use of the online platform of "stop school" in all provinces of China, this article found that the current online education platform consists of three parts, first, the Ministry of Education recommended online platform. For example, the national network cloud platform for primary and secondary schools, China Education Television Channel 4. This type of online learning platform is a collection of high-quality educational resources in the country, with a long construction cycle and operation time, and good platform stability in practical operation and operational management. Moreover, mature learning platforms do not require additional financial investment, but because of the high number of users of such online platforms, there are also negative effects such as slow internet speed and poor learning experience; secondly, provinces already have online education platforms. For example, the Beijing Digital School website in Beijing and the Shanghai Open University online learning in Shanghai, these online education platforms have rich educational resources on the one hand and a mature security system that can be put into use quickly. On the other hand, there are limitations in terms of national outreach and usefulness because of the obvious regional characteristics; thirdly, an online platform developed based on existing online educational resources. For example, each province has set up its own TV and Internet resources to build the "air classroom" platform, because such online platforms have a high degree of compatibility with the educational resources, teacher qualifications and learning progress at all levels, and can take into account the actual situation of schools at all levels and give full play to the advantages of "one school, one policy", which has good practical value in terms of teaching results. The use of online learning platforms by province in China is shown in Table 1.

B. Core Use Demand for Online Education Platforms and Learning Tools

The General Office of the Ministry of Education has issued a notice on the work of "stopping schooling" in primary

and secondary schools, which mentions such home learning problems as “insufficient knowledge of the laws and characteristics of online education”, “insufficient interaction and communication between teaching and learning” and “insufficient information technology capacity of teachers” in the current epidemic of online education and learning, which mainly focus on the independent learning capacity of students. From the point of view of social cognitive theory, home learning and independent learning have a high degree of coincidence for students' learning ability, independent learning is not only a necessary condition for home learning, but also the premise and foundation of online learning. Zimmerman, a leading American researcher on autonomous learning, identified six conditions of "choice of participation, “choice of method,” “control of time frame,” “control of learning outcomes,” “control of physical environment,” and “control of social environment” learning tasks as key to determining whether autonomous learning occurs. This paper compares the six conditions under which online learning tools currently in widespread use with whether autonomous learning occurs in order to obtain a characterization of the current match between online learning tools and autonomous learning.

TABLE I. MATCH BETWEEN ONLINE LEARNING TOOLS AND AUTONOMOUS LEARNING

Key conditions	Problem dimension	Why	How	When	What	Where	Who
	Psychological dimension	motivation to learn	learning methods	learning time	learning outcomes	learning environment	sociality
	Content dimension	choice of participation	choice of method	control of time limit	control of learning outcomes	control of physical environment	control of social environment
Learning tools	Basic information	1.Safeguarding equity in education. 2.Mental health education. 3.Sorting out the right values. 4.Completion of school learning tasks	1.synchronous live teaching. 2.A synchronous classroom recording, 3.Multi-dimensional mixed teaching	Classes typically last around 20 minutes.	1.Education for model achievement 2.Knowledge of disease prevention 3.Public safety education, 4.Mental health education, 5.School education tasks, etc.	home-study	1.Enrolled students in their school class 2.Enrolled students in the provinces and municipalities. 3.Students enrolled in schools at all levels throughout the country
	Functional features	Self-determination of participation in learning	self-selection of learning methods	self-adjustment of learning time	self-selection of learning content	self-selection of learning places	openness of learning participation

