Teaching innovation in rehabilitation to clinicians of the future with online learning

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ABSTRACT

In mid-March 2020, academic institutions decided to temporarily stop onsite classroom teaching due to the risk of COVID-19. This increased the need for effective online learning. In an ongoing Mayo Clinic-Northern Arizona collaborative medical education research trial, clinical exercise physiology and Physical Medicine & Rehabilitation (PM&R) students and faculty from 10 academic institutions will receive two separate live synchronous online medical education interventions. The primary aim of the study is to increase student awareness of emerging technologies and effective health communication for rehabilitation with motivational interviewing (MI). Time series still image photography will be used in combination with an interactive three-dimensional (3D) virtual tour to illustrate the strategic design of an outpatient rehabilitation workspace. Multiple brief video recordings of a role-playing vignettes between a clinician and a standardized patient will model the aims of the study within in-person clinical encounters throughout a 40-minute online presentation. There are five examples of technology: (1) touchscreen display monitors to interact with the patient (2) video recording with 3D markerless motion capture software analysis of a physical performance evaluation with the capacity to send images to the Electronic Medical Record (EMR) (3) Movement Sensor Technology that quantifies objective metrics about movement and performance, (4) a portable foot pressure mat to assess balance and use artificial intelligence software to recommend corrective treatment options and (5) a Connected Health (CH) mobile device (m-Health) application that enables the clinician to prescribe and monitor a home treatment plan between clinical visits. The secondary aim is to improve self-perceived MI proficiency in PM&R academic faculty and clinical instructors. Faculty will receive a 2.0-hour interactive online MI workshop with supervised teal/role-playing MI practice and mentor training for the purpose of teaching others and personal continuing education. This requires the replacement of standard interactive in-classroom teaching methods with a virtual online learning platform. Preliminary testing of both interventions in two convenient samples has provided greater insight into the practicalities of this method to teach innovative rehabilitation to clinicians of the future.

LEARNER OBJECTIVES

1. Define traditional online learning teaching methods for academic institutions.
2. Identify creative virtual teaching applications in medical education to increase clinician awareness about alternate methods of healthcare delivery.
3. Recognize the role of effective methods of communication to improve patient adherence in value-based PM&R.
4. Describe clinical applications of technology to enhance the patient experience and deliver PM&R services remotely with CH.

BACKGROUND

Healthcare costs within the US are significantly higher than any other nation, but clinical outcomes fall behind other countries.[1] The recent introduction of value-based reimbursement will challenge clinicians to improve patient adherence and clinical outcomes with alternate methods of healthcare delivery.[2-6] The application of innovative technology into healthcare has the potential to increase access to healthcare, improve the patient experience and lower cost.[7-8] Consequently, training clinicians to balance the use of technology with effective clinician-patient communication such as MI seems merited.[9-13] In a Phase I pilot study, innovative classroom teaching that incorporated creative multimedia technology supported applications helped medical educators enthuse the learner about their topic.[14-15] Subsequent restrictions to classroom teaching due to COVD-19 have increased the need for effective online learning.

What is Online Learning?

An increasing number of academic institutions are using multimedia technology consisting of online learning. Three online learning models include web-enhanced, hybrid and online education.

Web-Enhanced Learning: Predominantly an onsite educational course that uses the web to expand student learning beyond the boundaries of the classroom. Examples include posting of syllabi and course materials; creation of asynchronous discussion forums; and usage of online quizzes, grade books, communication, and assignment submission tools. These tools are used to supplement instruction and do not replace the traditional classroom education.

Hybrid Educational Course: A blend of onsite classroom teaching with online learning using the web. Hybrid courses move about half of the learning online and, as a result, reduce the amount of classroom time. The online portion of the instruction is delivered to the learner using a variety of tools including chat rooms, discussion boards, web pages, and multimedia technologies. Specific technologies employed will vary by course and instructor. Class contact time is reduced, but the material covered is equivalent to a normal full-time class delivered for the same number of credits. Students must attend face-to-face class instruction and login to their online hybrid course each week for the duration of the course.

Online Educational Course: Learners access primary content and instruction using a variety of tools from the web, including email, chat, discussion boards, web pages, and multimedia technologies. Again, specific technologies employed will vary by course and instructor.

The teaching platform can be customized based on the teacher preference and course content

Synchronous: Both teaching faculty and learners log onto a virtual platform at the same time and interact in the setting in which it occurs.

Asynchronous: Only learners log on to the virtual platform and interact with the content prepared by the teacher as their schedule permits.

Combined: Some combination of the above.

A dynamic and interactive learning environment between students and faculty, regardless of the setting in which it occurs. Email, telephone office hours, chat rooms, and web-based threaded discussions are some of the technologies that help facilitate interaction.

What is Virtual Online Teaching?

The replacement of standard interactive in-classroom teaching methods with a virtual online learning platform.

PURPOSE

This Phase II investigation will evaluate the effect of synchronous online medical education on attitudes associated with progressive approaches to PM&R practice.

METHODS

Primary Aim: To increase student awareness of emerging technologies and effective health communication.

