CHAPTER 5

An Exploratory Examination of Online Learning During and After the Pandemic: Learning Goal Congruence in Lecturing and Research Activities

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Introduction

There is no doubt that we are now living in a postpandemic era. Most universities and colleges worldwide have moved away from online or hybrid courses to in-person instruction. However, when the epidemic is brought under control, its influence will not fade away. Due to the pandemic, universities and teachers have been compelled to shift from traditional face-to-face instruction to online and hybrid models with inadequate

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preparation and cognitive reserve. How to prepare for teaching in a completely different environment while maintaining teaching quality is an essential topic for teachers. Unfortunately, it remains a problem in the postpandemic era when students switch from online to in-person learning environments.

The traditional educational management system confronts numerous new issues and circumstances. For instance, how can online instruction, which began during the outbreak, be connected to formal postin-person instruction? How do universities compute online and in-person teaching hours, credits, and instructors' workloads? How can universities and professors ensure the quality of online and in-person instruction? How can lecturers assist students in transitioning from online to in-person learning? How to differentiate between online and in-person classroom teaching materials and effectively collaborate with TA via email or online platforms. How can lecturers guarantee that most students can participate in online learning or discussion? How can students who might be having difficulty following the online teaching schedule be dealt with? How should instructors deal with this situation or inclusive class? Should instructors spend additional time working with students who are having learning difficulties? How do instructors schedule another online exam for students if students miss the exam?

Online and hybrid teaching introduces not only new challenges to education but also extraordinary opportunities. If we develop innovative thinking and novel ideas to embrace this unique opportunity and advance education and teaching reform, we would transform adversity into an advantage and a crisis into an opportunity. First, this is an unprecedented large-scale online education project that has, in a short amount of time, acquired a great deal of experience and lessons, making it worthy of a thorough summary and discussion. Never has there been a greater understanding of the significance and need to extend online education and instruction. As a result, online education has ushered in an unprecedented chance for substantial expansion. Third, the public's understanding of the importance and urgency of educational change will be significantly enhanced, and the discussion of educational theory and concepts will become more intense. In addition, there would be an emphasis on reviewing and reflecting on the education direction, future education path, and the development of educational technologies and specializations. We interviewed sixteen professors (most of whom are principal investigators) from twelve universities in the United States and China, including math

departments, statistics departments, psychology, cognitive sciences, engineering, humanities, and the arts, to further answer these issues and investigate the impact of the pandemic on online education. With nearly an hour of in-depth interviews, the challenges of online and hybrid teaching, the forms of coupling coworkers with students, collaboration levels, and technological issues were examined to demonstrate the pandemic's impact on higher education issues.

Synchronous, Asynchronous, and Hybrid Online Learning Before and After Coronavirus 2019

Advances in technology have profoundly altered the educational environment, resulting in the creation of new kinds of distant learning. In recent years, synchronous and asynchronous remote learning systems have gained popularity, each providing unique benefits and difficulties to students and teachers alike. The coronavirus 2019 epidemic has highlighted the necessity of effective and accessible online learning, driving educators to quickly adapt and develop unique teaching approaches to engage students and maximize learning experiences in this technology-driven era. This study will investigate the features, benefits, and drawbacks of synchronous and asynchronous remote learning, as well as the feasibility of combining these techniques to provide a more complete and adaptable learning experience for a varied student population.

Synchronous distance learning is an educational approach where both the instructor and students engage in learning simultaneously through video conferencing (Ruiz et al., 2006). This learning mode allows students to have their questions answered in real time, and it also reduces feelings of isolation, as it enhances social presence and community (McDaniels et al., 2016; Lowenthal et al., 2017). Social presence refers to "the degree of salience of the other person in a mediated interaction and the consequent salience of the interpersonal interaction" (Parker et al., 1978, p. 65). It is an essential factor that determines the level of interaction in an online learning environment (Mykota & Duncan, 2007), while interaction is a crucial dimension of the sense of community (Rovai, 2002). In synchronous learning, students often develop a strong sense of community as they feel connected to their classmates and instructor and are highly engaged in classroom activities (Young & Bruce, 2011; Shackelford & Maxwell, 2012; Yamagata-Lynch, 2014; Lin & Gao,

2020). Moreover, real-time discussions and immediate feedback shorten the perceived distance among students, thus fostering a strong sense of community (Pattillo, 2007; Parker & Martin, 2010; Francescucci & Rohani, 2019). However, synchronous classes may become long lectures that encourage multitasking and distraction (Lederman, 2020). Synchronous courses can also be challenging to participate in, especially when there are conflicts with personal schedules, which can leave learners feeling frustrated and fatigued (Schulman, 2020). This situation has changed during the coronavirus 2019 pandemic, as students are eager to learn how to utilize emergency remote teaching more effectively to achieve academic success (Shim & Lee, 2020; Mutmainah et al., 2023). Coronavirus 2019 has necessitated a rapid learning curve for educators, who have had to swiftly adapt and develop novel teaching methodologies that engage students and optimize the learning experience in a technology-driven era (Ahshan, 2021; Chiu, 2022). This is especially beneficial for students with emotional and speech anxiety, as learning in the familiar and comfortable surroundings of their homes provides a conducive environment (Prentiss, 2021; Mihai et al., 2022).

Asynchronous distance learning refers to a learning approach where students and instructors do not engage in real-time interaction. Instead, instructors rely on emails and online discussion boards to conduct interactions (Ruiz et al., 2006). This approach offers several advantages, including the flexibility for students to engage in learning at any time, allowing students to work at their own pace, and providing opportunities for students to reflect on learning content and refine their contributions (Hrastinski, 2008; Kim et al., 2016; Riggs & Linder, 2016; Pang & Jen, 2018). Additionally, students have more time to express their thoughts in a thoughtful manner on an asynchronous online discussion board (Brierton et al., 2016; Collison et al., 2000). However, asynchronous online classes have limited interaction, especially real-time interaction with peers and instructors, which can lead to feelings of frustration due to a lack of immediate response or timely support (Vonderwell, 2003; Frimming & Bordelon, 2016). Scholars have noted that students may develop a sense of isolation and loneliness due to a lack of interpersonal relationships with classmates and the instructor, leading to a perceived disconnection from the learning community (McMahon, 2013; Bowers & Kumar, 2015; Parte & Herrador-Alcaide, 2021; Woods, 2002). These feelings of isolation can further contribute to the online course dropout rate (McMahon, 2013; Ali & Smith, 2015; Bowers & Kumar, 2015). Based on the research,

undergraduate students generally expressed some level of satisfaction with asynchronous distance education. However, the study found a positive correlation between satisfaction and students' ownership of a computer and access to the internet (Taner et al., 2021). Asynchrony was helpful in improving learning outcomes and abilities in utilizing office software, as well as promoting learning independence (Mairing et al., 2021).