Learning tools are not only tools for learners to search for and access information, but also tools for processing, processing and publishing information. The choice of online educational learning tools during the epidemic should be based on the fit between the tools and the educational approach to help teachers and students in the implementation of teaching activities and the realization of interactive communication. On the other hand, the elements that affect autonomous learning when learning at home should also be taken into account. Before the outbreak of the epidemic, the market for online education learning tools was full of various learning tools, which were of varying quality. In order to better promote the online education learning tools market and provide reference for teachers, students and parents when

choosing learning tools, China's Ministry of Education announced the first batch of educational mobile internet apps filing list on December 16, 2019, with a total of 152 learning tools approved and becoming the main target for provinces to choose learning tools during the outbreak of the disease. In addition, through a survey on the use of online education learning tools in each province, it was found that Wechat, Alibaba Ding Talk, Tencent QQ, Superstar Learning, Cloud Classroom of the Ministry of Education, learning tools launched in each province, Tencent Classroom, CCTALK, a real-time interactive education tool of Shanghai Jiang, UMU, a learning tool for knowledge sharing and dissemination, Rain Classroom launched by Tsinghua University and Xue Tong Online, ZOOM video conferencing and online live streaming tool of Education.com, and XIVO Cloud Classroom tool became the main learning tools.

An analysis of the match between online learning tools and all the conditions for autonomous learning to take place shows that at present learning tools meet only the two conditions of “method of choice” and “control of the social environment”. In terms of “choice methods”, learning tools such as Tencent Classroom, Superstar Learning Pass, Alibaba Nailing, Rain Classroom, a learning tool for knowledge sharing and dissemination launched by Tsinghua University and Xue Tong Online, and Xivoyun Classroom, because of their technical functions of live and recorded broadcasting, teachers and students have greater freedom of choice in specific online education activities. At the same time, the learning tools represented by WeChat and Tencent QQ live video conferencing are completely teacher-led, and students have weak control over the learning mode, so when online education is conducted through these tools, the conditions for meeting students' independent learning “choice mode” are insufficient, which creates the obstacle to independent learning. In the area of “choosing a social environment”, learning tools such as the Cloud Classroom of the Ministry of Education, learning tools launched by the provinces, and the Rain Classroom of Tsinghua University and Xidang Online have a wide audience and a high degree of openness to learning participation. Among them, the cloud classroom of the Ministry of Education is a relatively mature operating tool with a full range of functions, which can achieve large-scale communication and interaction, forming favorable conditions for promoting students' independent learning. Based on the comparative analysis, it can be seen that most of the current learning tools cannot simultaneously meet all the key conditions for the occurrence of autonomous learning, mainly including the lack of learning motivation, learning time, learning outcomes, learning environment, thus forming the inhibiting factors that hinder the occurrence of autonomous learning.

IV. EDUCATIONAL AND LEARNING METHODS IN ONLINE EDUCATION

This is not the first time that China has adopted a “suspending class” educational response strategy in the face of a major public health event such as novel coronavirus pneumonia. At the same time, the discussion around educational methods and learning styles for online education is equally as old as ever. First, during the “SARS” period in 2003, under the guidance of the Ministry of Education, various provinces tried out educational methods to cope with the epidemic, such as Tangshan City, Hebei Province, which followed the “suspending class” approach for educational

purposes, and on 6 May 2003, the province took the lead in implementing the “air classroom”, using an online platform to provide primary and secondary school students with free teaching resources under the theme of “very learning, very classroom”, as well as previewing the curriculum on television and in the newspaper media. A blended, reverse-transformation approach is used, with students learning online and tutors answering questions over the phone. Secondly, smartphones, artificial intelligence as the representative of emerging technological means, to “suspending class” online education way to inject new development possibilities. From the current research findings, the educational approach to online education mainly consists of online simulcast, online asynchronous recording and hybrid online education. By combing through the cases of “undistracted learning” online education in 22 provinces, 5 autonomous regions and 4 municipalities directly under the Central Government of China, it is found that these three methods constitute the main methods of “non-stop learning” online education in China at present. At the same time, because of special periods such as the epidemic, online education methods have changed in terms of the theoretical basis of online education, educational participants, teaching resources and activities, the teaching environment and evaluation mechanisms.

