Asynchronous Tools for Interaction and Collaboration

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Contents

Abstract

The shift from conventional classrooms to the use of various types of distributed education is well documented in the literature. This shift occurred over the past 30 years, if not longer. Open, distance, and digital education (or ODDE) has become ubiquitous in education and training in a variety of settings such as the military, business, higher education, and K12 schools. More recently, ODDE has seen a rise in use in other settings, such as health care organizations. Although both synchronous and asynchronous technologies are available for teaching and learning, it appears that asynchronous tools are predominant in these settings. The use of asynchronous tools is the primary focus of this chapter, with consideration of both the technologies employed and the strategies applied. The purposes are to summarize their appropriate uses in terms of collaborative learning and share any insights to guide future research and practice. The chapter begins with a brief definition of terms used in this chapter along with descriptions of the types and

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purposes of asynchronous tools. The chapter culminates in directions for future research as well as any improvements in ODDE practice.

Keywords

Asynchronous tools · Interaction · Collaboration · Technologies · Strategies

Introduction

Open education can be viewed narrowly as being focused on OER and MOOCs (Zawacki-Richter & The COER Group, 2020). A broader view considers open education as being the dissemination and access to education and training to widen participation for all (Wikipedia, 2021). Zawacki-Richter and The COER Group (2020) views open education as an umbrella term to encompass distance and digital education. However, one distinction among the terms is with distance education in that it is often found in formal educational settings, whereas open education may be found in both formal and informal settings. However, as technologies and ways of learning evolved, distinctions tend to blur. The inclusive term: open, distance, and digital education and its acronym (ODDE) will be used in this chapter. ODDE can be found at all levels of education and in a variety of settings, such as the military, business, higher education, and K12 schools (Moore, 2019; Zawacki-Richter & Naidu, 2016; Zawacki-Richter & The COER Group, 2020). ODDE has given rise in other settings, such as the health sciences (Glover & Bodzin, 2021).

The various environments of open education, or ODDE, can be considered synchronous, asynchronous, or both. Generally speaking, *synchronous* is participants being together at the same time, but at either the different location (Davidson-Shivers, Rasmussen, & Lowenthal, 2018), whereas *asynchronous* is when participants may be in different places and at different times. Again, these two terms have seen a merging and blending over the years due to new technologies being used in terms of face-to-face, blended or hybrid, or fully online or at a distance type of environments (Petronzi & Petronzi, 2020). With newer technologies, participants may meet or work together simultaneously even when they are in different time zones and locations. The focus in this chapter is asynchronous tools for interaction and collaboration.

A Brief Review of Early and Current Research

Early research indicated an interest in media comparison; that is, whether online learning is better or worse than on campus learning or comparison of different types of mobile learning. Zawacki-Richter and Naidu (2016) among others pointed out such comparisons were not promising or helpful. Later, Bozhurt et al. (2015) using bibliometrics found that the highest ranking conceptual or theoretical background

concepts were community of inquiry, collaborative learning, constructivism and connectivism, blended learning, and transactional analysis. Although some of these concepts or topics are still present in the literature, others are found as well. They include online social communities, socialized e-learning, mobile assisted language learning, and game-based learning among others (Chen & Kinshuk, 2020). One other area, instructional design theories, was mentioned in Bozhurt et al.'s (2015) article. Chen et al. (2020) also found that case studies were mentioned often.

Defining Interaction and Collaboration

A basic definition of *Interaction* is when two or more people communicate or act together for mutual or reciprocal influence. Moore (1989) identified three types of interaction needing to occur for learning to place: student to instruction (or content), student to student, and student to instructor. Student to instruction is when the student is connecting to information and activities contained within the [ODDE]. Student-to-student interactions occur when participants interact with each other on an individual, small group, or large group basis and should facilitate some affiliation with each other (Davidson-Shivers et al., 2018). With student to instructor, the instructor and participants communicate with each other directly through many various formats: emails, feedback on assignments, and general communiques; these formats may be either on an individual or group basis (Davidson-Shivers, 2009). Northrup (2002) identified a fourth type of interaction, the student-to-learning management system (LMS), in which learners are able to see their grades, post assignments, and so on.

