*Connecting Technology to Teaching-Learning*


## Abstract

Technologies have the potential to be a disruptive or transformative force in teaching. This is even more evident after covid-19 forced a digital pivot in education, which largely still functions in an analog space despite the rapid advancement in technology. The forced digital pivot helped broaden many educators' perceptions on how technology can support teaching and learning; however, it also spotlighted gaps in the tension between sound, traditional, in-person practices that have been used for centuries and the more unfamiliar teaching from a distance in an online environment that has been around for a few decades. This paper compares the practice of a-theoretical approach to using technology, or "using technology for the sake of using technology", to the theoretical approach to using technology in education. The Teaching-Learning-Technology cycle is introduced to support and guide an educator's shift in moving from the a-theoretical approach to the theoretical approach to using technology in education.

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Technologies have the potential to be a disruptive or transformative force in teaching. This is even more evident after covid-19 forced a digital pivot in education, which largely still functions in an analog space despite the rapid advancement in technology. The forced digital pivot helped broaden many educators' perceptions on how technology can support teaching and learning; however, it also spotlighted gaps in the tension between sound, traditional, in-person practices that has been used for centuries and the more unfamiliar teaching from a distance in an online environment that have been around for a few decades. With the hangover from the forced digital pivot and the incredible speed of technological advancement, perhaps we need to pause, breathe, and ask, "*another technology? Does it make sense for my teaching and my students?*" For this article, I will focus specifically on digital technology.

For the purposes of this article, digital technologies are: digital tools, services, and networks used by educators to involve students in acquiring knowledge, know-how, and skills to analyze or critique in relation to a topic, issue, or task, and apply that knowledge confidently in an authentic situation. Digital resources in this sense include, but are not limited to, proprietary software, apps on mobile devices such as iPads or smartphones, and open digital resources like online videos or websites. Digital technologies can be used by individuals to reconsider the role of teachers, the role of students, the learning environment itself, and content. Digital technologies have long been seen as tools that can be used to provide personalized learning experiences for students (Alliance for Excellent Education, 2012; Bailey, Jaggars, & Jenkins, 2015; Christensen, Horn, &

Johnson, 2011; Collins & Halverson, 2009; Felix, 2002). However, digital technologies are not the only influencer on teaching-learning experiences. For example, personal experiences, aptitude, learning preferences, expectations, along with external factors such as educational reforms (current and past), individual school cultures, and various teaching approaches may all contribute to uninspiring learning experiences. Digital technologies have the potential to change what and how educators teach as well as promote various desired workforce skills such as critical thinking, problem solving, collaboration, and communication across all content areas (Kong & Song, 2013; U. S. Department of Education, 2010). This includes designing in-class activities, both in-person and online, and assessments through vivid simulations (such as immersion in a virtual reality environment) or games (such as testing a circuit through the iCircuit app), interactions with experts in a particular field through virtual means (such as virtual worlds like Second Life), or the creation of a meaningful product by participating in a virtual community (such as creating a digital video by learning how to remix existing videos). However, it is worthwhile to keep in mind that adding digital technologies into courses and classes *does not* guarantee good teaching practices or learning experiences.

## Assembling Our Own Learning Environments

The formal learning environment within many higher education institutions has changed with the availability and accessibility of digital technologies by providing opportunities to teach and learn beyond the classroom walls. Jansen and van der Merwe (2015) argued that digital technology literacy must be part of teacher knowledge because "in order to reach today's learners, teachers need to be responsive to the learner's

experience with their culture - which is what they experience through television, movies, YouTube, the internet, Facebook, music and gaming" (p. 191). Collins and Halverson (2018) extend that concept and argue that by incorporating appropriate technology, it can lead to transformative learning experiences and expand the learning potential of our students. In 2015, I had the opportunity to attend the Emerging Learning Design Conference at Montclair State University where Richard Halverson was the keynote speaker.

