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## Synchronous Tools for Interaction and Collaboration

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# Synchronous Tools for Interaction and Collaboration

Patrick R. Lowenthal

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## Abstract

The history of distance education in many ways is a history about the evolution of synchronous and asynchronous communication technologies. Distance education, and online learning in particular, has primarily relied on asynchronous communication technologies over the years. However, COVID-19 has sparked a new interest in using synchronous tools for interaction and collaboration in open, distance, and digital education. Given this it is incumbent upon educators and researchers alike to be familiar not only with the current iteration of synchronous communication technologies but also with how they have developed and evolved over time, the affordances and constraints of synchronous communication, interaction, and collaboration, some of the different types, and the overall implications for future research and practice.

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Synchronous communication · Asynchronous communication · Real-time communication · Chat · Audioconferencing · Video conferencing · Web conferencing

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**Introduction**

Open, distance, and digital education have evolved almost overnight with the demands of the COVID-19 pandemic. To be clear, open, distance, and digital education are not new. Distance education in the form of correspondence education dates back to the 1800s (Wedemeyer, 1981); open education, in the form of open universities, has been around since the 1960s (Tait, 2008); and digital education in its various forms (e.g., radio, television, online) has evolved throughout the last 100 years (Casey, 2008; Saba, 2011; Saettler, 2004). However, even with college enrollments in online learning consistently growing, and recently outpacing traditional in-person enrollments, before COVID-19, only about a third of students took online courses, and fewer instructors taught online (see Jaschik & Lederman, 2016; Seaman, Allen, & Seaman, 2018). This all changed with COVID-19. Within a couple of months, nearly every teacher and student on the planet gained some experience with distance and digital education (Stewart, 2021). However, as others have pointed out, the actual implementation of distance and digital education during COVID-19 has been more often than not an ad hoc version of distance and digital education (Hodges, Moore, Lockee, Trust, & Bond, 2020). Most colleges and universities found themselves with little time and resources and often little if any prior experience with distance education. Confronted with the need to continue teaching traditional in-person face-to-face courses at a distance, many faculty chose to simply hold classes online in live synchronous web meetings using web conferencing tools like Zoom, Google Meet, Microsoft Teams, or Webex (Dias, Lopes, & Teles, 2020; Lederman, 2020a, b). Web conferencing tools like these have enabled instructors and students to meet at the same time as their normally scheduled class but from a distance during COVID-19. These tools have also enabled administrators, faculty, and staff to work successfully from a distance during the pandemic (Lowenthal, West, Archambault, Borup, & Belt, 2021). Despite some of the challenges that arose with using these tools, many people suspect that communication technologies like these will continue and increasingly be used in both inside and outside of the classroom in various capacities in higher education when this pandemic is over (Dias et al., 2020; Lowenthal et al., 2021). Therefore, it is incumbent upon educators and researchers alike to be familiar not only with the current iteration of synchronous communication technologies but also with how they have developed and evolved over time, the affordances and constraints of synchronous communication, interaction, and collaboration, some of the different types, and the overall implications for future research and practice.

## Evolution of Synchronous Communication in Distance Education

Synchronous communication is communication that happens at the same time or what some describe as in real-time (e.g., communicating in-person face-to-face, talking over the phone, meeting in a web conference). Synchronous communication is usually compared and differentiated from asynchronous communication in which communication does not happen at the same time or in real-time (e.g., when sending a letter or an email). The history of distance education in many ways is a history about the evolution of synchronous and asynchronous communication technologies. As new technologies, and specifically communication technologies, were developed, educators have experimented with how they could be used for teaching and learning (Garrison & Anderson, 2003). Over the years, as new forms of communication technology have become more mainstream, forms of distance education using that new technology have increased in popularity as educators gained more familiarity and expertise with using it (Garrison & Anderson, 2003; Harasim, 2000).

Most people trace the history of distance education back to early forms of correspondence study in the 1800s (McIsaac & Gunawardena, 1996). This early form of distance education relied on asynchronous communication via the postal service; students would receive lessons in the mail and then mail the completed lessons back to a tutor to correct them (Bower & Hardy, 2004). This early form of distance education enabled learners to be able to learn essentially from any place and at any time—an ideal and defining characteristic of distance education (see Garrison, 2009). However, due to the reliance on the postal service, there was little interaction between a student and a tutor.

