

Educational Technology in Physical Therapy

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SETTING THE STAGE

The Association for Educational Communication and Technology states “educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (Chapman & Jensen, 2013; Januszewski & Molenda, 2008; Jensen & Mostrom, 2013). Simonson (2014) states that distance education differs from conventional methods, including customary understanding, geographic separation, interactive learning groups, and a learning community.



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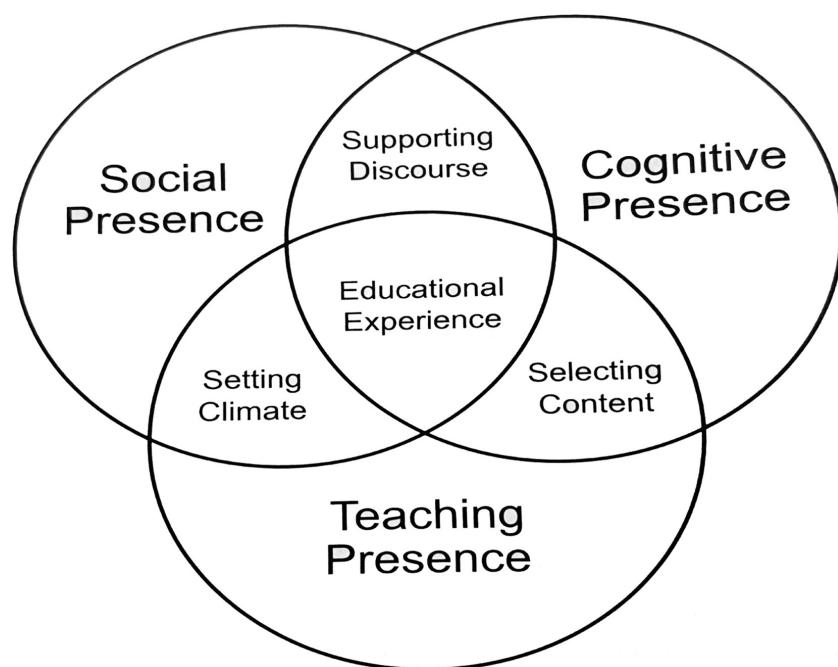
We must partake in technological advances in a powerful way that is affected by learning theory and outcomes and supported by the users’ enthusiasm; otherwise, we are wasting time and energy (Chapman & Jensen, 2013; Jensen & Mostrom, 2013). In the last few decades, the use of technology has exploded. Without the internet, businesses and schools would not have been able to survive and grow, especially during the COVID-19 outbreak in 2020.

After decades of research experience, Clark (1983) said,

the best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition.

The learning progression includes building autonomy and self-confidence in students and promises to deliver quality education for students, their patients, families, and communities.

A positive distance educational experience is based on “design, development, and delivery of instruction” and acquiring motivated learners with appropriate intellect (Clark, 1983). There needs to be comprehensive planning, commitment, collaboration among all stakeholders, and continuity or “life cycle” planning. Comprehensive planning includes student instructional needs, administration of technology providers, and infrastructure, which will increase the chance for success. The collaboration with faculty, students,



Source: Reprinted from Chapman and Jensen (2013, p. 76).

Figure 1. Community of inquiry model.

support personnel, and other instructional support programs to “provide a rich, well-functioning, and rewarding experience” (Chapman & Jensen, 2013; Jensen & Mostrom, 2013). The commitment is needed for the continuity of assessment, collecting data, and making changes as required. The university that creates a community of inquiry model (Figure 1) within the digital age (Jensen & Mostrom, 2013).

Social presence is the emotional connectedness a student feels with other students and professors. At the same time, the Teaching Presence is the feeling that the student has valid educational learning goals with technology implementation (Chapman & Jensen, 2013; Jensen & Mostrom, 2013). Last, Cognitive Presence is the degree that the student can reflect and grow academically in the digital community. The university and teachers are responsible for providing support to create