Halverson's keynote addressed the *7 Technological Changes that are Reshaping Teaching and Learning*. He discussed how "technology changes lives faster than it changes institutions" and rationalized "why IT doesn't influence teaching practices." Halverson noted that there are educators who are on the extreme ends of the spectrum regarding the use of technology in the classroom. Educators who are steadfast in excluding technology in the classroom for various reasons, such as level of comfort with technology, believe that technology is a distraction. And educators who embrace technology and are technology-tinkers may become frustrated with other educators who are resistant to using technologies in their classrooms.

Beyond hardware such as computers, Halverson also brought up the idea of "assembling our own learning environments." He explained that in these learning environments, learners are engaged in the digital world such as Twitter, Instagram, Pinterest, virtual communities. These learning environments resonate with the idea that formal learning does not need to be contained within the physical walls of an institution. Instead, educators and learners with access to the internet and/or digital devices could

harness the opportunities that are available with those affordances. Halverson included a graphic during the keynote that depicted the division of **education:school** and **learners:world**. He explained that there seemed to be a distinction in how individuals in the U.S. perceived education and learning, in the sense that formal education occurred in schools, whereas learning occurred all the time as a person experienced life.

The distinction between education and learning reminded me of a quote from Joi Ito, Director of MIT Media Lab. Ito (2014) in a TED Talk said, "education is something done to you and learning is something you do for yourself." This quote may reflect some students' learning experiences in school, in which students may not be active participants in their learning or have a voice in the learning process. Thus, these students perceive that education is done to them instead of something that they want to do. This is in direct contradiction to a social view of learning.

## Theoretical Framework:

### Seeing Teaching and Learning through a Social Learning Orientation

A social view of learning is heavily influenced byVygotsky's work (discussed later in this section). From a social view of learning, educators may regard technology, for example, as a medium that can *change* or *transform* teaching and an individual's learning experiences rather than as a tool for content delivery or as a way to simply *amplify* their current teaching practices. An example of amplifying instruction is simply incorporating a digital version of a traditional practice such as substituting a PowerPoint presentation for a long-used set of overhead projector slides. Transforming instruction, instead, is when a teacher uses technology to really change the way they teach (Girod &

Cavanaugh, 2001). For instance, when using technology to transform instruction, a psychology faculty member begins by shifting their teaching practices from talking about parts of the brain or having students read about it in an in-common book to having students use the 3D Brain app. In this case, the 3D Brain app allows the students to rotate and zoom in on the whole brain and the specific brain structures. But teaching is not transformative when it just replaces content from analog form to digital form. Therefore, in a transformative conception of pedagogy, in addition to using the 3D Brain app, the students are expected to participate in small groups such as a jigsaw activity to discuss the brain's functions, associated cognitive disorders, and symptoms associated with damage, and then share their findings with the class. This kind of analysis, discussion, and collaborative writing can be done using traditional learning tools of books, pens, and paper, however, technology provides an interaction with content that does not exist using traditional learning tools. The distinction between amplification and transformation is useful because technology is widely accessible in education (National Center for Education Statistics, n. d.), but how it is used affects teaching practices and learning experiences. Thus, even though technology is widely accessible and useful, the onus, nonetheless, remains on educators to design and facilitate learning experiences using technology that offer opportunities for students to direct their own learning and learning experience and not to just use the technology as the driving force.

When using digital technology in a transformative way, students are participants instead of observers in the learning process, therefore, participating in active learning activities. Active learning is grounded in constructivist theory, which emphasizes student

participation in learning activities that contribute to their knowledge construction (Chelliah & Clarke, 2011).