Collaboration is defined as when participants communicate and work together to complete a task or achieve a common goal. Through the use of participants' interactions and collaborations, a learning community may form. Collaborative learning is considered as a strategy to help students engage in activities to encourage a collaborative process to share and create information and meaning (Inchaouh & Tchaïcha, 2020). At a basic level, the elements of a learning community include the instructors, learners, and the instructional information (Davidson-Shivers et al., 2018) and given Northrup's (2002) fourth interaction type, the environment itself. To form a learning community, they provide not only cognitive presence from shared ideas and experiences, but also may form a shared or social presence by sharing skills and developing mutual relationships (Gast as cited in Mahoney & Hall, 2020).

Furthermore, collaborative learning is a situation in which participants communicate with each other to improve their learning and is best when they share information, ask questions, provide their own reflections, and learn or attempt to learn something together (Goodman, Geier, Haverty, Linton, & McCready, 2001). Such participation often assists learners to form some type of learning community (Palloff & Pratt, 2007) in which they can be cognitively and socially engaged in activities and construct new understandings (Inchaouh & Tchaïcha, 2020. Inchaouh and Tchaïcha (2020) also suggest that collaborative learning is thought to be

effective because students gain new habits and approaches to gain new information while interacting with each other or the instructor. However, they also mentioned a few challenges might occur when a team organizes and the following results occur: a) the free ride effect, when a member does not complete their tasks, b) the sucker effect, when a member does all the work, or c) the silo effect in which members split the task and work alone and later combine their information or product at the end; these effects often lead to poor quality results and inefficiencies (Nebel et al., 2017).

To reduce such an intended outcome, various instructional tools and strategies can promote participant collaboration and interaction. Such tools and strategies among others might be used to not only meet student needs, but support collaborative efforts as well.

Asynchronous Tools for Teaching and Learning

Additionally, another way to consider asynchronous tools as the hardware and software, or technologies with a second way being to view tools as instructional or learning strategies (Lai, 2020). The advancement in these current technologies has the potential for students to enhance their negotiation skills, obtain instant feedback, and become more efficient in their learning according to Lai (2020). However, even when the advancement in the technologies is promising, it is only when appropriate technologies are used along appropriate instructional strategies that the potential of student engagement can be effective (Bozhurt et al., 2015; Clark & Mayer, 2016a, 2016b). Thus, asynchronous tools can also be considered as the instructional/learning strategies used to support student learning in such environments (Mahoney & Hall, 2020).

Background on Asynchronous Tools and Use of Technologies

Although the Internet was developed and in use in the 1960s, it was not until the mid-1980s that wider applications for teaching occurred (Zawacki-Richter & Naidu, 2016). Access to the Internet was through Local area networks and Wide area networks (Davidson-Shivers et al., 2018) and communications were a text-based form of communication (Al Tawil, 2019). Harasim (2012) stated online applications had become a part of traditional courses in a substantial manner during this time. The early asynchronous technologies mainly consisted of discussion boards or forums and chats. However, with the advent of the World Wide Web or Web, graphics could be combined with text-based applications and access became easier. With the inclusion of graphics, new forms of technology were developed for use in ODDE. Currently the ODDE environments, comprised of interrelated and integrated components which interact with each other, facilitate online learning situations through LMSs. These open environments have had exponential growth in education and training (Seaman, Allen, & Seaman, 2018).

The advancements in technologies such as interactive whiteboards, webcams, web simulations, and video conferencing made such things possible. New media continue to be developed and used (Mahoney & Hall, 2020). The main technologies currently in use are as follows:

Discussion boards/threaded discussion. Discussion boards and threaded discussions refer to e-learning applications using a text-based forum in which the instructor posts discussion topics (Chen & Kinshuk, 2020). In this student-centered environment, learners are tasked with responding to the initial prompt and are required to also read and respond to classmates (Jo, Park, & Lee, 2017). This interaction is to facilitate the learners' exposure to alternate ideas, experiences, and perspectives of their peers as well as sharing their own. With discussions, there are pros and cons for their use.

Pros: Ability to participate in discussions about the content with others and the instructor can occur irrespective of time and place. Opportunity to reflect on and ponder the topic and readings before responding is valued. Non-native language participants have additional time to compose their responses.

Cons: Opportunities for misunderstandings, going off topic, bullying, and/or domination of the conversation can occur if immediate feedback from the instructor is missing. Some students delay posting to the forum that can be frustrating for early responders and lead to a less dynamic interchange.