Secondary Aim: To improve self-perceived MI proficiency in academic PM&R faculty and clinical instructors.

Students and faculty from 10 academic institutions will receive two separate live synchronous online medical education interventions. This requires the replacement of standard interactive in-classroom teaching methods with a virtual online learning platform.

Students will participate in a 40-minute presentation. Faculty will receive a 2.0-hour interactive online MI workshop with supervised real/role playing MI practice for the purpose of teaching others and personal continuing education.

Bringing PM&R to Life for Students with Multimedia Teaching Modalities

Still Image Photography: A purpose-built examination room was constructed to demonstrate the clinical application of innovation and technology to PM&R. The learner was shown the incremental progression of the construction with time series still image photography (See Figures 1-3).

Three-Dimensional (3D) Imaging: The Matterport 3D scanning camera system[16] was used to capture images of an outpatient clinic, which enabled the medical educator to guide the learner through an interactive exploration of the site (i.e. virtual tour) to highlight psychologically informed decisions that were associated with the strategic design of the workspace (See Figures 4-5).

Brief Video Demonstrations: Video recorded role playing between a clinician and a standardized patient living with chronic pain demonstrated an in-person clinical encounter (See Figures 6-8). The modeling of key components of MI while applying examples of emerging technologies to PM&R was combined with medical education (show and tell) with the intent of increasing the self-efficacy of the learner, sending the message "you can do and it will make a difference to the patient experience".[17]

Clinical Applications of Technology: The Phase I demonstration included four examples of technology with subtitles added to the videos to highlight key teaching points.

(1) Touchscreen display monitors to interact with the patient (See Figure 9).
(2) Video recording and analysis of a physical performance evaluation with the capacity to send images to the Electronic Medical Record (See Figure 10).
(3) Movement Sensor Technology that quantifies objective metrics about movement and performance (See Figure 11).
(4) Connected Health (CH) mobile device applications (m-Health) that enable the clinician to monitor and prescribe treatment plans to the patient in their home (See Figures 12-13).
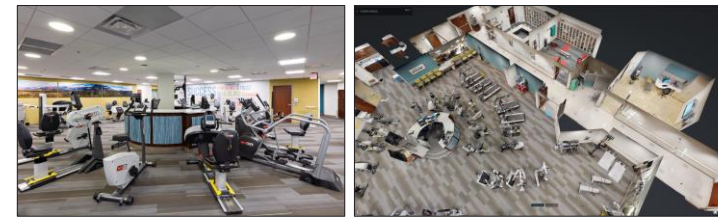
In Phase II, two additional demonstrations of technology included:
(1) Video recording with 3D markerless motion capture software analysis of a physical performance evaluation
(1) Portable foot pressure mat analysis that uses artificial intelligence software to recommend corrective treatment options to improve balance and movement deficits

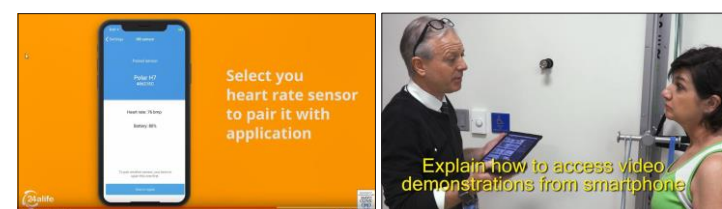## FIGURES 1- 3

FIGURES 4 - 5

FIGURES 6 - 8

Explain expectations and flow of visit | Ask for interpretation | Summarize for clarity and direction

FIGURE 9 | FIGURE 10 | FIGURE 11

Provide interactive discussion using touchscreen technology | Overhead Full Squat Test (heal assist) with Video Recording | Explain Movement Sensor Technology

FIGURES 12 - 13

Select you heart rate sensor to pair it with application | Explain how to access video demonstrations from smartphone

LESSONS LEARNED ABOUT ONLINE LEARNING RESEARCH

- Online synchronous education offers participants a variety of ways to interact with the facilitator depending on personal preference (i.e. virtual chat box, raise hand function, request help function) and may encourage participation from less outspoken individuals.
- Online synchronous education offers a simple and convenient way to provide surveys and handouts to participants.
- Effective communication and clear expectations are necessary to ensure participants are prepared for online synchronous education (i.e. access to virtual platform, working internet browser, connected microphone and video, access to PDF files distributed during presentation)
- Online synchronous education offers more scheduling flexibility with remote participation.
- Online synchronous education may be less cost-prohibitive for participants (i.e. decreased travel expense, decreased number of printed materials).
- Providing the training via online synchronous education may increase motivation to use clinical applications of technology as the training itself models the possibility for effective virtual communication

RESEARCH CHALLENGES

- Barriers to a multi-site study involving students and clinicians from numerous academic institutions include (1) multiple Institutional Review Board approvals, (2) subject recruitment and (3) intervention scheduling.
- The MI workshop was approved for Continuing Education credit by the state physical therapy association, but there is uncertainty about study eligibility in clinicians who are not affiliated with an academic institution.

CONCLUSION

Creative multi-media teaching applications can provide a virtual online learning experience for both students and faculty with the potential to enhance medical education.

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