Social constructivism emphasizes the importance of a student's social interactions with others along with a personal critical thinking process. This theory of learning tasks teachers with ensuring that collaboration and social interactions are incorporated into learning activities (Powell & Kalina, 2009). Social constructivism emerged from Vygotsky's research conducted in the 1930s, however, it has not been a static theory and remains a useful way of looking at how teaching and learning are conceived in research studies. Vygotsky (1978/1997) argued that learning precedes the developmental process, which is different from Piaget's cognitive constructivism view, where development is a prerequisite for learning. It is due to this particular distinction that Vygotsky emphasized that a student has a higher capacity to solve a complex problem with the support of others who are more capable compared to solving the same problem independently. That is, other individuals can influence one's learning rather than some cognitive developmental stage. Interactions and collaboration with other individuals are critical to the student's learning and development process. Vygotsky emphasized time and again the importance of social interaction in one's learning. This is a theory of learning that explicitly recognizes the powerful effects that social interaction and cultural influences have on a student and the learning process (Bonk & Cunningham, 1998; Kuiper & Wilkinson, 1998; Kundi & Nawaz, 2010; Powell & Kalina, 2009). Moreover, social constructivism resonates strongly with Brown and Adler's (2008) "we participate, therefore, we are" social view of learning. This alignment is important because it emphasizes the preference

of many current students to be connected to others, and to be participants and collaborators within a community or culture. Thomas and Brown applied this social view of learning to examining learning in the current knowledge age with technology and, as such, offers important insights into learning not necessarily addressed by Vygotsky's original work.

Thomas and Brown (2011) did not declare an explicit theoretical framework in their book, *A New Culture of Learning.* However, the new culture of learning they describe does resonate with key characteristics of social constructivist theory such as the importance of social interaction in learning and collaboration. There is an important difference between social constructivism and a social view of learning. Social constructivism focuses on how a student can learn from others who are more capable, like a teacher, while a social view of learning emphasizes learning from others through collaboration and knowledge sharing, and thus all learners function as equal participants in the learning process regardless how much they already know. This collaboration and knowledge sharing occurs even when those involved in the collaboration are not more knowledgeable. As such, Thomas and Brown (2011) challenge educators to think about how technology can be used to create new social practices, skills, and learning opportunities. They point out that individuals have access to more knowledge than ever. In this, the network age, individuals have access to what seems like an infinite amount of knowledge and information and can easily connect with others all over the world, provided they have access to the Internet and digital technologies. This phenomenon necessarily calls for educators to rethink formal teaching and learning experiences

because a traditional view of education highlights and emphasizes the teacher's knowledge and the process of giving this knowledge to the students.

Also in this digitally-mediated learning-scape, formal learning no longer occurs within the physical walls of a classroom, but also in the virtual or networked world. The shift of formal learning beyond physical walls has been happening. There are educators using Twitter to facilitate and enrich the learning experience by engaging students in conversations outside of the classroom. In fact, these conversations often engage individuals who are not part of the class, but who can add value and/or new ways of thinking. Of course, Twitter itself does not always ensure high quality discussions; however, it can be turned into a teaching opportunity by becoming part of and contributing to a conversation and/or a community. Learning and communities occur organically over and over again in this new culture of learning both inside and outside formal school contexts.

In this learning environment, along with the ease of access to knowledge and being *connected*, there is a need to redefine who the "expert" is. Experts are no longer necessarily individuals who have either academic credentials or personal experiences, but may be non-credentialed individuals with a passion for a given interest, topic or skill. Instead, the teacher and students work in a distributed expertise learning environment. Working in a distributed expertise environment, the teacher and students acknowledge multiple "experts" in the classroom and allow the experts to teach when appropriate (Brown et al., 1993). Once the "expert" is redefined like this, the need to rethink teaching arises, which leads to the need to rethink learning because the role of the student also

changes. In other words, within the kinds of learning contexts prized by Thomas and Brown and others, "learners and instructors take on roles of working together as part of a community structure that values both the individual's contributions to the community and the knowledge constructions of the collective" (Gallini & Barron, 2002, p. 149). Keeping in mind the new culture of learning, it seems that educational institutions are served well by adopting a participatory model of teaching and learning. The participatory model (see Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006) encourages imagination, innovation, and play in students and pushes educators to reshape their conceptual lens and rethink the learning-scape.