During the 1920s, educators began experimenting with using radio and then later television to broadcast lessons for people to learn at a distance (Casey, 2008; Saba, 2011). This new form of broadcasting distance education enabled educators to communicate with a larger audience while still being able to learn from anywhere that had access to the broadcast. Despite these advantages, it strayed away from the ideal that one could learn at any time. It also did not provide a way for learners to interact with their instructor or peers and therefore did not enable back and forth synchronous communication and interaction (McIsaac & Gunawardena, 1996). This type of distance education continues to persist, even today, but it still has never arguably become mainstream, likely because of issues like this as well as issues of the cost, infrastructure, and planning required to deliver this type of distance education. Thus, broadcasting forms of distance education were never able to fully replace earlier forms of correspondence study (Garrison & Anderson, 2003; McIsaac & Gunawardena, 1996). Instead, advances in recording technology enabled educators the ability to supplement correspondence study print materials with audio and video cassettes, thus preserving the benefits of being able to learn from anywhere, at any time (Gunawardena & McIsaac, 2004; McIsaac & Gunawardena, 1996).

This all began to change during the 1980s. Educators were interested in finding better ways to not only share instructional materials but also to communicate and interact with students from a distance. As the rise of the Internet and personal computers grew during the 1980s, educators began to experiment with using

computer-mediated communication to communicate and interact with groups of learners from a distance (Harasim, 1986, 2000; Moore, 1989). For instance, Linda Harasim (1986) is often attributed with offering the first for-credit online course in 1986 in which she had a group of learners posting in text-based asynchronous discussion forums over the course of a semester. While it took some time to catch on and grow, online learning became the most prevalent form of distance education during the 1990s and 2000s (Rovai, 2009). These early iterations of online learning largely relied on asynchronous text-based communication (i.e., email and discussion boards) to interact, communicate, and collaborate with one another.

Online learning has continued to grow over the years. However, even long before COVID-19, many argued that there was not one type of online learning (Lowenthal, Wilson, & Parrish, 2009; Moore, Dickson-Deane, & Galyen, 2011). Rather, online learning has manifested itself in different ways based not only on its use of technology but also other situational factors (e.g., for credit vs. not for credit; synchronous vs. asynchronous; self-paced vs. group paced). Academics have tried to develop taxonomies to help differentiate and make sense of these differences (Garrison & Anderson, 2003). With that said, early on and in many ways still to this day, one of the most common ways to differentiate online learning is by how instructors and students meet, interact, and communicate with each other. Thus, educators have often simply differentiated between in-person face-to-face, blended/hybrid, and online courses—and more specifically, between synchronous or asynchronous online courses. As helpful as it can be to describe and differentiate online courses in this manner, it fails to recognize that few courses have ever truly been 100% synchronous or asynchronous. For instance, even courses that primarily used and relied on synchronous communication (e.g., instant messaging, web conferencing) also used other forms of asynchronous communication (e.g., email, a discussion forum, or a grade book in a learning management system); just as courses that relied heavily on asynchronous communication might use synchronous forms of communication to some degree (e.g., initial kickoff meetings on campus, phone calls, proctored exams or office hours on campus). As web conferencing technology has advanced and become more reliable during the last decade, educators have increasingly experimented with intentionally using both synchronous and asynchronous communication in online courses; some have described this practice as “blended online learning” (Fadde & Vu, 2014; Power, 2008) while others have more recently described it as bichronous learning (Martin, Polly, & Ritzhaupt, 2020). Around the same time, others began experimenting with providing even more flexibility by blending all possible course formats into what has been referred to as multi-access (Irvine, 2009; Irvine, Code, & Richards, 2013) and hybrid-flexible course design or HyFlex (Beatty, 2007, 2019). These types of courses have attempted to be what Smith, Reed, and Jones (2008) referred to as mode neutral, enabling students to choose to attend courses in person or online—whether synchronously or asynchronously—each week.

