Impact of Covid-19 epidemic on online learning and educational resources in China

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Abstract

Online education was widely launched worldwide with the increasing impact of Covid-19 and multiple online platforms were developed or improved due to their demands. Several surveys have been conducted to analyze the Covid-19 impact on education, revealing the importance of information and communication technology (ICT). This epidemic has significantly changed all education levels and dramatically increased online learning. Online learning has various benefits with few drawbacks such as resources, economic effects, time, travelling, and so on. In this paper, we describe the impact of Covid-19 on education in China, the education of international students, problems in online learning, and the supportive technologies during this epidemic. Distance learning has been studied for years, expressed that it enhances the learners with lower paybacks; therefore, it was diminished dramatically. All these concerns will help us to understand global reforms and situations. We have also described affected regions, virus types, the Covid-19 cycle, and procedures to secure our education systems. Furthermore, we have highlighted some key issues of biosafety that will support the community to understand the standard procedures for developing a safe environment. Teachers play a key role in the development of a nation, and this study also enlightened the perspectives which should be addressed in future research.

1. Introduction

Education management refers to the rational allocation of human, material, financial and other resources in the educational environment and the planning, organization, coordination, supervision, and evaluation of various educational activities of the school under the guidance of certain educational ideas, policies, and concepts of education management, in order to achieve the educational objectives of the school, so as to achieve the coordinated operation of the entire educational activities. In addition to following the common management system of general students, the education management of foreign students has other different management characteristics. From the perspective of the current education management of foreign students in China, the education management of foreign students in China is mainly divided into two parts: teaching management and daily management [1][2].

Teaching management mainly includes plan management, system management, quality management, business management, organization management, etc. [3]. More precisely, it includes the distribution of students' majors, the set of courses, the setting of training programs, etc., and the scientific research management of graduates. Educational management is the macro administrative management of education by the state and the micro administrative management within the school. Daily management mainly covers enrollment management and life management. The part of enrollment management mainly refers to formulating the enrollment plan for international students, determining the enrollment method, establishing enrollment channels, etc. The life management part generally includes foreign-related management, life, and safety management, and carrying out relevant activities

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related to studying abroad. The connotation of education management is more carefully divided into three aspects: enrollment management, teaching management, and life management. Through SPSS, the concerns systematically analyze the problems in the management of students coming to China and then analyze the causes of these problems.

With the advent of the network era, modern information technology, with intelligence and informatization as the core and the Internet as the representative, has promoted the way of knowledge acquisition in the process of teaching and learning to become more diverse and faster. The speed of information exchange has increased rapidly [4]. While technology has changed the way of education, it has also changed people's teaching and learning concepts, teaching content, teaching methods, etc. Online technology has changed the distance between time and space. Images, animations, videos, etc., are frequently used in online teaching. The era of one piece of chalk and one piece of the blackboard is gone forever. As a high-level university, first-class universities gather excellent talents, have rich teaching resources, and have good external security, playing an increasingly important role in improving national and international competitiveness. As the most valuable human resource of a first-class university, first-class university teachers are the fresh troops of a first-class university and the main force to shoulder first-class teaching work. Online teaching is an important part of first-class university teaching in the network era. The external guarantee for the development of first-class university teachers' online teaching ability is directly related to the quality of talent training and the development level of first-class universities. Therefore, improving the external guarantee for the development of first-class university teachers' online teaching ability, promoting the development of teachers' online teaching ability, and improving the quality of online teaching have become important issues faced by educators.