Thomas and Brown (2011) introduced the term *learning-scape* to expand the traditional context of where learning occurs. Learning-scape includes both physical space (i.e., classroom) and virtual space (i.e., a social media platform). Consequently, educators must provide space in which students can drive the creation of meaning, content, and contexts inside the classroom. However, consistent with the social view of learning, educators and students become resources for each other and learn from each other. It is in this co-learning environment that true collaboration and knowledge sharing take place. In sum, the new culture of learning described by Thomas and Brown demands that through activities, the learner—educator and student alike—be active, contribute, and become part of a community or collective throughout the learning process. While existing digital technologies, such as social media platforms, provide a space for faculty members to teach in the new culture of learning, the "how-tos" of teaching need to be considered when incorporating technologies in their teaching.

## Digital Technology Use

Chelliah and Clarke (2011) sought to identify pedagogical considerations in higher education where Web 2.0 collaborative technologies are available and useful to increase individual creativity, contribute to communication and to build communities that support a social constructivist approach. Anderson (2005) described Web 2.0 collaborative technologies, or social software, as a group of tools that support and encourage individuals to learn together anytime and anywhere while maintaining control over their own identities and relationships. A broad range of tools falls under this description: web-conferencing tools, email, Flickr, YouTube, Second Life, Facebook, Twitter, blogs, wikis, social bookmarking tools and more (Anderson, 2005; Minocha, 2009a; Minocha, 2009b).

Several themes emerged when Chelliah and Clarke (2011) examined different pedagogical approaches when using Web 2.0 tools in teaching. These included: active learning, engaging students in the learning process, increased individual creativity that benefits many, development of 21st century learning and employability skills, and the provision of a learning environment that supports social construction of knowledge. Active learning is grounded in constructivist theory as it emphasizes student participation in learning activities that contribute to their knowledge construction (Chelli & Clarke, 2011). In this case, and as already mentioned, the student's role in the learning process is not passive (i.e., listening to lectures). Instead, the student is participating in discussions and/or hands-on activities. Furthermore, when active learning approach is applied from the lens of a social view of learning, the students are learning from both the teacher and

each other. Similarly, when engaging students in the process of *learning to learn*, they have the opportunity to develop self-directed, problem-solving research, and collaboration skills which are desirable 21st century learning and employability skills.

The use of Web 2.0 tools in formal learning contexts can support students' social construction of knowledge by providing virtual spaces in which to represent this knowledge. For instance, educators can use Pinterest for students to brainstorm, plan, and finalize their project (e.g., students in an Events Planning course can upload the menu, centerpieces, etc. to a Pinterest board and the teacher and peers can critique by using the blog feature). With the availability and accessibility of social media platforms, educators are afforded the space and opportunity to create a collaborative learning environment that extends beyond the physical walls and digital boundaries of learning management systems. However, this open learning environment may not be appropriate or suitable for all faculty members. Nonetheless, faculty members can foster a social view of learning through a participatory learning environment within the physical and digital boundaries by designing active learning activities with the transformative use of digital technologies.

## Active Learning

For the purposes of this article, active learning is defined as an approach to learning in which activities are designed to provide opportunities for individuals to participate in their learning experiences either independently (e.g., explaining how to solve a quadratic equation) or with others (e.g., analyzing a case study within a small group), specifically with both experts and novices. I built my definition upon Prince (2004) and other researchers' definitions (Braxton, Milem, & Sullivan, 2000; Drew &

Mackie, 2011; Grabinger & Dunlap, 1995). Prince (2004) emphasized that "the core elements of active learning are student activity and engagement in the learning process" (p. 224). Educators may choose to use independent, pair, small group, and/or large group activities to encourage and support student participation (Drew & Mackie, 2011; Prince, 2004; Srinath, 2014; Welsh, 2012; White, 2011). The concept of active learning disrupts the traditional view of the college classroom in the sense that content presentation is the major consideration for faculty members which typically results in lectures being the primary teaching practice. With active learning, students become participants in the learning process enabling them to consider various perspectives with which to think through a problem. In an active learning classroom, students are not sitting and passively receiving information. Instead, they are expected to participate in building knowledge through contributing to discussions, participating in collaborations, and/or interacting with content independently by applying a theory in a given scenario.