A. Synchronous Live Teaching Method

The online synchronous live teaching method refers to the synchronous educational activities of the participants of the teaching activities in different teaching spaces. The premise of this online education approach is the digitization of educational resources, i.e., breaking the traditional same physical and spatio-temporal constraints, the traditional blackboard, black pen, teacher dictation and other knowledge carriers, through the digital medium of visual audio as the main body of knowledge transfer. This approach is most similar to the traditional teaching model in that it is less difficult to operate and is widely used because it is more closely linked to normal teaching tasks. There have been some new changes in the application of online simulcast teaching methods in the epidemic, for example, in order to alleviate the burden on parents and students, the Ministry of Education issued the “Notice on Further Improving the Work of Primary and Secondary Schools to Stop School”, which puts forward specific requirements for online simulcast teaching methods. If the lesson is not longer than 20 minutes, it is prohibited to require teachers to conduct live or recorded lessons in general, and it is prohibited to “punch a clock” on the Internet every day, upload study videos, print assignments or study materials and other instructions. In addition, similar guidance has been introduced in various provinces, such as the “air classroom” in the third year of senior high school in Tianshui City, Gansu Province, which invites “parents to listen to the class”. These specific guidelines have also prompted specific operational changes in the way online simulcast education is conducted.

B. Asynchronous Recording Teaching Method

The main difference between the online asynchronous video recording teaching method and the live form of online education is that students' learning behavior can be freely adjusted. In the video teaching method, the teacher uploads the prepared teaching resources to the online learning platform, and the students choose their own study time and update the educational resources continuously. Online asynchronous recording and teaching methods vary depending on the learning tools used. For example, Superstar

Learning Pass uses data warehousing, resource integration, knowledge mining, data analysis, bibliometric models and other related technologies to provide teachers with recorded videos, PPT and other expanded resources for uploading, online practice and test evaluation, as well as analysis of student learning behavior. This type of online education is actually an open model of educational resources, teaching resources are not limited to the live broadcast of the teacher's narrative, can be linked and interacted with online educational resources to expand the scope of knowledge.

C. Multi-Dimensional Mixed Teaching Method

Hybrid online teaching refers to a change in the traditional model of one-way teaching by teachers through the integrated use of all elements of educational activities. The application of this teaching method benefits from the all-media features of the online education method, which includes technologies such as audio-visual, virtual simulation, interactive electronic courseware and artificial intelligence, providing convenient application functions for all aspects of educational activities. At present, one of the representatives of hybrid online education is the flipped classroom model, different from the previous teaching method of “online learning video students, teachers offline Q&A”, the flipped classroom under the epidemic can not be implemented in the face-to-face real physics teaching space offline Q&A tutoring, instead of online Q&A tutoring mode with multiple interaction. For example, the Wuhu Wisdom Education Platform and the Sunshine Cloud Class in Wuhu City have set up “my teaching” and “question and answer tutorial” functional modules to carry out the hybrid online learning mode of flipping the classroom, so that after students watch the teaching video online, they can have online discussion with the teacher in the “question and answer tutorial” module, and at the same time, the teacher can also arrange the learning plan in the module to guide students' online learning operation, and monitor students' learning effect in real time through statistical tools.

The selection and implementation of the “stop-and-study” online education method has similarities with the teaching resources, learning platform and teaching environment used in the daily online education method, but the epidemic that the online education method has to deal with is an extraordinary stage of education, and the online education method limited by the special environment of the epidemic shows three obvious characteristics. First, to match the overall educational guidelines for national epidemic prevention and control. When responding to major public health events, a strong commitment to life and health is always put first. Therefore, the online education method should not only focus on the educational activities and learning tasks of the school, but also meet the requirements of the physical and mental health development of the students during the home confinement. To this end, online education has to be adjusted in terms of the length of study, the curriculum, the organization of study tasks and the mental health of students. Secondly, it coincides with the educational laws that teachers and students carry out teaching activities at home. On the one hand, the teaching environment in a home setting is different from a dedicated physical space like a classroom, with a full range of teaching aids. On the other hand, the teaching environment in the home environment, with its high degree of adhesion to the daily space, can generate uncontrollable disturbing events and factors that affect the implementation of the teaching activities. Therefore, online education should respect the laws of home learning, stimulate students' awareness of