With online teaching becoming an important development direction of higher education in the world, the world's leading universities have realized the importance of external guarantees for developing teachers' online teaching ability [5]. Suppose a first-class university wants to improve the quality of online teaching. In that case, it needs to constantly improve the external guarantee for developing first-class university teachers' online teaching ability and promote the development of teachers' online teaching ability. In recent years, in the face of the surge in demand for online teaching, it is more urgent to improve the external guarantee for developing first-class university teachers' online teaching ability. The world's leading universities have begun to pay attention to the construction of external guarantees for the development of teachers' online teaching ability and have taken a series of measures to promote the development of teachers' online teaching ability and optimize the effect of online teaching. In particular, in 2020, online teaching stepped onto the historical stage. Facing the large-scale development of online teaching, first-class universities, based on their rich experience in online teaching for many years, organized teachers to participate in this large-scale training of online teaching ability development. In order to ensure that online teaching and offline teaching are of the same quality and equivalent, the external guarantee for the development of online teaching ability is also in a hurry. The concerns will promote the all-around development of teachers' online teaching ability in the short term. Therefore, the development of the online teaching ability of first-class university teachers in the network era needs to have a solid external guarantee to guarantee the sustainable development of teachers' online teaching ability.

In the context of today's network era, especially the large-scale online teaching practice since 2020, in the face of the surge in online teaching demand, the Chinese government has issued several policies to promote the deep integration of information technology, education, and teaching practice and ensure the smooth development of online teaching in order to truly achieve the substantial equivalence between online teaching and offline teaching. At the same time, a series of policies have also promoted the improvement of the external guarantee for the development of online teaching ability of first-class university teachers and encouraged teachers to actively participate in the development of online teaching ability, which is conducive to improving the quality of online teaching.

Online education is interconnected with communication technologies and resources. This paper broadly discusses online education in China during this modern era and epidemic situation. Additionally, we have described the problems in the online education system. Meanwhile, different types of viruses have been conferred, which can be helpful in comparing different eras. The covid-19 cycle is presented for different regions, and the general vaccination production process is described for such an epidemic situation. Later, standard procedures and a complete cycle are proposed to protect and secure our educational system in such an epidemic. This paper proposes a system that helps to organize face-to-face communication and interaction between teachers and students and to improve our educational system for such epidemic situations.

2. Online Learning in the Network Era

In recent years, with the continuous and in-depth promotion of educational informatization, online learning has become an important form of educational practice to change the teaching and learning model. It is transforming into ubiquitous learning or mixed learning paradigm under multi-space integration [6][7]. The outbreak of large-scale COVID-19 has made online learning a rigid need, which has promoted online learning to become one of the important ways for learners to carry out learning activities, establish interactive links and collaborate to build

knowledge [8]. However, due to the spatio-temporal separation of online learning, the lack of face-to-face communication and interaction between teachers and students, students and students has led to the loss of emotion in online learning. It is more likely to induce online learners to have emotional problems such as confusion, anxiety or depression, or even psychological crisis [9], which seriously affects the efficiency and effectiveness of online learning. Therefore, emotional analysis and intervention are still the problems that need to be solved urgently in online learning.

The student's emotions and interactions in the online learning environment are inextricably linked, and high-quality interaction cannot be separated from emotional participation. It has been proved that interaction is an indispensable condition for learning, a key link to promote knowledge construction, and an important factor in affecting learners' different emotional experiences [10]. It can be seen that interaction in the online learning environment plays a vital role in learners' emotions and affects the efficiency and effectiveness of online learners in many ways. In the context of quality education, in order to promote the coordinated development of "knowing and doing", many countries have taken emotion as the three-dimensional goal of teaching (knowledge and skills, processes and methods, emotional attitudes and values), and determined that emotion plays an important role in talent training [11]. Secondly, many researchers at home and abroad focus on key technologies and applications related to emotion.

3. Education in China for International Students

The study in China from the perspective of international communication belongs to the study of the international communication of Chinese (ICC). The ICC refers to the language communication phenomenon of Chinese going to the world based on the demand for Chinese from all countries. The concept of ICC is rich in connotation. In the narrow sense, the ICC only refers to the ICC. In a broad sense, the ICC includes the Chinese language and the ICC culture. This research uses the broad concept of "Chinese language communication", specifically covering theoretical research and practical activities related to the Chinese language and Chinese culture. Theoretical research includes Chinese ontology, Chinese linguistics, Chinese as second language acquisition, etc. Practical activities include macro-level factors such as national language conditions and language policies, national relations, social needs analysis, cross-cultural communication, and micro-level factors closely related to specific teachings such as teachers, textbooks, teaching methods, teaching systems, and cultural activities.