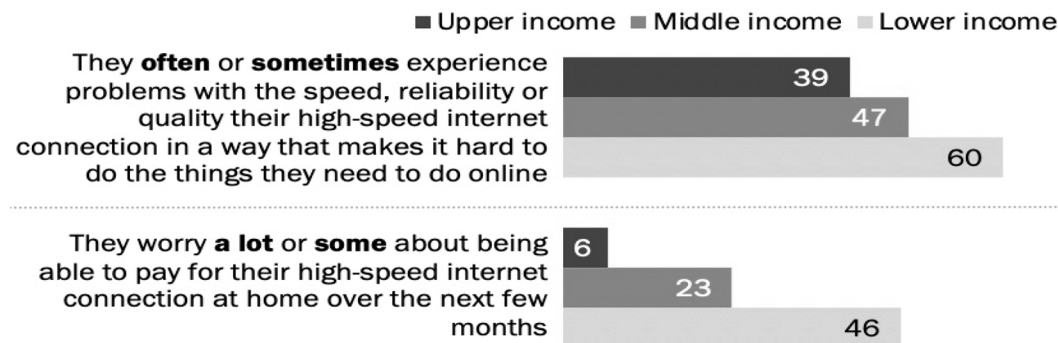
a meaningful and positive experience for all students, whether in synchronous, asynchronous, or hybrid programs.

The medium does not create an educational effect; according to Clark (1983), it is the content, the methodology of teaching, and the learner that shapes the process of educational technology. The Educause Center for Applied Research states that 89% of all students own a laptop, and 94% use the library for internet sources (Chapman & Jensen, 2013; Jensen & Mostrom, 2013).

According to the Pew Research Center, 90% of Americans say the internet has been a critical part of learning (McClaim et al., 2021). Although, according to Pew Research Center, the use of technology has not been without problems, reflectively. Lower income families struggle more than upper income families, sometimes with poor internet connections and the ability to pay for services. Figure 2 illustrates the

60% of broadband users with lower incomes often or sometimes have connection problems, and 46% are worried at least some about paying for broadband

% of U.S. home broadband users who say ...



Note: Income tiers are based on adjusted 2019 earnings. Those who did not give an answer or who gave other responses are not shown.
Source: Survey of U.S. adults conducted April 12-18, 2021.
"The Internet and the Pandemic"

PEW RESEARCH CENTER

Figure 2. Pew Research Center, Broadband users by income.

struggles of lower income families (McClaim et al., 2021).

In an article by Dolcini et al. (2021), internet access is imperative for young adults and adolescents for health and learning. They found reduced internet access in some of the most vulnerable and needy populations. The authors found that even with increased internet use in the population, socioeconomic and racial discrepancies were prevalent among Black, Hispanic, and low-income communities (Dolcini, 2021). The authors recommend that children and adults access the internet through local schools and libraries. In addition, "a variety of approaches, including private-public collaborations, increasing community *hot spots*, government-sponsored expansion of broadband to rural communities, and public access broadband has the potential to increase internet access

of youth in the United States" (Dolcini, 2021).

Clark's (1983) research review, *Reconsidering Research on Learning From the Media*, states that there is evidence of confounding factors that impact learning. The confounding factors include the novelty of new technology and instructional methods, which affect outcomes and the content itself. Content differences must be controlled in academia, and teachers must use the same curricula throughout a program and teach the same content using any media they choose.

According to Clark (1983), the novelty factor *wears off* after a time, which levels the playing field in more than 4 weeks usually; the design effort method includes a personalized system of instruction (PSI) and programmed instruction (PI) that contain methods that "seek to add structure,

shorter steps, reduced verbal loads, and self-pacing to lessons” (Clark, 1983). However, PI and PSI expand effect size in studies as the learning increases with the impact of valuable strategies and the methods are separated from the medium, which is why there are learning variances. Clark (1983) calls this variation an instrumental method to facilitate learning for various levels of intellect.

According to Clark (1983), computers are less novel to college students than to secondary school students. In addition, regarding intellect, we must create sufficient conditions, including strategies to teach required cognitive skills and control for novelty, methodology, and potential confounding effects, to individuals with lower cognitive skills.

The use of computers is divided between faculty that may have been born during the predigital technology era and students born into the digital technology era. Thus, students have learned to embed technology readily into their learning style and can demonstrate flexibility in all settings, craving technology-rich educational environments (Chapman & Jensen, 2013; Jensen & Mostrom, 2013).

Some forms of instructional technology include simulation, virtual reality, synchronous and asynchronous Zoom meetings, lectures, and other types. In the article, “Media Will Never Influence Learning,” (Clark, 1994) argues that technological methods are replaceable and that using money-saving methods may be practical. However, as discussed above, media use may require more engaging content for digital technology-era students. Some methodologies may cause boredom and apathy if not using high technological learning methods; hence, teachers need to plan a well-rounded curriculum to keep students engaged.

