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## Distance e-Learning is Closer than Everybody Thought: A Pharmacy Education Perspective



In the 1840's Isaac Pitman and his pupils were engaged in distance learning via mail correspondence. He would send them the teaching material he prepared, and they will send him the assignments they completed.<sup>1</sup> In the 20th century, attempts to technology-aided distance learning used videotapes that were mailed to students. Moreover, TV channels were utilized to transmit lectures and practical demonstrations. It took a while before distance learning transformed into e-learning and, by the end of the 20th century, it gained wider implementation.<sup>2</sup> Distance online learning was facilitated by the introduction of the Mac in mid 1980's, as a home personal computer (PC) and the advent of the internet in homes by the early 1990's. While the British Open University was the first licensed distance-learning university (Royal Charter 1969), The Glenn R. Jones International University (established in 1993 and fully accredited in 1999) was established to exclusively offers online degree programs.<sup>3,4</sup> Other institutions started to incorporate variable degrees of e-learning elements in its course and program delivery. Virtual reality simulators for endoscopy, colonoscopy, and laparoscopy were introduced into medical education in the 1990's.<sup>5</sup> Although these were utilized as virtual alternatives to experiential training, they were rarely accessible from home. The 21st century with the wide availability of smart portable devices, YouTube and other social media platforms brought social online learning to the masses.<sup>6,7</sup>

Distance online learning has always been a choice, that was considered a lesser alternative to the more regarded face-to-face learning. Then came the COVID-19 pandemic to present distance learning as a necessity. However, the majority of stakeholders across the education continuum, including health professions

educators and institutes, were caught off-guard. Many institutions were ill-prepared for this new challenge. Schools of Pharmacy were no exception, as they were not ready for a disruptive and complete transition in curriculum delivery. Hardware infrastructure and software solutions were deficient while students and, more urgently, faculty needed training.

Institutions, to variable extents, have invested in an e-learning infrastructure, which was augmented by a relative ease in acquiring new software solutions. For academic institutions, curriculum delivery is the priority, however, many challenges have emerged. The first challenge was the need to quickly and progressively create content for the online delivery of lectures. The majority of faculty were not trained on content creation tools for distance learning and they started to utilize their original material used in their face-to-face classes. The second and a harder challenge faced the distance learning process was students' assessment. The concept of "e-assessment" using onsite-like examinations while maintaining integrity and safeguarding against cheating was not fathomable. The third and most challenging prospective was virtualizing pharmacy experiential training, or parts of it, and its assessment. Some institutions with access to virtual clinical training platforms, that can be accessed from distance, started the slow transition into "e-training" environments. While schools that lack these capabilities, started the design of virtual activities that relied heavily on simulated clinical case studies that allowed students to attain some of the learning outcomes of the clinical rotations. Unfortunately, due to limitations of experience and resources, or the conviction that clinical training requires face-to-face interaction, other schools decided to postpone all clinical rotations hoping for better times after the recession of the pandemic.

For proper distance e-learning, faculty and students have to set up suitable home study environments which

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require spatial, technological, bandwidth, and financial resources. With COVID-19 stretching finances of many families thin, they found themselves obligated to provide e-learning and remote-work setups. Additionally, bandwidth availability and affordability across countries and among family households are not equal. A large proportion of educators and almost all students are tech-savvy and have no problems communicating or finding content online.

Administrators, teachers, students and parents were not psychologically ready to accept the idea of transforming from face-to-face learning to distance e-learning. The latter was perceived to pose many threats to the integrity and effectiveness of learning and teaching. A major push came from governments that mandated social distancing, lockdowns, and schools' shutdowns, with some governments explicitly directing academic institutions to switch to online learning. Most schools of pharmacy have engaged their e-learning capabilities as a contingency plan, which apparently mitigated the risk posed by the COVID-19 pandemic on didactic pharmacy education successfully. The jury is still out on the schools' success with experiential training. However, the reality that is sinking in is that pharmacy education after COVID-19 should not be the same as it was before COVID-19. Other waves of the disease are possible and other epidemics and pandemics are not far-fetched predications. Although we still need to keep delivering in the present, we need to set a course into the future. Schools of Pharmacy need to expedite, but not rush, the transition from fitness-of-purpose on-line learning to fitness-for-purpose one, and from a crisis-management mindset to a strategic-planning mindset. This requires an internal paradigm shift across the board to change the academic culture that used to consider online education as an inferior form of teaching and learning.