4. Difficulties in Online Teaching in China

With the rapid development of modern information technology represented by the Internet, new teaching methods based on online teaching platforms, such as micro class teaching, MOOC teaching, SPOC teaching, have sprung up like mushrooms. Influenced by the Internet, today's students have become "aborigines" in the digital age. They expect more up-to-date teaching methods, richer content, and more innovative teaching models. With the growing prosperity of online teaching, first-class universities need to constantly provide high-quality external guarantees for the development of teachers' online teaching ability to meet the new requirements of the online teaching environment on the responsibilities of first-class university teachers. In reality, the external guarantee for the development of first-class university teachers' online teaching ability lags far behind the new requirements of the network era. It does not match the growth of teachers' online teaching ability development needs and the urgent need for quality improvement. Especially in the face of large-scale online teaching practice in 2020, online teaching is still unfamiliar to most first-class university teachers, many of which are new attempts. No matter from the theoretical level of online teaching or the level of corresponding teaching practice experience, there are weak points, especially the support of organizational guarantee, service guarantee, technical guarantee, institutional guarantee and financial guarantee in the external guarantee of teachers' online teaching ability development, However, there are different degrees of practical difficulties and difficulties in the external guarantee of online teaching ability development of first-class university teachers, which are reflected in the fact that first-class universities do not pay enough attention to teachers' teaching development institutions, lack appropriate forms of teachers' online teaching ability development, lack of new technical resources in teachers' online teaching ability development platform, the teachers' online teaching ability development system is not perfect, and lack of funds for teachers' online teaching ability development, The development of online teaching ability of first-class university teachers has fallen into the "deep-water area of online swimming pool".

The theory of college teacher development became popular in the 1960s. The National Education Association (NEA) proposed the model of college teacher development in 1992, which colleges and universities widely recognized. It has established four dimensions of professional development, organizational development, personal development, and teaching development, among which teaching development is the core of the development of university teachers. Teachers' teaching development centers in many American universities use the structural model of university teachers' development proposed by the American Education Association to determine the focus of university teachers' teaching development. In 1975,

Bergquist W. H, S.R. Phillips, and Jerry G. Gaff of the United States put forward relevant theories on the teaching development of college teachers. Gaff's views are similar to those of Bergquist. This theory summarizes the basic structure of teaching development of college teachers and analyzes it from three dimensions: focus, goal, and activity are given in Table 1.

Table 1. Basic structure of teaching development of college teachers

	Teaching development of Bergquist and Phillips (process) [12]	Gaff's teaching development (process) [13]
Focus	Individual teachers, teaching progress, curriculum development	Course and teaching progress
Goal	Improve teaching and improve teaching efficiency	Promote students' learning
Activity	Teaching evaluation, classroom diagnosis, microteaching, teaching methods	Teaching process design and curriculum design, new textbook science
	Law, technology, and curriculum development	Practice, workshop with specific teaching theme, student evaluation

Combining new technologies and methods to build a learner emotion recognition model and realize a faster and more accurate recognition of online learners' emotional states will help clarify online learners' emotional states from the source. Learners' emotions in online learning environments have dynamic and time-varying process characteristics, and interactive data mapping learners' emotions have massive, multi-source, and heterogeneous characteristics. Traditional emotion recognition methods are difficult to obtain data features efficiently, and there are some deficiencies in recognizing learners' emotions. This research comprehensively uses deep learning technology and sequential pattern mining algorithm to accurately recognize learners' emotions using multi-channel interactive data. Then it excavates the rules of online learning emotional sequence patterns based on different interactive groups, which is conducive to a timely, comprehensive, and accurate grasp of the online learning emotional state and provides support for emotional process evaluation, timely feedback, personalized guidance, etc. in online learning.