The collaboration of clinicians and engineers to overcome barriers that interfere with successful technology development in the digital age includes participation in

the origination and transformation of biotechnologies; the American Council of Academic Physical Therapy and program faculty and leadership need to complete a formal survey and to include levels of excellence to incorporate advanced technology in the curricula of physical therapist education programs (Trumbower & Wolf, 2019).

Program changes will require substantial effort to integrate biotechnology into course curricula. The necessity to rethink the curriculum to make room for new content in biotechnology has faculty concerned about the future of their programs; in addition, there needs to be an open “biotechnology education repository to engage and invite physical therapy and science, technology, engineering, and mathematics students, clinicians, faculty, and other stakeholders (e.g., small business, industry, technology firms) to learn about ongoing and emerging methods to interface biotechnology in physical therapy, as well as to facilitate new interdisciplinary collaborations beyond the physical therapy profession” (Trumbower & Wolf, 2019).

IMPLEMENTATION OF STRATEGIES

A flipped classroom approach has been a popular strategy that uses technology (Roe, 2019). The core content is learned before classes as homework through various means, and then discussion, case studies, and groups can break out from the flipped method instead of lectures. According to Roe et al. (2019), 51 students passed the course exam ($n = 54$) using this method, and the number of students with above-average performances increased by more than 10% from the previous year’s performance. Flipped classroom teaching enables a learning environment that develops abstract cognitive thought by pre-teaching asynchronously through lecture videos and readings and then applying the material during a synchronous learning experience during class (Roe, 2019).

According to Peisachovic's article, (2022) "Shifting to Delivering Simulation Virtually Within a Healthcare Education Setting," the COVID-19 pandemic changed how healthcare student education is delivered worldwide to a virtual methodology. Simulation is based on a teaching-learning approach embedded in experiential learning, critical to developing clinical decision-making skills (Peisachovich, 2022). There needs to be a built-in debriefing follow-up for asynchronous learning, which can be time-consuming (Peisachovich, 2022). It is easy to forget the debriefing with our busy schedule in some asynchronous courses.

The simulated ward round and professional skills program was developed due to medical students' perceived weakness in clinical skills; 60-minute simulation scenarios focused on replicating experiential learning methods in a ward environment in unusual and complex cases (Morgan et al., 2018). The results indicated self-perceived growth in clinical skills. In another study on adding computer simulation to an Australian entry-level physical therapy curriculum, some significant barriers to increasing computer simulation were a lack of resources, facilities, and dedicated recurrent funding (Pritchard, 2016).

However, the more simulation is developed over time, the easier it will be to access, and the cost may be diverted to the students out of their books and technology fees. Overall, simulated patients appear to be an effective positive alternative educational strategy for developing physical therapy clinical practice competencies and serve a valuable role in entry-level physical therapy education as a form of methodology and content (Pritchard, 2016). Computer simulation can replace student actors or real-life patient interaction, which can be unpredictable and lacking content to practice various evaluation and treatment techniques in a stricter simulation curriculum. It is a methodological technique of learning content but has not been deemed a better form of learning; however, this

may be more inclusive with less effort from the external environment. In addition, computer simulation can be used at a convenient time and place for the student and does not vary as a patient or another student-actor would (Pritchard, 2016).

A study of a physical therapist in a virtual world of technology surveyed the use of palliative care for interprofessional education (Lee, 2020). Graduate students in healthcare who attended two universities in the same city volunteered in the study's preclinical and clinical trials (Lee, 2020). It was feasible for the students to schedule one of the ten time slots convenient for them. Palliative care through this method was a positive experience using a virtual learning environment (Lee, 2020). For example, one activity was based on the value of team members' cooperation, including engaging in a scavenger hunt and interviewing the patient asynchronously. Then a debriefing of learned skills which needed review was held synchronously by the teacher (Lee, 2020). The students felt it was a safe and relaxing environment for the complex subject of palliative care.

Another study adopted virtual reality that teaches healthcare students to be empathetic and compassionate with elderly patients. It allows them to simulate caring for patients with age-related diseases such as macular degeneration, Alzheimer's, and hearing loss (Dyer, 2018). Some virtual reality (VR) simulates what the patient hears and sees, which adds to the immersive experience (Dyer, 2018). As mentioned, some experiences teach first-person learning, while others include coaching end-of-life conversations (Dyer, 2018). "Research indicates that empathy leads to better patient care and outcomes and that educational interventions work" (Dyer, 2018, p. 500).