Blending synchronous and asynchronous online learning has been recognized as a highly effective mode of learning delivery (Gregory, 2003). It is often referred to as the hybrid teaching and learning model. The combination of both modes can bring various benefits to student learning. For instance, asynchronous learning allows instructors to provide extra content exposure to students who require additional time without slowing down the class, while synchronous learning enables instructors to read students' body language to determine if they understand the content and provide further assistance (Horvitz et al., 2019). Furthermore, students feel validated by the instructor and their peers during live meetings (Norberg et al., 2017). However, conducting blended courses comes with its own set of challenges. Clinefelter and Aslanian (2015) reported that 75% of online students who are not opposed to participating in synchronous meetings cannot do so regularly due to personal scheduling issues. Among these students, 33% would not mind meeting two or three times per course, while 18% are willing to meet only once per course (Clinefelter & Aslanian, 2015). Moreover, many instructors prefer teaching asynchronously for several reasons (Finol, 2020). First, streaming videos and live meetings require fast internet connections, which not all students have access to, and low-speed internet can influence course quality. Second, instructors may face technical difficulties such as audio and video troubleshooting, which can take up a significant portion of online meetings. In asynchronous courses, instructors can take their time to set up the learning path and maintain good course quality. Additionally, student conflicts in personal schedules can prevent students from logging in on time for live meetings, particularly in large classes. Finally, an hour-long lecture or live meeting can be tiring for both the instructor and learners. However, concerns regarding online learning have been reevaluated in light of COVID-19. Due to policy changes implemented by the CDC, schools now have the option to provide a hybrid approach that combines online and in-person learning, catering to the needs of students who prefer face-to-face interaction while providing greater flexibility for those who face health or scheduling difficulties. Additionally, the pandemic has had a

significant impact on the global economy, prompting many individuals to return to school or pursue education in their spare time. As a result, the demographics of traditional college students are changing, with older adults seeking higher education, individuals returning to school to complete their degrees, and those seeking new career paths. This new blended learning style is better suited for these nontraditional, part-time, and remote learners (McKenzie & Solovyova, 2021; Irani-Kermani et al., 2021; Whalley et al., 2021).

In conclusion, synchronous and asynchronous distance learning systems, as well as their hybrid forms, have had a tremendous impact on the educational scene, especially in light of the coronavirus 2019 epidemic. While each technique has advantages and disadvantages, combining different modalities of learning has the potential to produce a more engaging, inclusive, and adaptable educational experience for students with diverse needs and situations. As the pandemic continues to have an impact on the world and the way we approach education, more research into the challenges and opportunities presented by these modes of learning will be critical to the development of effective and accessible online learning environments that cater to the evolving needs of students and educators alike.

The Challenges of Online and Hybrid Teaching: Decentralization and Desynchronization

With the rapid expansion of technology and its associated fields, agreement on standard definitions and terminologies remains a challenge among practitioners and researchers in the domain of learning technology. Online learning has been defined as the ability to access learning activities through technology, and it has been characterized as a contemporary form of remote learning that provides access to educational opportunities for nontraditional and disadvantaged learners. Hybrid course delivery methods have emerged as a blend of in-person classroom instruction and online activities. The fundamental differences between online and in-person learning are explored through three key domains: decentralization, open source, and desynchronization. This chapter focuses on the impact of these domains on teaching and learning methodologies in virtual education, including the challenges and opportunities they present. The research question for this chapter is as follows: How do decentralization, open source, and desynchronization impact teaching and learning

methodologies in virtual education? The hypothesis is that these domains have profound impacts on teaching and learning methodologies in virtual education.

Agreement on standard definitions and terminologies remains elusive among practitioners and researchers as the domain of learning technology and its associated fields continue to expand (Lowenthal & Wilson, 2010; Volery & Lord, 2000; Moore et al., 2011). The majority of authors define online learning as the ability to access learning activities via technology (Benson, 2002; Conrad, 2002; Carliner, 2004). Scholars have characterized online learning as a contemporary form of remote learning that provides access to educational opportunities for nontraditional and disadvantaged learners (Benson, 2002; Conrad, 2002). For the purposes of this chapter, online learning and teaching denote online lectures delivered through software such as Zoom, Webex, and Microsoft Teams. Hybrid course delivery methods incorporate a blend of in-person classroom instruction and online activities. This approach minimizes the amount of time students spend in traditional face-to-face courses and increases the emphasis on online course delivery (Mupinga, 2005).

Virtual learning represents a significant departure from traditional in-person education, with numerous changes in teaching and learning methodologies. This session focuses on three key domains—decentralization, open source, and desynchronization—to explore the fundamental differences between online and in-person learning. Decentralization arises from the internet's nonhierarchical, parallel structure, in contrast to the traditional instructor-centered, top-down approach (Gaynor, 1998; Sawada & Ragatz, 2005). In-person education used to revolve around the instructors, who held a dominant role in teaching activities. However, virtual teaching and learning have altered this dynamic. Participants indicated that they no longer felt at the center of online education. For instance, in Zoom teaching, instructors may appear to be at the center, but in reality, no one is. Simply being a network administrator does not automatically confer gravitational centrality to instructors.