The continuous expansion of international trade, economy, and tourism can be affected through intentional or unintentional ways that have become an upcoming threat by invasive viruses. The important infected regions are shown in Figure 1. The increasing contradiction among regional economic and social, the conflict among different regions, nations, religions, beliefs, and political systems is intensifying. The viruses have brought unprecedented challenges to economic, social, and national environments.
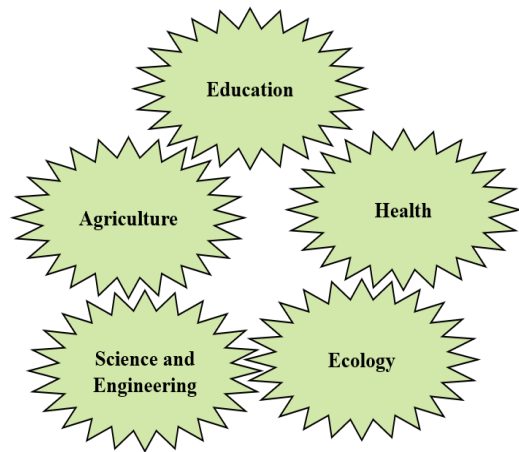

Figure 1. Infected regions by an infectious virus

The concept of biosafety is comprehensive. It refers to the state effectively preventing and responding to threats from dangerous biological and related factors. Biotechnology can develop steadily and healthily, people's life health and biological systems are relatively free from danger and threat, and the biological field can maintain national security and sustainable development [14]. Some viral infection diseases, especially the Covid-19 cycle among different regions, and typical stages of exploring the drugs and vaccines to overcome the infectious diseases are shown in Figure 2.
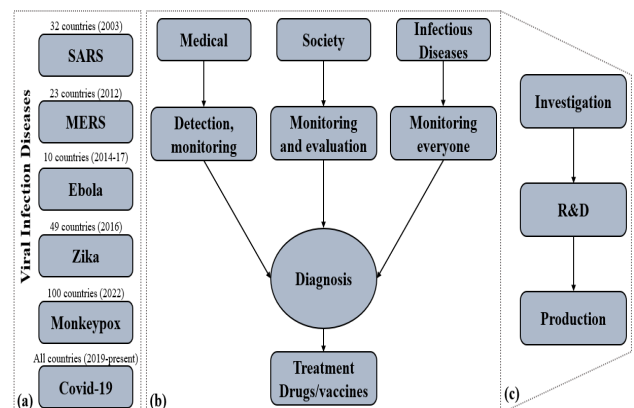

Figure 2. (a) Virus types in different eras, (b) covid-19 cycle among different regions, and (c) stages to find the particular drugs and vaccines

Figure 3. Standard procedures to lessen and secure our education system in epidemic

The standard procedures to secure our educational systems are shown in Figure 3. In recent years, the research on emotional self-efficacy and its related emotion regulation in the online learning environment has received extensive attention. Emotional regulation refers to the process in which individuals use certain strategies to influence and control emotions based on monitoring and evaluating emotions according to the requirements of internal and external environments. Simply put, it is the process of managing the emotions of oneself and others [15]. For example, Xu *et al.* took 298 graduate students from 86 online learning groups in the southeast of the United States as the research objects and used a multi-level model to analyze the predictive factors of emotional management in group work [16]. The results showed that emotional management in group work was positively correlated with feedback, learning-oriented reasons, environmental arrangements, motivation monitoring, and seeking help. Järvenoja *et al.* used process-oriented measures to obtain multi-channel data such as self-report, video and physiology in specific situations, which proved that emotion regulation is affected by multiple motivation levels from the perspective of time and that emotion regulation and motivation are intertwined with the online learning process [17]. Zhang *et al.* divided six Chinese undergraduate English learners into two groups. They explored the expression forms of learners' sense of pleasure and emotion regulation in online collaborative language learning by using semi-structured interviews and online group dialogue videos [18]. The research results show that participants mainly participate in the shared regulation process, including collaborative planning, monitoring, and evaluation to achieve group-level pleasure. Participants use