A few things are clear. Distance education has continued to evolve over the years. This evolution has been influenced in part by advances in technology as well as a desire to balance the ideals of anytime anywhere learning with regular interaction

and collaboration. Early adopters have been eager over the years to experiment with new technologies; however, ultimately it is the pedagogy and perceived affordances and not simply the technology that influences which new iterations persist and grow (Garrison & Anderson, 2003; Irvine, 2020; Lowenthal & Mulder, 2017). Putting issues of labeling and semantics aside, boundaries between in-person face-to-face and online learning are disappearing with the help of COVID-19; most courses in higher education in the coming years will likely entail a blend of synchronous and asynchronous communication. But questions remain on which types of tools one should use and why.

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## Affordances and Constraints of Synchronous Communication

Online learning, from the first online course during the 1980s until today, has relied mostly on asynchronous text-based communication (Peterson et al., 2018). As mentioned earlier, this has enabled instructors and students to interact, collaborate, and ultimately learn from any time and from any place. However, despite affordances like these, people have been skeptical and even overtly critical of online learning, largely because of the perceived drawbacks of text-based asynchronous communication (Lowenthal & Dunlap, 2020; Oztok et al., 2013). Education is a social process that relies on social interaction and communication. Text-based asynchronous communication, though, has been criticized over the years for being inherently task-based and inadequate with relational and social communication (Lowenthal, 2010). More specifically, people have pointed out how text-based asynchronous communication lacks visual cues, takes time for conversations to develop, and can lead to misunderstanding or in educational settings it can feel like busywork (Gao et al., 2013; Fadde & Vu, 2014; Murphy & Coleman, 2004).

Research suggests, though, that synchronous communication might be able to address many of the challenges of text-based asynchronous communication (Johnson, 2006; Watts, 2016). For instance, synchronous communication, whether text-based (e.g., chat), audio-based (e.g., conference call), or video-based (e.g., web conferencing), happens in real-time. Communicating in real-time makes communication more efficient; it can help solve problems and clarify meaning by enabling one to pick up on one's tone and to ask follow-up questions, which in turn can help improve not only overall communication but ultimately the ability to collaborate (Lowenthal et al., 2017; McDaniels et al., 2016). In addition to the affordances of real-time communication, video-based synchronous communication enables people the ability to look others in the eyes, see their body language, and improve affective communication by establishing immediacy and social presence (Belt & Lowenthal, under review; Hrastinski, 2008; Park & Bonk, 2007; Parker & Martin, 2010). Web conferencing applications, in particular, enable participants the ability to share and view, discuss, and create materials in real-time—and even record meetings for later (asynchronous) viewing (Snyder & Garner, 2020).

However, despite the affordances of synchronous communication, it is not a panacea; there are a number of notable constraints with synchronous

communication. Perhaps most notable is that synchronous communication requires participants to meet in real-time, at the same time. It can be challenging, and sometimes even impossible, to find a time that works for everyone to meet—especially, when students might live across the world or simply have busy lives or nontraditional work schedules (Liu & Alexander, 2017; Lowenthal et al., 2020; Themelis, 2014). People also regularly face technical difficulties when using web conferencing applications, such as poor audio or video quality, often due to poor broadband connectivity (Lowenthal et al., 2021). Broadband issues, coupled with practices to require students to turn on their webcam, can also highlight inequities and aspects of students' lives that they could keep private in text-based asynchronous discussions (Bali & Meier, 2014). At the same time, affordances are lost when all or most students keep their webcam off or when the enrollment is so high that it makes it difficult to make eye contact, view one's body language, or even see all students webcam (see Day & Verbiest, 2021; Dennen, Word, & Arslan, 2021; Lowenthal et al., 2021). This is not to mention how class sessions held in web conferencing applications can turn into long lectures, which can encourage disengagement, distraction, and multitasking and result in students feeling frustrated and even exhausted (Lowenthal et al., 2020; Schulman, 2020).