First, virtual learning is characterized by a lack of centralized authority or hierarchy, with course-related information and content distributed equitably among the network's nodes (Hemetsberger & Reinhardt, 2009). Students can access online materials easily and quickly by entering keywords into the search engine during or after virtual courses. However, this instant search capability may discourage students from communicating with instructors, leading to a decrease in the instructors' prominence

as the primary course content resource. Based on feedback from participants and course evaluations, it is evident that students tend to ask fewer questions during virtual classes and instead search for answers to their course-related questions online. This trend was observed among the fifteen professors from ten different disciplines who were interviewed. In laboratory classes, students collaborate online using tools such as Google Docs, Overleaf, or Co-Lab and ask fewer questions than they would in traditional face-to-face classes. This is especially true in quantitative fields such as engineering and math, where there are numerous mathematical formulas to consider. In in-person instruction, students can ask questions and interrupt the lecturer at any time if they encounter a problem. However, in online education, students tend to seek immediate answers to their questions from websites such as Google, leading to the dilemma that students who seek direct answers may not gain a thorough understanding of the solutions. This approach may lead to a lack of deeper comprehension of problem solving, which can pose difficulties during examinations where questions may be changed, and students may lack a profound grasp of the reasons for the absence of the correct response. Hybrid methods now make it easier for instructors to ask questions, with students more inclined to ask questions during in-person encounters with their instructors. Many instructors remain online for ten to fifteen minutes after class to assist students with their questions. However, students still ask fewer questions online than they would during in-person or hybrid classes, which could impact the self-motivated learning goal, a critical factor in adult learning (Lin & Wang, 2015).

Second, virtual education introduces desynchronization as a means of disseminating teaching and learning. Online learning behavior is autonomous and spontaneous rather than unified and constant. It is not practical to expect everyone to attend and leave class simultaneously over the internet. However, making it a standard is not appropriate because it does not align with the internet's characteristics. The internet's most significant advantage is that it eliminates space-time boundaries, enabling learning to occur anytime and anywhere. Instructors can record their lectures and upload them to platforms such as Canvas or Blackboard after class. Consequently, students do not miss the course or lose access to original course materials; they can watch the lecture videos without temporal and spatial limitations. For students, teaching and learning no longer need to occur concurrently in time and space. However, they must engage in online learning within a limited time frame (Lin & Gao, 2020).

Moreover, desynchronization in teaching and learning offers teachers and students greater flexibility. Along with text materials, the internet provides instructors with an array of multimedia resources, such as graphics, photos, videos, streaming media, virtual reality, augmented reality, and mixed reality, that cannot be conveyed verbally or acquired through conventional face-to-face instruction. These multimedia tools can assist instructors in presenting concepts and formulas more efficiently and naturally. Studies have shown that multimedia can help readers and viewers remember more content in stimuli and create a comprehensive mental representation of the content (Luan, 2016, 2021; Luan et al., 2022). Desynchronization also provides teachers with buffer time for course preparation and student inquiries. For example, one professor stated that he had to teach a course he had never taught before because another instructor had to take medical leave in the middle of the semester. In addition to flipping through the syllabus, online resources provided him with a time buffer to answer students' questions, allowing him to search for answers and prepare a proper interpretation for students. Online learning presents significant challenges for students. They are exposed to an environment rich in information and distractions, lacking the traditional learning environment of a classroom and the dialog with peers seated next to them. They can only learn by observing the instructor's online instruction and after-class videos, and they must address their problems through text input, such as email or online chat, or explore the web for solutions. However, the information, knowledge, and skills acquired through online learning surpass the scope stipulated in teaching materials and syllabi. Information acquisition, screening, selection, integration, reorganization, online communication, and multitype cooperation are essential skills in the current era, and they represent core literacy and skills for future career development.

In effect, decentralization offers a more effective and structured methodology for teaching and learning in hybrid education. Based on the interviews, most courses during the 2020 school year were hybrid, with students completing one week of online courses and one week of in-person courses. During the second week of in-person instruction, students were encouraged to ask questions, which required them to complete their homework while engaging in an online lecture or watching a video.

In contrast to traditional in-person instruction, this technique requires students to be more present in class and actively engage with the teacher's teaching model. Students must be proactive in identifying academic issues

and finding answers to their queries, receiving new information from the teacher's response. The pandemic facilitated the transition from passive to active learning for students. Furthermore, many professors have had students lead other lab members in group reading activities, such as the Reading Club/Journal Club, during the pandemic. For example, ACLab at Northeastern University offers two hours of student-led learning activities every Monday morning through Zoom meetings, alternating between a reading club and a journal club. Students can use the mark functions provided by Zoom to highlight key points in papers, while other students can post their questions through the chat function responding to the paper. The media research lab at Peking University provides an alternative way for students to exchange their ideas and make comments on other students' research opinions by using the WeChat group chat function. WeChat is a free messaging and calling application available for iOS, Android, Windows, and MacOS. During the online lecture, students are allowed to post their opinions or questions in the WeChat group. After class, each student is required to review the chat history and write a reflection essay. By offering more opportunities to express their ideas without interrupting the lecture, students feel more involved in the course content.

Through the preceding examination of online and hybrid instruction, it is evident that the most significant factor influencing virtual learning is teaching methods and that teaching and learning as a whole are undergoing a profound transformation. For instructors, the centrality of instructors in traditional education has diminished, and the need to harness the characteristics of the network to develop more intuitive and effective teaching content is a new challenge to their teaching design and abilities. Students' self-discipline and online learning skills are critical variables in ensuring the quality of virtual learning.

The analysis of online and hybrid instruction highlights the significant transformation taking place in teaching and learning as a whole. Decentralization, open source, and desynchronization are the three key domains that impact teaching and learning methodologies in virtual education. Decentralization offers a more effective and structured methodology for teaching and learning in hybrid education, where students must be more present in class and actively engage with the teacher's teaching model. Desynchronization provides teachers with buffer time for course preparation and student inquiries while offering greater flexibility to students. The challenges and opportunities presented by these domains are essential to consider for developing intuitive and effective teaching

content in virtual education. Ensuring the quality of virtual learning depends on students' self-discipline and online learning skills, emphasizing the need for instructors to harness the characteristics of the network to develop effective teaching strategies.