Instant messaging or IMs. Messages sent via mobile, wireless, and desktop devices allow real time text chat in a pop-up notification window to a select list of recipients (Rambe & Bere, 2013). Message metadata may include timestamps and messages can contain links to images, websites, podcasts, and maps (Robles, Guerrero, LLinas, & Montero, 2019).

Pros: IMs promote social interaction. They can support immediate communication notices and facilitate group cohesion (Sun, Lin, Wu, Zhou, & Luo, 2018).

Cons: Learners may engage in off-topic conversations. They might be less effective at generating knowledge construction (Rambe & Bere, 2013; Sun et al., 2018).

Social media. Social media apps are designed with features to promote social interaction (Akcaoglu & Lee, 2018). They have an advantage over learning management systems (LMS) which are designed to hold course content, assignments, and assessments in a format more conducive to task management.

Pros: facilitates connections between formal and informal learning (Gurjar, 2020). Familiarity with social networking sites can increase the likelihood of students using the tools and interacting with each other and with the course content (Beach & O'Brien, 2014; Pallas, Eidenfalk, & Engel, 2019).

Cons: Learners may attend to social connections to the detriment of engaging with the course content and may not make connections between social content and the learning objectives. Heavier workload for the instructor due to efforts to post,

administer the social site, and patrolling for student misconceptions and even cyberbullying. The social media platform privacy settings and business model may be contradictory to the academic institution's requirements.

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Screencasts (authoring tools) capture recordings of a computer screen accompanied by explanatory video (Wakefield, Tyler, Dyson, & Frawley, 2019). Captured recordings can include text, audio, video, slides, and webcam images.

Pros: Screencasts promote active learning and can increase skills identified in Bloom's Digital Taxonomy, such as communication, creativity, and multimedia skills (Wakefield et al., 2019).

Cons: The technological infrastructure needs can be vast and vary greatly with different tools. File storage needs vary with some requiring cloud storage and others' needing local storage. Users may not have threshold technology skills needed to use the tool. LMS integration varies across platforms.

Video conferencing is a digital learning environment using the Internet to broadcast one-to-many, or one-to-one, instruction sessions either synchronously, prerecorded, or recorded during broadcast for sharing at a later time. Video conferencing supports the transmission of information for instructional and noninstructional purposes. Instructors and students can use video conferencing to send and receive information and communications to complete learning objectives (Gegenfurther & Ebner, 2019).

Pros: Video conferencing is effective at facilitating academic achievement and positive outcomes are possible for foundational or procedural knowledge whether presented as a single event or over time. Longer broadcasts can be more effective than shorter ones, but no optimal duration has been identified.

Cons: Many platforms lack social opportunities such as comments, likes, and emojis that might promote interactions.

Gamification/role play/simulations refers to the addition of game structures and elements for educational purposes. Gamification can be achieved through the use of quests, simulations, role-play, and quizzes and often incorporates multimedia elements, hand-held mobile devices, and a variety of Web-based tools (Faiella & Ricciardi, 2015; Karaaslan et al., 2018).

Pros: Gamification of instruction elicits motivation to learn and facilitates a host of cognitive, behavioral, and affective skills development. It is useful for problem-based learning, developing critical thinking, and creative exploration. Gamification is appropriate for business and humanities disciplines and in employee training and development.

Cons: Some students may exhibit resistance to group competition. Gamification relies on sufficient student self-efficacy and technological skills. The novel effects of game use may affect learning outcomes when the novelty wears off. This tool or strategy is not appropriate for final assessment. They can be time consuming to design.

Interactive whiteboard/slide show/collaborative canvas are online interactive shared digital screens for writing and sketching, to which multimedia, audio, and images can be added during collaborative assignments (Ng, Ting, Lam, & Liu, 2020; Sweeney, Beger, & Reid, 2021).

Pros: Most tools in this category feature the ability to record and share activities for later viewing; zoom features for close-up views. They provide a means to facilitate student interaction and collaboration and they promote social interaction. These tools can support a self-directed learning experience and students can access many of them via mobile devices and desktop browsers. Group assignments are supported with features that allow multiple participants to work on one board at the same time. Lesson and project templates are freely available. The nonpermanent surface supports student exploration of topics.

Cons: Some learners may experience high cognitive load and resist using these tools. Preinstruction lessons for teaching the tool can be time consuming. There are some limits to the size of the board and some tools do not allow audio and video media.