independent learning and promote the occurrence of independent learning activities. Finally, the “big data era” thinking became dominant. An online education platform is not simply a technical tool for information delivery, it is a cognitive channel for student learning behavior collection and analysis. The change in the way online education has changed traditional education is not only the replacement of information dissemination tools, but also the reawakening of all aspects of educational activities. The separation of the teaching space prevents the effective implementation of the previous way of identifying student understanding, adjusting the pace of teaching and learning tasks by observing student facial reflections and live interactive communication. At the same time, the collection and analysis of data on learning behaviors provided by online teaching platforms and feedback on teaching activities has become an innovative approach that must be accepted.

V. EMERGING ISSUES AND LESSONS LEARNED IN ONLINE EDUCATION

Currently, limited by the impact of the epidemic, research on the problems in “undistracted learning” online education has been based mainly on web-based questionnaires and individual video interviews. According to the guidance issued by China’s Ministry of Education, the key issues to be addressed in online education include the guarantee of network stability, the lack of information technology capacity of teachers, the burden on families and students, the interface between home learning and regular teaching, the guidance of home learning, and the policy mechanism to be continuously improved. Around these issues, some Chinese scholars have identified them with the help of questionnaires and case studies. For example, Yang Xiaozhe and others used a large-scale online research method to collect 15,438 teacher questionnaire data nationwide, and from the perspective of teachers, the main participants in online education, to analyze the problems of “stopping classes and not learning” in online education, and summarize the five difficulties identified by teachers as “students are unable to participate in learning on their own; the network and technology are not stable; teachers themselves are not familiar with technology; teachers can not control the progress of the classroom; teachers can not interact with students”. This article analyzes the implementation of online education guidance initiatives in various provinces in China, and concludes that the current problems in online education are mainly composed of three core elements: online network technology, epidemic prevention and control, and home learning, involving the government, schools and families.

A. Network Technology

The development of a strategy to deal with the “stop-and-go” online education needs to avoid the problems caused by online web technologies. One is to provide network bandwidth support for large-scale online education, to ensure the smoothness of large-scale simultaneous access and information security. Secondly, the development of IT skills for the users of online web technologies, i.e. teachers and learning. The main difference between online education and traditional teaching is the application of information technology tools, whether or not you can skillfully apply these tools is directly related to the learning experience of students,

becoming an important influence on the application of online education.

B. Epidemic Prevention and Control

As early as the implementation of the strategy of “undistracted learning” online education, the Ministry of Education made it clear that online education is not the same as the superimposition of traditional educational content and means of dissemination, it is a broad way of learning, mainly expressed in the diversification of teaching resources. At present, the teaching resources of school education include daily school education, epidemic prevention knowledge, life health, patriotic education and other diversified content. Through the analysis of online education application cases in various provinces, it is found that the teaching content is still dominated by the daily teaching content in schools, and the teaching resources related to epidemic prevention and control are insufficient.

C. Home Learning

The home is a place where people live and live, the design and equipment configuration of the home environment is based on quality of life, the classroom is a special place for the dissemination of human knowledge, the blackboard, the lecture table, tables, chairs and stools, air conditioning, multimedia equipment and other teaching aids are designed for teaching. The most obvious consequence of equating online education with a change of venue is to increase the burden on parents and students, and the purchase of equipment and the provision of learning materials in order to transform the home environment into a classroom efficient venue will increase the mental and financial burden on families.

As the core participants of “undistracted learning” online education, i.e. the government, schools and families form the fulcrum of mutual influence. The smooth exchange of information between these three directly affects the healthy development of online education response strategies.

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