Types of Coupling Work with Students

The coronavirus 2019 has had a huge influence on the area of education, with traditional classroom-based learning taking place in virtual or online schooling. The semantic base space (SBS) hypothesis provides a useful framework for understanding communication processes in both traditional and online classrooms (Hougaard et al., 2022). Instructors establish the presentation space, while students develop the SBS space to evaluate and comprehend the material received. While online learning offers some advantages, such as overcoming time and space constraints, it also has considerable drawbacks. This begs the question of how teachers and students can react to these changes and maximize the benefits of virtual training. This section investigates the pros and downsides of online learning, as well as the changes in teaching styles that have arisen in reaction to the epidemic. While virtual instruction offers considerable obstacles, instructors who adapt their teaching approaches and use technology may create an interesting and successful learning environment for their students.

Oakley's notion of Semiotic Base Space suggests that there exists a semiotic space in all forms of communication. This SBS is connected to two "input" spaces, namely, the Presentation Space and the Reference Space (Hougaard et al., 2022). The reference space relates to the subject at hand, the signified item, while the signifier is introduced in the presentation space. The construal in the presentation space and the object in the reference space are combined in the virtual blend space. Notably, blending in the virtual blend space is performed by an interpreter whose concerns restrict the relevant emergent inferences.

Teaching is essentially a form of communication or interaction between instructors and students to transfer knowledge. Instructors are responsible for constructing the original version of the presentation space, while students are responsible for reprocessing the information by creating the SBS space to recognize, reconstruct, and analyze the received information. Online teaching is a form of education and instruction in an open virtual environment. In this virtual arena, instructors and students, students and students, and students and learning resources can be linked indirectly via

the network and terminal devices. Terminal devices present and exchange information via interactive windows on the local device (computer or laptop); hence, this interaction can only be local and directional. Therefore, every information interchange is a process of SBS space building and interpretation for students.

While the benefits of online learning in overcoming temporal and spatial limitations are apparent, there are also several drawbacks. Both students and instructors must create multiple semiotic base spaces through a network platform/channel to facilitate two-way communication. If several SBS spaces are produced or switched simultaneously, instructors and students must invest additional cognitive resources to transition and integrate different SBS environments. In the case of live lecturing, instructors are unable to capture the full reaction of students, as the camera's scale limitation obscures their body language, a crucial means of conveying meaning (Parrill & Sweetser, 2004). This poses a challenge for teachers attempting to engage with students without the ability to capture feedback signals. Additionally, the involvement of a vast range of networks and electronic devices often necessitates technical assistance to resolve any issues that may arise at any time. For example, certain courses may require a large chalkboard to be used during instruction, which is readily achievable through traditional in-person teaching using a marker and whiteboard. However, with virtual instruction, particularly through the Zoom platform, professors must log into two separate electronic devices: one for video and viewing student responses and another (an iPad, for instance) for writing on the chalkboard. Given the screen size, the lecturer must devote a significant amount of time writing while simultaneously paying close attention to students' responses and ensuring the proper display and preservation of the blackboard's content.

Participating in online instruction can place students in a vulnerable situation, where their attention is easily diverted. Without the physical presence of instructors and a common learning environment, students are prone to distractions, particularly when they encounter difficulties in understanding the course material. They may be hesitant to interrupt their instructors and ask questions, leading to a loss of focus and feelings of burnout and isolation. To address this issue, instructors need to adjust their teaching plans and approaches to accommodate the challenges of virtual learning. Interviews with instructors revealed that they spent significant time reviewing recorded videos to observe students' facial expressions and better understand their comprehension of the course content.

Some instructors also took a more personalized approach, reaching out to students directly to provide additional support and assistance in problem solving. Others allowed students to submit questions through Zoom's private chat feature during online lectures, which the instructor would periodically check and address. These measures not only ease students' concerns about interrupting the lecturer or being recorded but also help them stay engaged with the lecture and overcome any learning obstacles they may encounter.

Based on the responses from interviewees, hybrid learning, particularly during in-person sessions, required CDC-mandated safety measures that involved seating two students on opposite ends of a long table, thus requiring instructors to move back and forth between workstations to attend to student inquiries and guide their discussions. Another advantage of online education mentioned by the interviewees was the abundance of data available on student behavior, such as time spent on the online platform, number of logins, and assignment performance, which can be utilized to measure student engagement quantitatively. However, online tests present a challenge, as students may perform exceptionally well due to access to online resources during the exam, resulting in a decline in performance without such resources, highlighting the issue of academic integrity in the online learning environment.

The utilization of PowerPoint presentations as a primary teaching method has undergone a significant transformation since the outbreak of the epidemic. Prior to the pandemic, PowerPoint presentations were not the mainstay of instruction. Instructors had the liberty to expand and supplement their presentations in the classroom based on student input. However, with the transition to online education, this paradigm has shifted. Instructors must now prepare comprehensive PowerPoint presentations, incorporating multimedia channels to convey information more effectively due to the lack of instant and direct feedback from students. Consequently, lecturers must anticipate the difficulties and misunderstandings that students may encounter while introducing complex concepts, placing themselves in the position of the students.

During the discussion on the integration of technology with education, a comparison was drawn between teaching strategies before and after the pandemic, including the preparation of PowerPoint presentations, responding to students' questions, and tracking their performance. It is evident that technology has had a significant impact on the relationship between instructors and students, with the link evolving as the educational

environment changes. Technology has become not only an instrument and method of education and instruction but also the foundation of the educational environment, fostering a collaborative relationship between instructors and students. As such, many professors would not be able to teach in the postpandemic era without the teaching methods and tactics they became accustomed to during the pandemic. Some instructors who previously had little experience with electronic gadgets have become so proficient in using them that they can no longer function without them. For instance, in a machine learning class with at least seventy-five students, the instructor requires that all students have their cameras turned on. Therefore, the instructor uses a supersized screen to display all the students' windows while utilizing a computer to display PowerPoint presentations and an iPad to display chalk writing. The instructor also offers random questions based on the students' facial expressions on the screen or allows for free discussion.