Podcasts are serially broadcast information in audio format presented as lectures, conversations, commentaries, and interviews. Broadcasts can be streamed live on the Internet and are downloadable to be listened to on digital and mobile devices for just-in-time listening (Shiang, Cerniglia, Lin, & Lo, 2021; Elekaei et al., 2020).

Pros: Podcasts contribute to improved listening skills and the variety of topics covered is vast. They are easy to access and share via desktop or mobile devices.

Podcasts are motivating to students as an alternative to text-based content and they can be listened to while performing other activities. Podcasts support independent study and learning.

Cons: Podcast transcripts are often not available. Students may become over-whelmed and not listen when they perceive podcasts to be extra work and they are not suitable for long, elaborated lectures. Podcasts are subject to fading or sporadic broadcasts. There is a lack of empirical research on knowledge retention when using podcasts for instructional purposes.

Blockchain/badging. Blockchain is a network of encrypted databases housing a digital ledger of educational credentials (Weller, 2020). It is a binder, or e-portfolio, for diverse academic accomplishments and credentials such as formal course work, degrees, certifications, badges, and Personal Learning Environment (PLE). In a blockchain learning environment, learners choose their own learning adventure by accessing a network of open access resources (Alexander & Wang, 2019).

Pros: Users can update educational records in one place and changes are populated across the network of databases linked by blockchain. Employers and academic institutions have access to applicants' credentials without having to log into various accounts. Addresses issues of Universal Design for Learning (UDL), motivation, and self-efficacy when learners can seek out preferred learning experiences.

Cons: Its application to educational use is in its infancy. Expanded use of digital ledgers places a power consumption and the proposed transparency it offers may not be forthcoming (Weller, 2020). Blockchains in their current form appear to be expensive in terms of climate energy.

Background on Asynchronous Tools and Use of Strategies

Strategies are the design elements for individual and group activities to align with objectives; they also may be ways the instructor communicates about the content assignments and assessment methods (Rios, Elliott, & Mandernach, as cited in Mahoney & Hall, 2020). In other words, strategies are used as tools to meet student needs, build on their capabilities, and strengthen their skills to interact and collaborate with others (Davidson-Shivers et al., 2018).

To support the development of a shared community and student learning in such environments, the design elements and strategies for individual and group activities should be aligned with course objectives and the ways instructors communicate about the course goals, procedures, contents, assignments, and assessment methods (Rios, Elliott, & Mandernach, as cited in Mahoney & Hall, 2020). Such strategies among others might be used to not only meet student needs, but support collaborative efforts as well.

Theoretical underpinnings of strategy use. Online instructional strategies have come a long way from early learning communities using online discussion boards.

Expanded access to the Internet and digital technologies and devices spurred development of innovative strategies to support learning. The following are the main theoretical ideas, which relate to asynchronous tool use.

Clark and Mayer's Guidelines. Clark & Mayer (2016a, 2016b) suggest that asynchronous and synchronous instruction share a common goal in support of collaboration and interaction. They suggested that in order for interaction to promote meaningful learning, it requires strategies and activities to have high cognitive engagement (Clark & Mayer, 2016a, 2016b). Effective asynchronous tools can stimulate varying levels of psychological processing leading to knowledge construction. They also suggest that interaction activities should be designed to promote cognitive processing along a continuum of engagement leading to learning. The learners and learning context drive the need for varying interactions which support low to high psychological engagement (Clark & Mayer, 2016a, 2016b). At the lowest level of engagement, the instruction is designed to strengthen associations between what is already known and the new content being presented. At the high end of the continuum, instruction prompts and guides the learner toward the acquisition of new mental models. Clark and Mayer (Clark & Mayer, 2016a, 2016b) also explained that behavioral engagement such as clicking, dragging elements on screens does not lead to learning unless appropriate instructional strategies which are activities that deliberately lead to cognitive engagement. Furthermore, designing instruction that includes cognitive engagement can be effective even in the absence of physical activity. The benefit of designing instruction that includes having learners construct artifacts is in the evaluation and feedback process.

Additionally, Bozhurt et al. (2015) found that collaboration does not occur without active interactions with each other in accordance with other theoretical perspectives of constructivism and connectivism. Their findings suggested that "these theories explain how learning occurs on networks through collaboration in a community by interactions" (Bozhurt et al., 2015, p. 344) among other theories such as community of inquiry, cognitive load theory, and transactional distance theory. Bozhurt et al. (2015) also found that learner motivation and being self-regulated as well as instructional design theories were important for efficient and effective learning.