emoticons and words to achieve emotional regulation in the online collaborative environment. We can control such situations by developing a global scientific community and network. Figure 4 shows the standard procedures to secure our education system during the epidemic and the key factors to support these procedures.
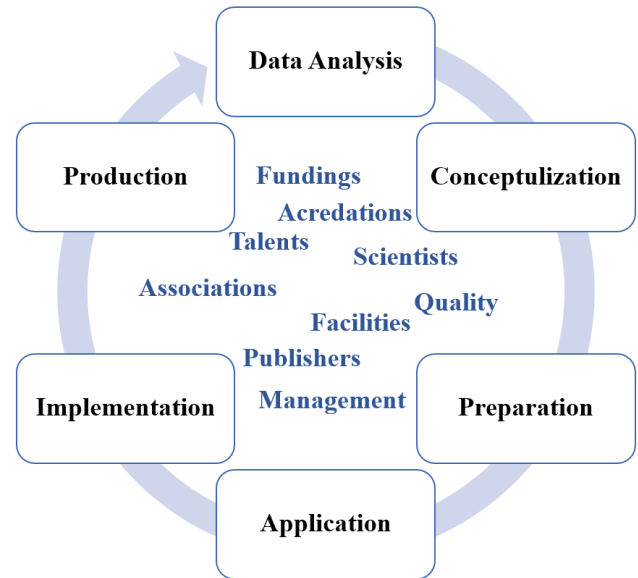

Figure 4. Complete cycle to provide a safe environment for education in epidemic and the key factors (i.e., in blue) to support this cycle.

5. Online Learning Technology in China

Massive Open Online Courses (MOOCs) is a curriculum model in educational resources [19] which discusses online courses and interactive participation and approach to the open resources. MOOCs have broken the limitations of traditional classroom education in time, geography, and learning rhythm, allowing learners to participate in curriculum learning anytime and anywhere [20][21]. At the same time, through the forum provided by the online learning platform, learners can communicate with teachers and other learners to connect learners, teachers, and educational institutions.

This paper supports a face-to-face learning environment and takes the interaction containing rich emotional information as the entry point. Based on online learning interaction and behavior, which starts from the relationship between "online interaction" and "learning emotion", our focus is on the emotional analysis and intervention research of learners based on interactive data in an online environment. Therefore, it provides a new idea for intelligent learning services and efficient learning effects in an online learning context. According to the actual needs of online learners' emotion research and the shortcomings of current research, this paper identifies learners' emotions through online learning to construct

learner's emotion intervention mechanisms and strategies driven by online interaction.

Research shows that learners' learning behaviors and emotions are important factors affecting dropout and learning effectiveness [22][23][24][25][26][27][28]. On the one hand, learners' involvement in various learning behaviors reflects their willingness to continue learning, directly affecting whether they drop out of school and the quality of learning results. Nagrecha *et al.* predicted the dropout behavior based on the selection of learning behavior characteristics and analyzed which learning behaviors impact the dropout behavior [22]. Wang *et al.* analyzed learners' discussion behavior in the forum and found that learners' positive and constructive discussion behavior is an important factor affecting learning effectiveness [23]. Spivey *et al.* used online learning behavior data to study the relationship between learners' efforts and learning effects. This study used the number of times learners visited learning resources to express the degree of learners' efforts. It found that learning effects were affected by the frequency of access to learning resources. Continuous access means learners' continuous learning, and learning with reasonable intervals positively impacts learning effects [24]. On the other hand, emotion reflects the psychological activities of learners in the learning process, which is of great importance to learning. Positive learning emotions can stimulate learning motivation and promote learning. On the contrary, negative emotions can hinder learning. In the current online learning platform, learners generally express their views and feelings on problems by publishing posts. According to the speech behavior theory [29], learners are also implementing certain behaviors when publishing posts, and the speech information contained in the text reflects the learners' behavior psychology. Wen *et al.* conducted emotional analysis on the text data contained in the forum posts, and further analyzed the correlation between emotion and the number of learners who dropped out of school [27]. Tucker *et al.* mined the text data generated by learners and studied the relationship between learners' emotions and learning effects (homework, tests, test scores) [28].