The coronavirus 2019 epidemic has changed schooling, resulting in a considerable move toward virtual instruction. This section discusses the advantages and disadvantages of online learning and the influence of technology on teaching practices. The Semiotic Base Space Theory provides a valuable foundation for comprehending the communication process in virtual education. While online learning offers substantial obstacles, instructors who adapt their teaching techniques and skillfully use technology may provide their students with an interesting and effective learning environment. It is clear that technology has evolved into more than just a tool and technique of education and instruction; it has also become the cornerstone of the educational environment, creating a collaborative interaction between instructors and students. As a result, to maximize the benefits of virtual training, lecturers and students must continue to adapt to the changing educational landscape.

Collaboration Levels

The teaching assistant (TA) system distinguishes the American educational system from the Chinese educational system. TAs help teachers handle large enrollment classes, offering critical support to both students and instructors. The coronavirus 2019 epidemic has had a huge influence on how TAs engage with instructors, with many sessions now taking place on virtual platforms. TAs have also been given new tasks, such as gathering feedback from students during online lectures and solving student

concerns. This raises concerns about how the TA job has evolved throughout the epidemic, as well as the effectiveness of instructors' innovative approaches. This section will look at the study topic and hypothesis: How has the function of the TA changed throughout the epidemic, and what new techniques have instructors implemented to guarantee successful collaboration with their TAs? The pandemic is said to have prompted instructors to change their communication tactics with TAs, resulting in more virtual meetings and increasing usage of online communication platforms. However, TAs have been given additional tasks, such as gathering student feedback, which has increased their burden.

The teaching assistant (TA) system is one of the distinguishing features between the Chinese and American educational systems based on the investigation from the PI's interview. While most Chinese universities do not provide TAs to instructors, under the American education system, instructors with course sizes exceeding thirty students are assigned at least one TA. Collaborating and communicating with TAs is thus an equally essential aspect of ensuring teaching quality for American instructors.

Typically, teaching assistants (TAs) hold office hours to assist students with questions and provide feedback to professors, enabling instructors to refine their teaching plans and methods. According to the interviewees, the pandemic also affected the instructors' previous collaboration approaches with their TAs. Before the pandemic, instructors and TAs would meet to clarify their respective roles and duties. However, due to the pandemic, presemester meetings were canceled or shifted to online platforms such as email or Zoom. TAs' responsibilities, which previously required their physical presence in the classroom, became a part of online instruction during the semester, with TAs joining Zoom meetings like other students. Since most interviewees were unable to meet their TAs in person, they would outline all of the TAs' responsibilities and commitments in the initial email. Thus, TAs had a comprehensive understanding of their roles and duties through the clear TA descriptions provided by instructors.

Moreover, online education has bestowed upon TAs an additional responsibility of collecting feedback from students during online lectures and subsequently sharing it with the instructors. Some TAs also serve as research assistants to the instructors and therefore have a better understanding of the course material and teaching methods. Hence, they can assist the instructor in providing solutions to the challenges and problems faced by students. Prior to the pandemic, TAs were required to meet with

instructors in person on a weekly or biweekly basis to report on student performance and questions. However, with the convenience of online communication, TAs can now send emails or messages via communication channels such as Slack to instructors at any time, enabling faster feedback and appropriate revisions by the instructors.

The TA system is a key component of the American educational system, offering valuable assistance to both students and professors. Coronavirus 2019 has prompted instructors to change their cooperation techniques with TAs, focusing increasingly on virtual meetings and online communication channels. TAs have also been given extra tasks, which has increased their burden. The innovative tactics chosen by teachers have both advantages and downsides, and they will most certainly continue to change as the epidemic diminishes. Nonetheless, teamwork between instructors and TAs is crucial for guaranteeing instructional quality and student success.

Technology Issues

Technology integration in education has changed the way students study and gain information. In recent years, the emphasis in education has turned to encouraging collaborative learning and creating a varied learning environment, with online education playing an important part. With the spread of the internet, online education has become a need, necessitating the resolution of technological difficulties and solutions related to online instruction. According to the interviews, the biggest technological problem connected with online education is coordinating the usage of numerous software applications. This section will look at the technological problems of online training and highlight some of the ways instructors have used to overcome them.

The research question and hypothesis offered are as follows: What are the key technological obstacles connected with online training, and what solutions have instructors used to meet these challenges? It is expected that the use of technology in education will continue to increase and affect the way students learn and apply information and that tackling technological challenges related to online instruction is crucial for the online education system's success.

As technology continues to advance and be applied in education, the focus of schooling is shifting from simply imparting textbook knowledge to facilitating collaborative learning among students and constructing a diverse learning environment. When considering the future of education,

it is important to address technical issues and solutions associated with online instruction, particularly in response to the pandemic. According to the interviewees, the primary technical challenge associated with online education is coordinating the use of various software programs. As previously mentioned, instructors often require multiple devices for chalkboard writing and multimedia presentations. Instructors also employ a range of simultaneous presentation and student interaction strategies. Some have experimented with writing and streaming on paper using phones set vertically on their desks, while others use software that allows PDF files to be annotated, such as Liquid. On Zoom, instructors can preprogram the course into a PDF and deliver it to students in a screen share format, using Liquid's many color markers, highlighting, drawing, and other functions to illustrate course content and essential topics during their explanations.

In coding-focused classes, instructors may utilize simultaneous editing platforms such as Overleaf or Google Colab. These platforms allow students to collaborate on a project document and enable multiple students to register online concurrently, enabling instructors to observe their coding problems in real time. However, these software programs are not free and require instructors to submit an application to the school to purchase them. Additionally, some instructors utilize platforms such as Piazza to foster interaction and discussion among students. Students are required to post their questions on the platform based on the day's events and are encouraged to participate in postclass conversations about the course material. These activities assist students in cultivating their self-regulation abilities, which are crucial for performing well in coursework (Lin et al., 2020; Lin & Dai, 2022).

Indeed, the limitless nature of knowledge and the constantly evolving technological landscape highlight the importance of teaching students' skills beyond mere content acquisition. The shift toward online education has further emphasized the need for students to develop the ability to critically evaluate and select information, as well as to apply and adapt that knowledge to solve complex problems. With the increasing availability and accessibility of online resources, students can become self-directed learners, taking ownership of their education and pursuing their interests and passions. Instructors can play a vital role in facilitating this process by guiding students toward reputable sources, encouraging collaboration and discussion, and providing opportunities for practical application and experimentation. Overall, online education has not only expanded access

to knowledge but also transformed the way in which students learn and apply that knowledge in real-world contexts.