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## Overview of Synchronous Tools

Educators have used a variety of synchronous tools over the years to improve interaction, communication, and collaboration in open, distance, and digital education. In the following section, some of the main types of synchronous tools used by educators, how they have been used and are currently used, and some relatively newer and emerging synchronous tools will be discussed.

### Audio-based Tools: Telephone and Audio Teleconferencing

The telephone was the first widespread tool used in distance education for real time two way communication (Barron, 2004). Educators began experimenting with using the telephone for real time communication in the 1930s and 1940s but it did not become more commonplace until the 1970s and 1980s with audio teleconferencing (Garrison, 1985). There were four main ways that educators used the telephone as an instructional aid during the 1970s (i.e., teleteaching, telelecturing, dial-access, tele-tutoring; Flinck, 1975). Then, during the 1980s, universities even began offering “audio courses” for college credit (Olgren, 1997). This all became possible because as Garrison (1985) explains,

audio teleconferencing built upon the foundation of correspondence study by enhancing the quality of the interactive process among students and teacher. The ability of the student to receive immediate feedback from the teacher as well as fellow students without a

corresponding loss of independence is a significant development in distance education. (p. 237)

Advances in telecommunications soon enabled educators to supplement audio teleconferencing with images or data transmissions (i.e., audiographic conferencing) and then video (Wolcott, 1994). But when people talk about audio-based synchronous tools in distance education, they are usually focusing on what Garrison (1985) referred to as the second generation of distance education and differentiating it from video or web conferencing (which will be discussed later). The telephone—whether that be with traditional landlines, cell phones, or VOIP (e.g., Skype)—is still used today to supplement distance education, however, it is often used more for one-to-one communication between an instructor and a student (Dunlap & Lowenthal, 2010). And while this is not scalable in many ways, Garrison (1985) pointed out that “the use of the telephone by a teacher for instructional purposes is perhaps the most personalized use of telecommunications in distance education” (p. 237).

While a telephone or audio teleconferencing can add two-way real-time communication to distance education and online learning, it still (for the most part) lacks a visual channel and therefore as Wolcot early on pointed out “the abilities to both convey messages and to relate interpersonally is strained when the participants cannot see one another” (p. 141).

## **Text-based Tools: Chat and Messaging**

Another common type of synchronous tools used in open, distance, and digital education are text-based chat and messaging tools. Text-based chat dates back to the early days of the Internet (Chatterjee, Abhichandani, Li, TuLu, & Byun, 2005). While the technology and features have changed over the years (e.g., Many chat applications today also enable video and/or asynchronous features), even in the early day’s text-based chat was defined by short, rapid, text-based conversations happening in real time (Preece, Maloney-Krichmar, & Abras, 2003). These chat and messaging tools essentially could be used one-on-one in a private text-based chat or in a many-to-many group chat format (e.g., in chat rooms).

Internet relay chat, in particular, was created in the late 1980s (Chatterjee et al., 2005); though chat and messaging arguably did not become mainstream until the late 1990s with the development of applications like AOL Instant Messenger. But by the mid-1990s, educators were already experimenting with using chat and instant messaging in distance education courses (Duin & Arhee, 1996; Kimbrough, Hochgurtel, & Smith, 1998). The use of text-based synchronous chat increased even more once learning management systems (LMS) began including their own chat tools. For instance, Kirby (1999) used chat rooms in WebCT to have online debates; students were apprehensive at first but after the second debate Kirby stated “were overwhelmingly positive about the synchronous learner-learner interaction and the activity as a learning experience” (p. 204). Early on researchers found that while text-based asynchronous discussions might be better for deep reflection,

synchronous chats were sometimes more effective with simulating a real conversation, building a sense of immediacy and community, and establishing social and teaching presence which in turn can decrease feelings of loneliness (Motteram, 2001; Stein et al., 2007; Wang & Chen, 2007). However, researchers quickly identified some drawbacks to chat and messaging tools. They found that they could favor fast typers, fast thinkers, and native speakers of a language, and lead to out-of-sync contributions and confusion, while also presenting accessibility issues (Bober & Dennen, 2001; Calvo, Arbiol, & Iglesias, 2014; Stein et al., 2007). Given this, researchers like Cox et al. (2004) concluded that chats should be supplemented with other forms of communication (e.g., text-based discussions). Thus, while chat and instant messaging tools continue to be used in open, distance, and online learning, they are often used in conjunction with other communication technologies. Further, increasingly chat and messaging apps today tend to have synchronous and asynchronous capabilities leading some to describe things like chat as almost being semi-synchronous because while you can see when someone is online and chat in real time, you can also send a message to be read and replied to sometime in the future when the other person is not online or not available to chat at that time.