Typically, educators who embrace an active learning approach believe that content transmission alone from an educator to a student is not enough to support an individual's learning. Instead, when students are active participants in the learning process, they tend to retain and have a deeper understanding of new knowledge. This means that students need to be able to experience as well as acquire the concepts, accepted practices, and norms of the overall context in which the content to be learned is generally found or generated (Brown & Adler, 2008; Lankshear & Knobel, 2011; Ray, Jackson, & Cupaiuolo, 2014).

## Transforming Teaching Practice to Involve the Student: Changing the Learning-scape

Technology alone does not promote active or participatory learning. It is how the educator uses it that facilitates the desired learning experience. Technology, for my purposes here, is broadly identified, from books through more advanced technologies such as the Internet and digital simulations. For effective technology use within teaching and learning, technology cannot be treated as a separate entity from content and pedagogy (Jang & Chen, 2010; Koehler et al, 2005). In fact, technology incorporation should be connected to the educator's subject matter and teaching practices (Jang & Chen, 2010), which resonates with Shulman's (1987) the construct of pedagogical content knowledge. Shulman (1987) argues that pedagogical content knowledge is of special interest to educators because "it represents the blending of content and pedagogy into an understanding of how particular topics, problems or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction" (p. 8). In other words, specific content areas necessitate a particular teaching practice or teaching practices.

In the participatory learning environment, or what Thomas and Brown (2011) call learning-scape, educators serve as facilitators. As facilitators, they help students to bridge their prior knowledge base and experiences to the new learning context, to design activities that involve students in deeper cognitive activities, to encourage students to take ownership in their own learning, and to become part of the learning process (Alliance for Excellent Education, 2012; Hooper & Rieber, 1995; Kong & Song, 2013;

McCombs, 1997; U.S. Department of Education, 2010). Within this learning environment, students have more opportunities to interact, collaborate, and negotiate with others in the class; therefore, they necessarily are more actively involved and have more control over their own learning. Students also tend to participate in activities that involve creativity, problem-solving, and critical thinking because the faculty members purposefully design more opportunities to facilitate the students' knowledge construction (Chen, 2008; Hunt, Eagle, & Kitchen, 2004; Liaw, 2001; U.S. Department of Education, 2010). With a social view of learning as the foundation for making teaching and learning decisions, the roles of a teacher and a student change and so does the learning environment, which leads to considerations for using digital technologies to support transformative teaching.

## Digital Technologies in Education

Digital technologies have the potential to be a disruptive or transformative force in teaching and shift the role of teachers, the role of students, the learning environment, and the curriculum (American Association of Colleges for Teacher Education Committee on Innovation and Technology, 2008; Bonk, 2016; Christensen, Horn, & Johnson, 2011; Lankshear & Knobel, 2011; Rheingold, 2012; Thomas & Brown, 2011). They are transformative in the sense that they have the potential to change what and how teachers teach and to promote desired workforce skills, such as collaboration and tapping into distributed expertise and know-how. The learning-scape, as I have defined it, entails redefining the role of the expert, the role of the educator, the role of the student and takes

into account the ability to be *connected* and requires the teaching-learning interplay to be a participatory experience.

Christensen, Horn, and Johnson (2011) argued that historically schools have met various measures, such as preserving democracy, preparing individuals for a job, keeping America competitive, and teaching all children, but rarely to anyone's satisfaction because the measures keep on moving. Disruptive innovation is generally used in the business sector to provide a predictive model of and explanations for an organization's interactions with innovations. Furthermore, disruptive innovation is not necessarily concerned with a breakthrough improvement of a service or product. Instead, it simply disrupts an established, exclusive practice to make it more widely available. For instance, the personal computers are a disruptor of mainframe and minicomputers, and community colleges are a disruptor of four-year colleges (Christensen, n.d.), and online learning is a disruptor of traditional in-person learning. Even though disruptive innovation does not have to be technology based, technology has and continues to have influences on changes in schools. In this sense, educational institutions in many instances have embraced and have often succeeded in implementing disruptive innovations. However, expectations for educational institutions keep on changing; therefore, the perception of schools not meeting larger social expectations persists.