The use of technology in education has increased access to knowledge and revolutionized how students learn and apply that knowledge in real-world circumstances, especially during the COVID-19 era. While the change to online education has given various benefits, it has also posed technological hurdles that teachers must overcome to ensure the quality of online learning. Coordination of the usage of numerous software applications has been a main technological problem connected with online training, and instructors have devised a variety of ways to handle this issue. As technology evolves and is employed in education, overcoming technological issues related to online instruction will be critical in guaranteeing the success of the online education system.

Conclusion

Through the preceding discussion of the online and hybrid education challenges, coupling work with students, collaboration levels, and technology issues, the traditional "visible" school-based method of instruction is turned into the "invisible" web-based mode of instruction. Teaching and learning are no longer a specific time for students and teachers to congregate in a single location but across time and space through the network platform, from conventional chalkboard writing to advanced multimedia and multiway displays. Specifically, in-person instruction is an educational and instructional activity conducted in a confined physical environment. Instructors and students, students and students, and students and learning resources are in full three-dimensional touch in this physical area, making interaction highly convenient. Instructors routinely interact with students during instruction, especially in small class settings. Through direct observation, eye contact, discourse questions, responses, and the sense of atmosphere, instructors will consciously or subconsciously modify the topic, tone, speaking speed, and even instruction. Students also receive the impression that they are being closely cared for. The atmosphere of collective learning in the classroom also enhances students' attention, while the classroom is usually separated from outside disturbances. The comparison of online, hybrid, and in-person learning is shown in Table 5.1.

During the COVID-19 pandemic, online and hybrid instruction was initially considered a temporary replacement for in-person learning.

Table 5.1 Comparison of three types of teaching methods

	In-person	*Online*	*Hybrid*
Temporal requirement	Instructors and students appear at the same time	Students should present themselves at the course time but may have some flexibility	No requirement
Spatial requirement	Instructors and students appear at the same physical location	No	Yes
Communication signals	Body language, oral expression, facial expression, eye contact	Verbal expression, facial expression (limited), eye contact (limited), online chat	Body language, oral expression, facial expression, eye contact
Requirement for instructors	Low demands in capturing the students' feedback	Highest demands in capturing the students' feedback	Could capture the students' feedback during the in-person meeting
Synchronical need	Yes	No	Mixed
Learning environment	High	Easy distraction	High for an in-person meeting
Technology requirement	Low	High	High for online teaching and low for the in-person meeting

However, it is not just a stop-gap solution but an essential and inevitable development for future education. Virtual education is not meant to replace traditional classrooms but to enhance them by adapting to technological advancements. The pandemic presents an opportunity to accelerate the acceptance of virtual education and increase social awareness about the core concept and future of education. The focus should be on understanding the purpose of education, fostering adaptability among students to diverse learning environments, enabling collaboration online and offline, and presenting course material successfully and vividly. These are the challenges that traditional education must address to keep pace with the changing needs of students and advancements in technology.

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Appendix: Interview Questions

Basic Questions

1. How many courses did you teach before the pandemic, and did they change during the pandemic?
2. Could you tell us the average classroom size before and during the pandemic?

3. What is the most challenging issue in your teaching during the pandemic?
4. How do you make the course materials relevant in terms of complexity for students with different levels of field knowledge?
5. Name three of your greatest strengths in your teaching style; have they remained the same during the online/hybrid teaching in the past three years? How do you bridge the abstract concepts with real-world examples, keeping the contents up to date?

Knowledge of Common Ground

1. Could you briefly explain a course you taught last year? What teaching methods do you employ in addition to direct instruction?
2. How do you get student feedback if you're concerned about the content you have taught?
3. How do you make accommodations for a smart student in your online class?
4. How do you monitor the performance of students during online learning outside of exams?
5. What are your thoughts on an inclusive classroom?

Coupling of Work Types

1. Give us an example of how you dealt with students' questions before the pandemic and another example of your solution during online teaching (in class and after class)
2. What is your PPT-making strategy before the pandemic? How about during the online teaching?
3. How did you allow students to express their creativity and ideas before the pandemic? Are you following the same strategy during online teaching? Give us an example.
4. What do you do if the whole class is "not getting it"?
5. How many exams are in your course? Did you change the number of exams due to online teaching? How do you know this is a good amount?
6. How do you connect your class and your students to the real examples?

7. What software or approaches do you use during online teaching?
8. How do you identify students' distractions?

Collaboration Level and Evaluation

1. What is your classroom management plan before the pandemic? What has changed during the pandemic? What do you wish to accomplish with it?
2. Do you have an active TA? Could you describe the TA's duty before and during the pandemic?
3. How do you communicate with your TA? How does your TA report the issues he/she encountered in his/her work? How did you deal with it? Could you give us an example? Give us an example of effective communication with your collaborator and your TA.
4. How do you develop self-esteem with students?

Technology Issues

1. What is the biggest challenge in technology you encountered during your online teaching experience?
2. What software or techniques do you use for tracking students' performance in the class?
3. What software or techniques do you use to communicate with your students after class?
4. What if students do not have access to the recommended computer? What is your solution?
5. What are the digital and online resources for you to distribute to your students in preparing for the class? Are you showing more videos in your online teaching? Do you prefer to use online teaching tools?

Random Questions at the End

1. What was the most important thing you learned from your teaching experience during the last three years?
2. What was the most impressive thing you encountered in your teaching experience during the last three years?

References

Ahshan, R. (2021). A framework of implementing strategies for active student engagement in remote/online teaching and learning during the COVID-19 pandemic. *Education Sciences, 11*(9), 483.

Ali, A., & Smith, D. (2015). Issues in informing science and information technology comparing social isolation effects on students attrition in online versus face-to-face courses in computer literacy. *Issues in Informing Science and Information Technology, 12*, 11–20.

Benson, A. D. (2002). Using online learning to meet workforce demand: A case study of stakeholder influence. *Quarterly review of distance education, 3*(4), 443–452.