Developing a virtual reality balance assessment for fall prevention and education that accounts for vestibular, visual, and somatosensory integration can be

used in a product called UprightVR (Almajid, 2021). Utilizing UprightVR for elderly fall prevention may open the door to preventing the suffering of the elderly from falls and the complications of falls, family training, nursing home education, and therapists' evaluation training and treatment planning. In addition, using a VR unit may objectively measure scores that novel therapists and students find difficult to assess if the patient unknowingly has vestibular or visual complications. The unit uses the Oculus Rift head mounted display device that is integrated into an internet portal. The Oculus Rift head mounted display simulates various positions on and off a foam mat with open and closed eyes (Almajid, 2021). The novel therapist and students can use this device reliably with other clinical measures learned in school such as Time Up and Go, Berg Balance Scale, Time Up and Down Stairs, Sit to Stand, and Stand to Sit for educational purposes to improve evaluation skills with and without the VR assistance.

TELEHEALTH

In physical therapy, telehealth was another use of technology that student therapists and novel therapists needed to master. In pediatrics, student patient education, family education, and telehealth treatment were critical during the outbreak of COVID-19. The only way to treat children safely and coach parents for the first several months was to use Zoom sessions on computers or phones. The use of exercise telehealth was based on the school-based treatment model, while the coaching and educational side was the birth-to-3 model. Sessions typically lasted from 30–60 minutes with families and children. It was also beneficial to form videos of the children's exercise routine to supplement sessions for the school-aged children that could be done with their parents. School-aged children could work out daily with the video with parent supervision and one to three

times a week with telehealth session(s). The model worked well in the beginning.

However, as vaccines started to emerge, many birth-to-3 clients opted for outpatient settings instead of telehealth. There was a shortage of birth-to-3 telehealth clients for a brief time in the Philadelphia suburbs until the states allowed the therapists to return in person with masks and waiver forms to start. Then, as most health professionals received all their vaccines and boosters, the state relaxed its requirements for waivers and masks. For the education of healthcare students, Zoom has also been an effective tool. In a qualitative study about telehealth during COVID-19 called, "Evaluation of Pragmatic Telehealth Physical Therapy Implementation During the COVID-19 Pandemic," the use of telehealth for several purposes in a large teaching hospital was effective (Miller et al., 2021). Five qualitative themes emerged from a survey that suggested successful implementation: "organizational factors (policies, preexisting partnerships), engaging external stakeholders (satisfaction survey), champions (clinician leaders), clinician education (dynamic, ongoing training), and process (promote adaptability, small tests of change)" (Miller et al., 2021). After the themes were established, it was determined that a majority of the patients, 92%, would likely attend telehealth sessions in the future (Miller et al., 2021).

The last use of interprofessional education experiences using technology across different fields, according to the World Health Organization, increases the breadth of learning from each area. These experiences include transforming "professional identities, practices, and relationships within and across health professions through the development of interprofessional practice" (Stickley, 2020). A study using interprofessional learning activities between physical therapy students and health information students that consisted of synchronous online workgroup meet-

ings and homework provided a novel learning experience for the students (Stickley, 2020). Online discussions comprised roles and responsibilities in health care, feedback, and discussion of different electronic health record systems (Stickley, 2020). Working with people in other professions helps establish mutual respect, similar values, and respect for their roles (Stickley, 2020). In addition, openly and respectfully addressing healthcare needs and promoting and advancing the health of populations through communication with families, patients, communities, and other professionals in healthcare and other fields encourages teamwork.

As healthcare workers, we want to promote and maintain healthy lifestyles as a team and prevent and treat disease in a timely, efficient, and effective manner. Keeping open communication through emails, educational pieces, Zoom meetings, synchronous and asynchronous lectures, and group discussions or case presentations in person or by Zoom around the world helps keep the lines of communication open. It was a very positive experience for all to collaborate with peers.

In summary, technology in physical therapy is here to stay. The expansion of technology and the classroom change from all synchronous to asynchronous or hybrid is authentic. The follow-up evaluation of learning material by teachers needs to determine if the coursework is taught in completion or if there are holes in the curriculum. Telehealth also needs to be addressed as well as technology such as VR, simulation, tracking devices, Zoom collaboration and other methods of biotechnological advances are part of a digital age, rich curriculum. Evaluation of the curriculum will continue to be contemplated with new emerging technologies. New technologies may replace older teaching methods. However, the media is only the teaching vehicle and does not determine

the methodology and content of the teacher.

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