An examination of literature on teaching and professional learning settings where digital technology is being used to transform teaching, for example, from teacher-centered to learner-centered and/or learning processes, for example, from passive to active, to a social view of learning. From the extant studies, it appeared that there were

two uses of digital technology in schools: one was a macro-level use of digital technologies and the second was a micro-level use of digital technologies. Macro-level use of digital technologies occurred when the researchers used a specific digital technology or technologies to accomplish a larger purpose (Cesareni, Martini, & Mancini, 2011; Joia, 2001; Roberts, 2004; Keskitalo, Pyykkö, & Ruokamo, 2011; Seaba & Kekwaletswe, 2012; Tsaushu, Tal, Sagy, Kali, Gepstein, & Zilberstein, 2012; Wu, Yen, & Marek, 2011). For example, researchers used digital technologies such as a learning management system like Blackboard to deliver content in order to allow more student active participation in a lecture setting. Micro-level use of digital technologies referred to the researchers use of specific digital technologies to accomplish a specific goal within a specific context (Cooner, 2010; Fominykh & Prasolova-Forland, 2012; Lavonen, Meisalo, & Lattu, 2002; Mhlongo, Kriek, & Basson, 2011; Rosen & Beck-Hill, 2012); for example, using a simulation like the iCircuit app in a physics laboratory setting to increase the student's conceptual understanding of the subject matter. So aside from considerations concerning *which* digital technology to use, faculty members should also consider *how* to use the digital technology in their teaching.

A review of the research literature also suggests that two main factors have impeded the incorporation of digital technologies in education. One of the factors is that often when educators use digital technologies in their teaching, it is not grounded in theory (Selwyn, 2014). The other factor is that frequently there is a disconnect between the use of digital technology and the consideration of the educator's teaching practices, the learning environment, and specific content/subject matter that is being taught (Hooper

& Reiber, 1995; Schwartz, 2008; see also, Figure 1). The inattention to these factors in the use of digital technologies in education along with the common practice of offering standalone courses and professional learning opportunities that only address the *mechanics* of specific technologies may well explain why educators have a tendency to use technologies to amplify their teaching instead of transforming their teaching.

An a-theoretical approach to technology use and limited teacher training methods further exacerbate the disconnect between expectations of educators and the actualities of the real-life academic environment. Figure 1 visually captures this disconnect. The theories of learning set the foundations for the teaching and learning experiences. Furthermore, they inform the pedagogy (method and practice of teaching), the learning environment (role of the educator, role of the student, culture, and context of the classroom), and the tools (such as digital technologies) that may be used during the lesson. As it is depicted in Figure 1, often in education there is a reciprocal relationship between pedagogy and learning environment as informed by the instructor's enacted theory/theories of learning. However, the way in which digital technologies are used is often treated as a separate, stand-alone entity. For example, each student uses a tablet to create a mind map, but when it is not connected to a theory, the students may not be working collaboratively (if the theory is a collaborative one, or the teacher may have no clear reason for having students create such maps and so their learning value is undermined because the act of creating the map itself becomes the goal, rather than the map being an extension of theory of mind and learning that focuses on conceptual understanding or the like. However, if the teacher designs the tablet activity using a social

view of learning then the students may be expected to discuss and debate the elements that are essential to create a cohesive mind map collaboratively in a Google Doc during and outside of class time. The disconnect is also exacerbated and remains mostly unaddressed due to the perceived *potential* of digital technologies in education, such as when technology is expected to help increase a teacher's efficiency in content delivery and personalize students' learning experiences (Henderson, Selwyn, & Aston, 2015). However, the reality of the role that digital technologies play in education is not always consistent with its perceived potential. One of the reasons is due to the a-theoretical approach to using digital technologies in education. Another reason is that the use of digital technologies in teaching and for learning is inconsistent among institutions and academic disciplines (Selwyn, 2014).