Bowers, J., & Kumar, P. (2015). Students' perceptions of teaching and social presence: A comparative analysis of face-to-face and online learning environments. *International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), 10*(1), 27–44.

Brierton, S., Wilson, E., Kistler, M., Flowers, J., & Jones, D. (2016). A comparison of higher order thinking skills demonstrated in synchronous and asynchronous online college discussion posts. *NACTA Journal, 60*(1), 14–21.

Carliner, S. (2004). *Overview of online learning.* Human Resource Development Press.

Chiu, T. K. (2022). Applying the self-determination theory (SDT) to explain student engagement in online learning during the COVID-19 pandemic. *Journal of Research on Technology in Education, 54*(sup1), S14–S30.

Clinefelter, D. L., & Aslanian, C. B. (2015). *Online college students 2015: Comprehensive data on demands and preferences.* The Learning House, Inc.

Collison, G., Elbaum, B., Haavind, S., & Tinker, R. (2000). *Facilitating online learning: Effective strategies for moderators.* Atwood Publishing.

Conrad, D. (2002). Deep in the hearts of learners: Insights into the nature of online community. *Journal of Distance Education, 17*(1), 1–19.

Finol, M. O. (March, 2020). Asynchronous vs. Synchronous Learning: A Quick Overview. *Bryn Mawr College.* Retrieved from https://www.brynmawr.edu/blendedlearning/asynchronous-vs-synchronous-learning-quick-overview

Francescucci, A., & Rohani, L. (2019). Exclusively synchronous online (VIRI) learning: The impact on student performance and engagement outcomes. *Journal of Marketing Education, 41*(1), 60–69. https://doi.org/10.1177/0273475318818864

Frimming, R. E., & Bordelon, T. D. (2016). Physical education students' perceptions of the effectiveness of their distance education courses. *The Physical Educator, 73*(2), 340.

Gaynor, C. (1998). *Decentralization of education: Teacher management* (Vol. 292). World Bank Publications. https://doi.org/10.1596/0-8213-3810-2

Gregory, V. L. (2003). Student perceptions of the effectiveness of Web-based distance education. *New Library World, 104*(10), 426–431.

Hemetsberger, A., & Reinhardt, C. (2009). Collective development in open-source communities: An activity theoretical perspective on successful online collaboration. *Organization Studies, 30*(9), 987–1008. https://doi.org/10.1177/0170840609339241

Horvitz, B. S., Garcia, L. R., Mitchell, R. G., & Calhoun, C. D. (2019). An examination of instructional approaches in online technical education in community colleges. *Online Learning, 23*(4), 237–252.

Hougaard, A., Oakley, T., & Coulson, S. (2022). Who's talking? Cognitive semiotics in the (new media) wild. *Cognitive Semiotics, 15*(1), 47–73. https://doi.org/10.1515/cogsem-2022-2003

Hrastinski, S. (2008). Asynchronous and synchronous e-learning: A study of asynchronous and synchronous e-learning methods discovered that each supports different purposes. *Educause Quarterly, 31*(4), 51–55.

Kim, D., Park, Y., Yoon, M., & Jo, I. H. (2016). Toward evidence-based learning analytics: Using proxy variables to improve asynchronous online discussion environments. *The Internet and Higher Education, 30*, 30–43.

Lederman, D. (2020, March). Will shift to remote teaching be boon or bane for online learning? *Insider HigherEd*. Retrieved from https://www.insidehighered.com/digital-learning/article/2020/03/18/most-teaching-going-remote-will-help-or-hurt-online-learning

Lin, X., & Dai, Y. (2022). An exploratory study of the effect of online learning readiness on self-regulated learning. *International Journal of Chinese Education, 11*(2), 2212585X22111193. https://doi.org/10.1177/2212585x221111938

Lin, X., & Gao, L. (2020). Students' sense of community and perspectives of taking synchronous and asynchronous online courses. *Asian Journal of Distance Education, 15*(1), 169–179.

Lin, X., & Wang, C. H. (2015). Factors that affect returning to graduate school for international and American adult learners. *Institute for Learning Styles Journal, 1*(2), 40–53. https://doi.org/10.5430/irhe.v1n1p1

Lin, X., Dai, Y., Shi, H., & Li, C. (2020). E-learners' satisfaction as predictors of online classroom community. *Journal of Contemporary Education Theory & Research, 4*(2), 12–19.

Lowenthal, P., & Wilson, B. G. (2010). Labels do matter! A critique of AECT's redefinition of the field. *TechTrends, 54*(1), 38–46. https://doi.org/10.1007/s11528-009-0362-y

Lowenthal, P., Dunlap, J., & Snelson, C. (2017). Live synchronous web meetings in asynchronous online courses: Reconceptualizing virtual office hours. *Online Learning Journal, 21*(4), 177–194. https://doi.org/10.24059/olj.v21i4.1285

Luan, L. (2016). Finding a Basic Interpretive Unit through the Human Visual Perception and Cognition-A Comparison between Filmmakers and Audiences (Doctoral dissertation, Bowling Green State University).

Luan, L. (2021). *How readers process narrative information involving characters' decisions* (Doctoral dissertation, Bowling Green State University) https://etd.ohiolink.edu/apexprod/rws_olink/r/1501/10?clear=10&p10_accession_num=bgsu1636587253464058

Luan, L., Liu, W., Zhang, R., & Hu, S. (2022). Introducing Cognitive Psychology in Film Studies: Redefining Affordance. *International Journal of Education and Humanities, 2*(3), 70–78.

Mairing, J. P., Sidabutar, R., Lada, E. Y., & Aritonang, H. (2021). Synchronous and asynchronous online learning of advanced statistics during Covid-19 pandemic. *JRAMathEdu (Journal of Research and Advances in Mathematics Education), 6*(3), 191–205.

McDaniels, M., Pfund, C., & Barnicle, K. (2016). Creating dynamic learning communities in synchronous online courses: One approach from the Center for the Integration of Research, Teaching and Learning (CIRTL). Online Learning, 20(1), 110–129. https://doi.org/10.24059/olj.v20i1.518

McKenzie, M., & Solovyova, M. (2021). Pivoting to Remote Learning: Our Practices for Supporting Non-traditional International Students and Part-time Contract Instructors.