A medicinal chemistry online course can be used to provide a glimpse into how an intentionally distance online learning course may look like. A typical discussion of any class of drugs would usually encompass a biological introduction, basic pharmacological information, mechanism of action, structure-activity relationships (SAR) and drug-receptor interactions, and chemical and metabolic degradation pathways. The usual medium will be PowerPoint presentations with static two- and, rarely, three-dimensional chemical structures and pathways. The burden will be on the instructor's logic and the student imagination to correlate the static presentations to the dynamic three-dimensional biological environment. The distance

online version of the same course can utilize the following:

1. PowerPoint presentations that contain factual learning elements and explain drug degradation and metabolism. These will be synchronously delivered online by the instructor.
2. Asynchronous massive open online courses (MOOCs) will be used for biological introductions. MOOCs will be distributed to students for self-learning, or with flipping of the classroom.
3. Virtual 3D models to explain the SARs and drug-receptor interactions. These models will be prepared and synchronously presented online by the instructor. They will also be downloaded and manipulated by students using free visualizing software.<sup>8</sup>
4. The synchronous delivery can be performed via learning and content management systems such as Moodle. Various modules of these systems can allow the platform to follow and document students' attendance, participation, and inter-student collaboration.
5. Students' assessment can be measured by a variety of methods including:
  - a. Case studies and problem-based assessment can be used to test for higher cognitive skills such as analysis, interpretation and synthesis;
  - b. Group projects can be used to allow social learning and build student collaborative attitudes and assess soft human skills;
  - c. Applied skills in computer aided drug design (CADD) techniques. Students will be trained to use the 3D visualization software, and RCSB protein data bank (PDB), and to simulate the chemical and molecular drug-receptor interactions.<sup>8</sup> All required software manuals and proper training can be provided to the students in an asynchronous manner.
  - d. Real-time online tools that allow for submission of essays and reports, Slides for presentations, and Sheets for data analysis and graphical presentations;
  - e. Online MCQ-based examinations which can be delivered and proctored using electronic solutions such as Blackboard® with Respondus®, or ExamSoft® with ExamMonitor®. Both solutions use artificial intelligence (AI) to analyze student behavior that is recorded by a camera to detect for potential suspicious behavior during examinations.

If designed and deployed properly, distance online learning can inspire students to become active learners who assume responsibility for their own education to evolve into life-long learners.

First and for most, Schools of Pharmacy should invest to increase individuals and technological capacities in order to offer rich learning and training experience. This includes three dimensions: 1) providing content authoring capabilities that include sound-proof recording rooms and video/audio editing software, 2) acquiring electronic content delivery and student assessment platforms, and 3) offering faculty and students the necessary training and providing IT support. It is clear that the investment will be substantial and expensive in the short time, but necessary and worthwhile in the long run to accommodate the needs of distance e-learning.

As the learning curve is steep, Schools of Pharmacy will need to seek interinstitutional collaboration especially with institutions that possess well evolved online learning delivery platforms. Sharing of experiences with other schools seeking the same goals will increase efficiency and a facilitate success.

The educational software industry has to rise up to the challenge by developing solutions that are affordable, intuitive and resource efficient. To cater for the needs of experiential training, especially in clinical settings, extensive utilization of AI, virtual, and augmented reality are going to be invaluable. Maybe the industry will dare to go a mile further, by adapting an affordable version of the remote robotics used in surgery to health professions education.

The partial or of complete transition to distance e-learning will have implications for all involved. Students household “technological capacity” can be a major threat and a leading cause of educational disparity in countries with high rates of poverty. Schools will likely need to offer aid to students and their families to relieve some of the financial burden of having home setups suitable for e-learning. Schools of Pharmacy will need to review the quality and quantity of staffing. Teaching loads must take into account time spent in developing the e-learning content. Additionally, schools will need to reform budgeting in terms of allocation of funds and invest in fit-for-purpose infrastructure, and may need to restructure students’ fees. Governments may need to rethink their educational support and to explicitly require schools to direct some

of its budgets toward e-learning capacity building. Regulatory bodies should enable the transition, but at the same time maintain, their role as curators of the quality of education regardless of the mode of delivery. National and international ranking systems of pharmacy programs will need to pay more attention to e-learning readiness, efficiency and effectiveness.

We do not have to be perfect from the beginning but have to be intentional, serving well-crafted strategic goals.

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