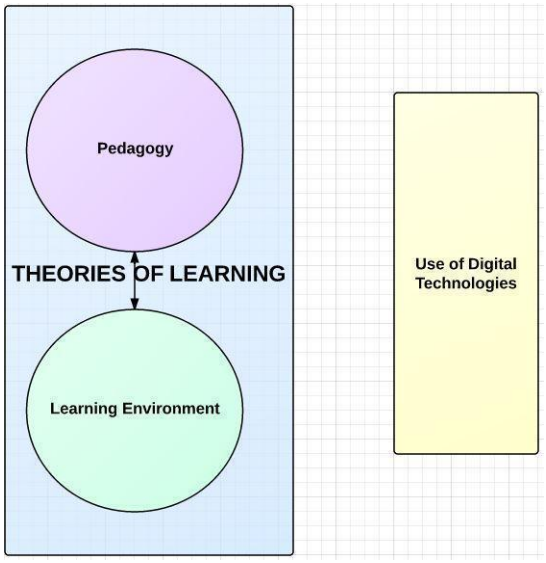


*Figure 1.* Typical relationship between teaching/learning and use of digital technologies within the education technology field in higher education.

## Getting Focused: Learning - Teaching - Technology Cycle

Two different frameworks resonated with me. One is the previously discussed Thomas and Brown's (2011) new culture of learning. Thomas and Brown (2011) emphasized the concept of individuals being connected through technology that creates new social practices, skills, and teaching-learning opportunities. The other is drawn from the National Research Council (2000) with respect to learning environments that apply to the overall classroom practice and not specifically with the incorporation of digital technologies, which I will discuss below. By weaving the two frameworks together, I was able to map out a learning-teaching-technology cycle that connected the teaching-learning experience and the use of digital technologies that inform each other. The Learning-Teaching-Technology Cycle (see Figure 2) can be used as a consideration to amend the disconnect between teaching-learning and technology use in the classroom.

In 2000, the National Research Council released *How People Learn: Brain, Mind, Experience, and School*, which explored the critical issue of linking the science of learning to actual classroom practices. In the research-based work, the authors discussed designing effective learning environments that are learner-centered, specifically "environments that pay careful attention to the knowledge, skills, attitudes, and beliefs that learners bring to the educational setting" (National Research Council, 2000, p. 133). The National Research Council noted the complexity of the learning environment, as it is a space that goes well beyond the physical classroom. Instead, a learning environment is demarcated by the interconnection of learner-centered, knowledge-centered, and

assessment-centered learning environments all informed by the community: the classroom, the school, and the larger community of homes, nation, and world.

In a learner-centered learning environment, educators acknowledge the importance of recognizing and building on the knowledge, skills, attitudes, and beliefs each student brings into the educational setting. The intersection of learner-centered and knowledge-centered learning environments is where the educators take into account the student's preconceptions and pre-existing knowledge about the subject matter to be learned. Thus, the activities are designed to go beyond the rote memorization of a concept, and go on to nurture understanding and develop the necessary skills related to the concept. For example, instead of memorizing the scientific method, the students are tasked to use the scientific method to create an experiment that explains a given phenomenon. In examining the third interconnected learning environment in their proposed framework, the assessment-centered learning environment, the National Research Council (2000) discussed the merits of both formative and summative assessments with particular emphasis on feedback and alignment. The editors noted that feedback should be occurring continuously throughout instruction. It is also critical that the assessments align with the learning goals which determine what is taught and how it is taught. In addition to considering the student and the learning environment, the process of incorporating digital technologies in the classrooms should also be considered.