In the traditional learning environment, teachers can easily observe whether learners are absent from class. In the online learning environment, due to a large number of applicants for a course, it is necessary to use statistical or machine learning methods to predict dropout behavior to identify risky learners. There are various research methods for predicting dropout behavior. According to traditional machine learning methods, the most commonly used methods for predicting dropout behavior include support vector machine [30], logical regression (LR) [31], decision tree (DT) [32], random forest (RF) [33], hidden Markov model [34], etc. Fei *et al.* regard the prediction of dropout behavior as a classification problem about time series and use LSTM to encode the characteristics of learning behavior into continuous values and predict [35]. In addition to the above research, Crossley *et al.* analyzed

learners' online learning activities and the texts generated on the forum by combining learning behavior data and text data to predict whether learners can complete the course [36]. Li *et al.* proposed a dropout behavior prediction model based on multi-view semi-supervised learning based on various online learning behavior characteristics [37].

At the same time, social media technology is increasingly popular in the workplace. A global survey report released by McKinsey in 2017 showed that up to 80% of professionals recognized the critical role of social media in their daily work to varying degrees [38]. In the long fight against COVID-19, the global market for working social media applications has also expanded rapidly. For example, from January 22 to February 20, 2020, the download volume of nailing and WeChat for enterprises increased by 146% and 572% year on year [39]. By using social media to access diverse information sources anytime and anywhere, employees gradually realize that they can use various social media to carry out independent learning in a fragmented way. The so-called fragmentation is reflected in two aspects. First, employees can learn from familiar working relationships by using nails, WeChat, QQ, etc., to communicate with work partners or view conversations in chat groups [40][41][42]. We can also learn from the online community by searching and browsing the content created by netizens (such as official WeChat accounts, senior experts of Zhihu, and active users of Weibo). Information from working relationships and online communities usually involves different fields and lacks close connection, leading to fragmentation of learning content. Secondly, from a technical perspective, the use of social media is not limited by time and space, so employees can use their spare time to obtain information through social media anytime, anywhere. For example, employees can use their nails to discuss work problem solutions with colleagues on business trips and browse work-related content on the official WeChat account on the bus, in line, or during work breaks. However, industry experts and scholars have predicted that social media is expected to become one of the interactive platforms supporting employees' micro-learning and mobile learning shortly [43][44]. Most enterprise managers have not paid enough attention to how employees use social media to carry out work-related fragmented learning activities, why employees participate in fragmented learning, and what consequences such learning activities will cause. In other words, enterprise managers' understanding of employees' fragmented learning practices on social media is still lacking and lagging behind, which may cause managers to miss opportunities to cultivate talents in a way that employees enjoy.

6. Conclusions

Multimedia are developing rapidly because they are not limited by time and space. However, online learning has

two problems: high dropout rate of courses and poor learning effect of learners. Learning behavior and emotion are important factors that affect dropout and the learning effect. To reduce the dropout rate and improve the learning effect, the oriented learning behavior and emotion analysis study the problems in their practical applications. This paper describes online learning in China, its limitations, and solutions. The outbreak and spread of large-scale COVID-19 in the world have made online learning a rigid need, which has promoted online learning to become one of the important ways for learners to carry out learning activities, establish interactive links and collaborate to build knowledge. However, due to the spatio-temporal separation of online learning and the lack of face-to-face communication and interaction between teachers and students. It is easy to induce online learners to have emotional problems such as confusion, anxiety or depression, and even psychological crises, which seriously affect the efficiency of online learning. Therefore, the analysis and intervention of learners' emotions in the online learning environment is still an urgent problem to solve in online learning.

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