## **Video-based Tools: Video and Web Conferencing**

Video-based tools – sometimes called videotelephony, video conferencing, or web conferencing – are the most used synchronous communication tools today. Video conferencing dates back to the 1960s (Correia, Liu, & Xu, 2020); however, for the first few decades, special equipment was needed to essentially connect two or more locations – such as two different classrooms. Video conferencing, though, arguably did not really begin to catch on until the early 2000s with the development of applications such as Webex and Macromedia Breeze and the increase of high speed broadband Internet.

These new web conferencing applications eliminated the need for special equipment and for the first time allowed teachers and students to log on and join a web conference from anywhere with a stable high-speed internet connection. By the mid-2000s, educators were increasingly experimenting with using web conferencing for distance education, whether that be by offering weekly synchronous class sessions, supplemental synchronous sessions (e.g., review sessions, class presentations, guest presenters), or even weekly office hours. However, just as Cox et al. (2004) recommended in terms of using text-based chat, rarely have educators solely used web conferencing to teach a distance or online course; at minimum, email but often a learning management system are used in conjunction with these video-based tools.

From these early days until today, most web conferencing applications include a number of different synchronous applications—thus, making it difficult to truly label any of them simply as “video-based tools”. For instance, they include not only the ability to share video through a webcam but also the ability to share audio and text-based communication in real time as well as the ability to screen share, share files,

and complete polls to name a few others. To complicate matters further, instructors and/or students can use a web conferencing application like Webex or Zoom and choose not to enable or use certain features. For example, an instructor can enable students to turn their webcams on or to use audio to communicate with others but students can choose to simply chat with others using text only.

Around 2010, companies started developing video chat tools (e.g., Skype and FaceTime) that enabled people to use video-based synchronous communication in one-on-one or in small groups. Instructors and students continue to use tools like this in distance and online learning but for the most part they are either in ad-hoc situations or for small groups but its use has never been as popular as web conferencing.

### **Other Synchronous and Semi-Synchronous Tools**

There are still a number of other tools like online whiteboards that can be used without a web conferencing application or a number of tools that might better be classified as semi-synchronous because they can be used asynchronously or synchronously depending on when and how they are used. For instance, tools like Jamboard or Padlet that enable instructors to use them in real time like a whiteboard but students can also collaborate asynchronously over a period of time. Then there are other social networking tools like Twitter that have been used a lot in massive open online courses to enable students an authentic way to collaborate with other learners in a course as well as a larger community of practice. Tools like twitter enable users to post and for other users to view and if they choose to respond after the fact or if they are online at the same time (e.g., for twitter chats or as a back channel during live events) they can respond and chat in real time. Different tools like this, though not unlike web conferencing applications, continue to blur the boundaries between classifying something as purely synchronous or asynchronous.

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### **Implications for Research and Practice**

Research on open, distance, and digital education suggests that while there are some inherent affordances and constraints with different communication technologies, ultimately the success of using these communication technologies—whether they are synchronous, asynchronous, or even semisynchronous—depends not only on situational factors (e.g., how they are used in a given learning environment, the context they are used, etc.) but also on the experience, comfort level, and actual use of participants. For instance, web conferencing applications have the potential to address many of the constraints of text-based asynchronous communication; however, this assumes things such as that all of the users have their webcams on, that the group is not too large, and that the instructor is using the tool in an interactive, if not collaborative, way. Therefore, as the use of synchronous tools, and specifically synchronous video-based tools increases, more research needs to be conducted to

find out under what contexts and which ways do adding synchronous tools to courses make up for the inconvenience of taking away the benefit of learning from any time that they want.

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