The community of inquiry. Garrison, Anderson, and Archer (1999) developed the Community of Inquiry (COI) as a framework to study text-based computer-mediated communication used to exchange ideas and experiences in online learning environments. Within the framework, cognitive presence, social presence, and teaching presence encompass a range of interactions within a dynamic relationship that can be used to influence instructional design to elicit optimal learning outcomes (Akyol & Garrison, 2008; Garrison et al., 2010).

Cognitive load theory. Sweller's (2011) Cognitive load theory (CLT) is also important to consider. It relates the amount of memory needed when learning or problem solving, especially in online environments**.** CLT demonstrates the limitations of the human brain when processing information from multiple sources. CLT posits the human brain has limited working memory capacity, and that activating auditory and visual channels as points of entry into memory facilitates remembering

and learning. This means allowing learners time on tasks to process new information with the goal of moving the information into long term memory.

When using technology tools, it is important to avoid introducing extraneous cognitive load. Providing detailed instruction on how to use a tool prior to using it in a lesson will help reduce cognitive load. During instruction, using techniques such as priming, chunking, rehearsal, and worked examples allows learners time to make connections between the new information and what they already know. The implications of CLT become apparent when faced with creating instruction using digital tools. The sheer vastness of options and features available for some tools, coupled with the complexity of becoming familiar with how to use the tool, and new content being introduced can easily lead to cognitive overload and negatively impact learning.

Transactional Distance theory. According to Moore (2019), transactional theory is based on the idea of "transactional distance as the gap between the understanding of a teacher (or teaching team) and that of a learner, and distance education is the methodology of structuring the courses and managing dialogues between teacher and learner t bridge that gap through communications technology" (p. 34). That is, as structure increases, the transactional distance increases and as dialog decreases, transactional distance decreases. For instance, in low transactional distance, in which structure is low and dialog is high, learners receive information and guidance in an ongoing, frequent manner with the instructor and the instructional materials. Lower distance might be more suitable for a less self-directed learner, whereas a learner who is highly self-directed might prefer a higher structured lesson and with less dialog.

Self-regulated theory. Bozhurt et al. (2015) suggested that learners needed to have some sense of self-regulated learning when in an open environment. Self-regulation is attributed to Bandura's early work. Self-regulation emphasizes that the learner has the capability to set goals and monitor and reflect on their learning and the outcome in a cyclical manner (Kirk, 2021; Ormrod, 2016). Rand and Davidson-Shivers (2013) suggested that online learners should have a minimal working knowledge of the computer, Web, and software applications. However, more importantly, they need to be self-directed and motivated. It also requires that learners display self-motivation and good study skills. Kirk suggests that it is different for each learner and the various learning tasks.

Motivational theories. Ormrod (2016) defined motivation as "an internal state that arouses us to action, pushes us in particular directions, and keeps us engaged in certain activities" (p. 424). Motivational theories direct designers and teachers to consider appropriate conditions to incorporate into instruction (Driscoll & Burner, 2005), and there are multiple theories which relate to student learning successfully and to participate effectively in the learning environment (Davidson-Shivers et al., 2018).

One motivational theory, Wlodkowski and Ginsberg's (2009) Motivational Framework for Culturally Responsive Teaching, works well in all types of learning. It contains four elements: establish inclusion, develop learner attitudes, enhance meaningful learning, and promote learner competence (Ginsberg & Wlodkowski,

2009) and provide strategies to assist learners to become a member of the learning community and engage in their learning processes (Wlodkowski & Ginsberg, 2010). For establishing inclusion, the strategies of using icebreakers might help learners get to know each other. Having open chats or discussions to talk about the course could also be useful for assisting students. Angleo and Cross (1993) suggest using what they call the "muddiest points" discussion or chat to clear up any misconceptions in the instruction or preconceptions in a learner's prior knowledge. A strategy for the second element, develop learner attitudes, might allow learners to choose types of assignments or project topics to help facilitate relevance and volition for learners. The next element, make learning meaningful, could be obtained by creating instruction which is engaging and challenging (to a degree) by using case studies that are challenging to allow for critical thinking and problem-solving techniques or strategies that ask learners to reflect or apply their knowledge. The last element, promote learner competence, might use the strategy of providing ways for learners to practice at various levels of Bloom's Taxonomy or Gagne's Categories of Learning (Davidson-Shivers et al., 2018).