Thomas and Brown's (2011) view of teaching and learning resonates with The National Research Council's (2000) view that the learning environment is no longer restricted in a physical setting. More importantly, both Thomas and Brown and The

National Research Council emphasized the complexity of the learning environment that is influenced by the individuals and the communities in which we reside. Thomas and Brown's (2011) learning-scape is virtual, existing in social media platforms such as Twitter, discussion forums like Reddit and others, whereas The National Research Council's learning-scape is in the physical sense including school community and community surrounding the home. Consequently, the teaching-learning process is not isolated; instead, it is a dynamic, interconnected, and inter-informed process that ideally involves the student, the educator, the family, and the larger community. In Thomas and Brown's *New Culture of Learning*, they challenged educators to think about how technology can be used to create new social practices, skills, and learning opportunities. With that in mind, I proposed the Learning-Teaching-Technology Cycle (see Figure 2). As depicted, each element of the cycle is critical, connected, and they inform each other without a set starting point.

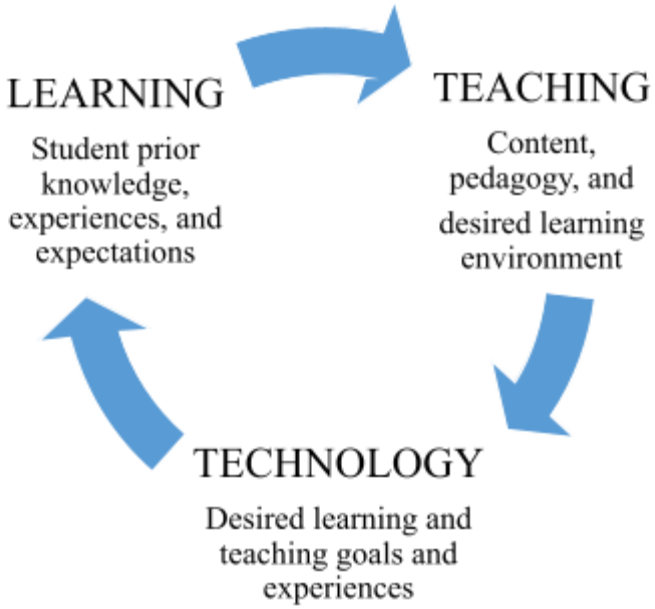


*Figure 2.* Learning-Teaching-Technology Cycle

Drawing on the work of the National Research Council (2000) and Thomas and Brown (2011), I propose the learning-teaching-technology cycle that resolves the typical disconnected relationship between teaching-learning and using digital technologies, as it was discussed previously (also see Figure 1). The learning-teaching-technology cycle (see Figure 2) depicts the complex interplay between teaching, learning, and technology. The learning element takes into consideration the student's prior knowledge, experiences, and expectations. The teaching element takes into consideration the educator's content, pedagogy, and desired learning environment. The selection of and the use of digital technologies are informed by the learning *and* teaching elements, although there are also instances where the availability of a specific digital technology can inform teaching and learning. For example, if faculty members decide to use a learning management system

such as Blackboard, they may decide to have content readily available on the learning management system and spend the majority of the class time facilitating various highly interactive activities such as debates. In sum, digital technologies should be used to support and/or enhance the teaching-learning experience while meeting learning objectives. They should  not be used to *drive* lesson planning. In this sense, a faculty member would start with a learning objective, do research for the appropriate digital technology or resource, and then design an activity; thus, engaging in the learning-teaching-technology cycle. Perhaps, by using technology intentionally and with the purpose of learning, developing skills, and supporting student success, we can take a small step to adapting to the constantly changing expectations for educational institutions and begin to bridge the gap between the perception that formal education and informal learning are distinct entities.

*I dedicate this work to Dr. Michele Knobel, a leading scholar in the area of new literacies - the everyday literacy practices mediated by digital technologies. She was an inspiration, a role-model, and an academic parent to me. I miss her dearly.*

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