McMahon, M. (2013). A study of the causes of attrition among adult on a fully online training course. *Irish Journal of Academic Practice, 2*(1), 10. https://doi.org/10.21427/D7XQ63

Mihai, M., Albert, C. N., Mihai, V. C., & Dumitras, D. E. (2022). Emotional and social engagement in the English language classroom for higher education students in the COVID-19 online context. *Sustainability, 14*(8), 4527.

Moore, J. L., Dickson-Deane, C., & Galyen, K. (2011). E-learning, online learning, and distance learning environments: Are they the same? *The Internet and Higher Education, 14*(2), 129–135. https://doi.org/10.1016/j.iheduc.2010.10.001

Mupinga, D. M. (2005). Distance education in high schools: Benefits, challenges, and suggestions. *The clearing house: a journal of educational strategies, Issues and Ideas, 78*(3), 105–109.

Mutmainah, S., Marwiyah, S., Balqis, R. R., Ghina, N. N., & HI, M. M. (2023). The effectiveness of e-learning on Indonesian language general course during

Covid-19 pandemic in Jember University. In *AIP conference proceedings* (Vol. 2679, No. 1, p. 060006). AIP Publishing LLC.

Mykota, D., & Duncan, R. (2007). Learner characteristics as predictors of online social presence. *Canadian Journal of Education, 30*(1), 157–170.

Norberg, A., Stöckel, B., & Antti, M.-L. (2017). Time Shifting and Agile Time Boxes in Course Design. *The International Review of Research in Open and Distributed Learning, 18*(6). https://doi.org/10.19173/irrodl.v18i6.3182

Parker, E. B., Short, J., Williams, E., & Christie, B. (1978). The Social Psychology of Telecommunications. *Contemporary Sociology, 7*(1), 32. https://doi.org/10.2307/2065899

Parker, M. A., & Martin, F. (2010). Synchronous virtual classrooms: Student perceptions from an online and blended education course. In *2010 International conference on technology for education* (pp. 93–100). IEEE.

Parrill, F., & Sweetser, E. (2004). What we mean by meaning: Conceptual integration in gesture analysis and transcription. *Gesture, 4*(2), 197–219. https://doi.org/10.1075/gest.4.2.05par

Parte, L., & Herrador-Alcaide, T. (2021). Teaching disruption by COVID-19: Burnout, isolation, and sense of belonging in accounting tutors in e-learning and b-learning. *International Journal of Environmental Research and Public Health, 18*(19), 10339.

Pattillo, R. E. (2007). Decreasing transactional distance in a web-based course. *Nurse Educator, 32*(3), 109–112. https://doi.org/10.1097/01.NNE.0000270224.38543.2f

Prentiss, S. (2021). Speech anxiety in the communication classroom during the COVID-19 pandemic: Supporting student success. *Frontiers in Communication, 6*, 642109.

Riggs, S. A., & Linder, K. E. (2016). Actively Engaging Students in Asynchronous Online Classes. IDEA Paper# 64. IDEA Center, Inc.

Rovai, A. (2002). Building sense of community at a distance. *International Review of Research in Open and Distance Learning, 3*(1), 1–16. https://doi.org/10.19173/irrodl.v3i1.79

Ruiz, J. G., Mintzer, M. J., & Leipzig, R. M. (2006). The impact of e-learning in medical education. *Academic Medicine, 81*(3), 207–212. https://doi.org/10.1097/00001888-200603000-00002

Sagirani, T., Ferdiana, R., & Kumara, A. (2013). "The framework of learning media development for the children with special need." *Proceedings of the 2013 IEEE International Conference in MOOC, Innovation and Technology in Education, MITE 2013*, pp. 180–184. https://doi.org/10.1109/mite.2013.6756330

Sawada, Y., & Ragatz, A. B. (2005). Decentralization of education, teacher behavior, and outcomes. *Incentives to Improve Teaching*, *255* https://doi.org/10.14507/epaa.29.5279

Schulman, C. (2020, April). I used to shut my windows to New York's noise. Now I long for a honking horn. Washington Post. https://www.washingtonpost.com/outlook/2020/04/09/new-york-silent-coronavirus

Shackelford, J. L., & Maxwell, M. (2012). Sense of community in graduate online education: Contribution of learner to learner interaction. *The International Review of Research in Open and Distance Learning, 13*(4), 228–249.

Shim, T. E., & Lee, S. Y. (2020). College students' experience of emergency remote teaching due to COVID-19. *Children and Youth Services Review, 119*, 105578.

Taner, A., Akyıldız, S., Gülay, A., & Özdemir, C. (2021). Investigating education faculty students' views about asynchronous distance education practices during Covid-19 isolation period. *Psycho-Educational Research Reviews, 10*(1), 34–45.

Volery, T., & Lord, D. (2000). Critical success factors in online education. *International Journal of Educational Management*. https://doi.org/10.1108/09513540010344731

Vonderwell, S. (2003). An examination of asynchronous communication experiences and perspectives of students in an online course: A case study. *The Internet and Higher Education 6*(1), 77–90. https://doi.org/10.1016/s1096-7516(02)00164-1

Whalley, B., France, D., Park, J., Mauchline, A., & Welsh, K. (2021). Toward flexible personalized learning and the future educational system in the fourth industrial revolution in the wake of Covid-19. *Higher Education Pedagogies, 6*(1), 79–99.

Woods, R. H., Jr. (2002). How much communication is enough in online courses?—Exploring the relationship between frequency of instructor-initiated personal email and learners' perceptions of and participation in online learning. *International Journal of Instructional Media, 29*(4), 377.

Yamagata-Lynch, L. C. (2014). Blending online asynchronous and synchronous learning. *The International Review of Research in Open and Distributed Learning, 15*(2). https://doi.org/10.19173/irrodl.v15i2.1778

Young, S., & Bruce, M. A. (2011). Classroom community and student engagement in online courses. *Journal of Online Learning and Teaching, 7*(2), 219–230.