Instructional Design Strategies for Asynchronous Teaching and Learning

Based on the various theories described above, strategies for teaching and learning become a part of the asynchronous tools. Davidson-Shivers et al. (2018) developed a strategy worksheet to assist in the design of online learning. It is based on various learning, communication, and design theories. The main four sections frame the instruction/learning process from start to finish:

1. *Orientation to learning* purpose is to draw student awareness to the instructional purposes and goal, establish learner expectations, determine learners' prior knowledge, and assist in their navigating the lesson site.
2. *Presenting the instruction* purpose is to provide the content and learning activities along with guiding the learners, allow for practice with feedback, and at the end of the lesson summarize the major concepts and help learners plan for any assessments to occur.
3. *Measuring and assessment of learning* is to provide an appropriate measurement tool that is aligned with the learning goal, advise the learners of their progress and scores, and offer remediation as necessary.
4. *Summary and closing the lesson (or unit or course)* is to provide additional opportunities for retention, remediate for unmet learning, and enhance and enrich students' learning.

Other authors such as Ko & Rossen (2017) developed guidelines for online teaching. Angleo and Cross (1993) provided information about types of assessment that can be used throughout the instruction and as ways of measuring learner knowledge, attitudes, capabilities, and needs. According to Davidson-Shivers et al.

(2018), the following list is a compilation of various strategies that could be incorporated in ODDE environments. The list of strategies is based on the work of Davidson-Shivers et al. (2018) as well as other sources cited throughout this chapter and is as follows.

Strategies used for orientation and helping the learner attend

- Use questionnaires, pretests, or advance organizers to probe learners' prior knowledge, skills, interests, and understandings.
- Use stories, scenarios, etc., to draw attention to the learning goal or purpose and expected learning performance.
- Use a concept map or other navigational tools to orient the learner to the environment.
- Use icebreakers to help build the learners' community.
- Use reflection questions to relate to personal or professional interests.
- Use advance organizers.

Strategies used for presenting instruction to facilitate learner knowledge gain

- Provide content information through a variety of media: audio, video lectures, or discovery learning.
- Elaborate on the content by interaction with experts.
- Use case studies or problems solving techniques.
- Use pertinent games or simulations for students to connect prior knowledge to new learning.
- Provide learning cues such as Socratic dialogues, pose questions.
- Highlight key information through visuals or audio
- Allow students to practice their knowledge gains through roleplaying, games, reciprocal teaching, etc.
- Provide rubrics on scoring prior to any practice or assessment.
- Provide feedback on learners' performance by text or media comments, peer reviews, automated feedback from the course site.
- Close the lesson with a review or summation of the content by instructor or students.
- Preview the next topic or task (if any) with a question or directions.

Strategies for measuring and assessing the learners

- Use low stakes quizzes or tests for units within a course.
- Use projects or roleplaying situation.
- Pose interesting questions or issues for learners to address through discussions, debates either text-based or video-conferencing tools.
- Provide rubrics or checklists to score or measure learning.
- Ask students to recall, summarize, or make meaningful connections about the content and learning.

Strategies for summarizing and closing the instruction
- For retention, ask learners to summarize or highlight main points of learning.
- For remediation, allow learners to review assessment to understand their errors and have them review the content again.
- For enhancement and enrichment, discuss how the lesson relates to future lessons.
- Ask learners to provide their next steps toward advancing their learning.
- Provide wrap-up remarks or ask students to provide them to close the lesson.

Two Issues Within ODDE Environments to Ponder

Is collaboration really necessary? Although this chapter's primary focus is on interaction and collaboration, there may be situations when interaction or collaboration with others is not necessary for learning to occur. Davidson-Shivers et al. (2018, p. 14) developed a continuum of interaction with ". . . one end, individual learners participate in independent, self-paced learning and interact with the content, but have minimal to no direct interaction with learners or the instructor" and "at the other end, participants are highly interactive with each other and the instructor and are motivated to build a sense of community." In between is a combination of both independent activities with other actions involving interaction and collaboration with other learners, the instructor and the content. Some individuals might prefer an independent, self-study mode. Transactional distance and self-regulated theories appear to suggest that some learners who are autonomous in nature might only need to interact with the instruction with the proviso that it has higher structure. If that is true, then further research is needed to determine how much structure is needed and for whom (i.e., the learner). One investigation could center around the questions of who are autonomous learners and how can they be supported in an environment that requires collaboration with others?

What happens when collaboration is needed, but does not occur? The second issue centers around learners not fully engaged or interacting with each other even though collaborative learning is viewed by the instructor as a necessary and beneficial part to their learning. Instead, student interactions may only be perfunctory with each other by doing the typical "respond once and reply twice" in a discussion. They might not always function as a team when trying to complete a team-based task or achieve specific goal, instead they tend to divide and conquer the task so-to-speak separately and then assemble the pieces together for the final product. As such, this could not be considered as collaborative, engaged learning. Although some studies have addressed this issue, further research study is necessary to address increasing effective collaboration among the students.

Summary and Conclusion

In this chapter, we have provided a brief overview of some important learning theories and best practices for designing instruction in asynchronous online learning. We offer a glimpse of technology tools that, when used appropriately, can enhance student engagement and result in positive learning outcomes.

Inventions and innovations in digital technologies have improved accessibility to programs and products that facilitate human communication processes and that can be enlisted into teaching and learning scenarios. Today instructors, learners, and content interactions are mediated through computer technologies such as personal computers, cellular phones, and mobile computing devices. Innovations in technology have borne new ways of communicating that can be visual, vocal, or textual. These types of communication have increasing implications for how teaching and learning are conducted. Clark & Mayer (2016a) provide scientific evidence supporting the efficacy of using multiple forms of computer-mediated communication when designing instruction. These multiple forms of communication enable elaborate and effective ways of communicating and they have potential to leverage student motivation, self-directed learning, engagement, and interaction in online learning environments.

A recent synthesis of student engagement with digital technologies conducted by Nkomo and Daniel (2021) reports on some issues of concern that have serious implications for the future of online learning. They caution that student engagement is a complex concept and educational researchers do not always agree on what constitutes engagement. However, this concept is extremely important in a digitally mediated learning environment because it influences academic success, soft skills development, and personal growth. Student engagement is multidimensional and includes behavioral, emotional, and cognitive components. Behavioral engagement is demonstrated when students complete assignments and plan for success. Emotional engagement can reveal itself in interest in course topics or through negative stress responses. Self-reflection and regulating learning are indicators of cognitive engagement. Nkomo and Daniel (2021) emphasize the importance of engaging all three dimensions of student engagement when designing instruction.

Eliciting appropriate engagement can be challenging for asynchronous learning and instructors should avoid using digital technologies in a way that might disengage students. By attending to the three elements of: (a) having students interact with peers, (b) making sure they can log into and navigate digital tools, and (c) by offering content in a format that can be replayed or viewed multiple times sets the stage for engagement. Careful design of instruction remains crucial to student engagement. Conducting a learner analysis and using good design principles will assist students in having a more successful learning experience.

Suggestions for Future Research

Based on this review of the literature, there are suggestions for future research. One area of research is to study emerging technology tools for use in ODDE environments. For example, Lund (2021) calls blockchain the fourth phase of the industrial revolution characterized by a level of interconnectedness and automation that will change the world. Tapcott and Kaplan (2019) predict blockchain will be a next generation network with nodes of teachers and learners connecting and collaborating across a secure and easily accessible network of knowledge resources.

Although artificial intelligence has been found in recent literature (e.g., a recent special issue of *British Journal of Educational Technology*), AI might be another focus area of future research. One area to explore is how AI can be incorporated or used as a tool for interaction and collaboration among participants in ODDE environments.

Past research appears to have focused on exploratory studies, case studies, and bibliometrics. Perhaps it is time to use what has been found in such studies and shift focus to the use of standard methodologies and large sample sizes in the research. Additionally, it would be good to pursue research to investigate how asynchronous tools (i.e., technologies and strategies) could be used to address current topics, which might include social justice issues, underserved populations, or diversity concerns and potential issues when algorithms are used in the analyses or configuration of a software application.

Implications for Practice

This chapter has three main implications for practice. First, when developing instruction in any ODDE environment, it would be wise to consider what technologies would be appropriate. The list of common technologies in this chapter, which briefly highlight pros and cons for each technology, may be one way to make that determination. Second, if either interaction or collaboration is considered important, consider the types of strategies and technologies that might be employed in the ODDE environment and choose wisely. Learners need to see they are relevant and meaningful. Third, consider whether collaboration is really necessary for the type of instruction being planned; it might not be necessary after all.

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