Designing an Interprofessional Online Course to Foster Learning Health Systems

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Abstract. The Learning Health Systems (LHS) framework demonstrates the potential for iterative interrogation of health data in real time and implementation of insights into practice. Yet, the lack of appropriately skilled workforce results in an inability to leverage existing data to design innovative solutions. We developed a tailored professional development program to foster a skilled workforce. The short course is wholly online, for interdisciplinary professionals working in the digital health arena. To transform healthcare systems, the workforce needs an understanding of LHS principles, data driven approaches, and the need for diversly skilled learning communities that can tackle these complex problems together.

Keywords. Learning health systems, digital health, health informatics, data science

1. Introduction

There is a growing appetite to advance the digital maturity of health care systems. There are many iterative steps involved in transforming such complex systems. The Learning Health System (LHS) represents one framework to undertake this process (1). This approach was developed as an 'improvement science' based method to realize the potential of health data and knowledge through rapid and continuous cycles of data interrogation, application of insights gained into practice and practice change, with the objective of streamlining and optimizing processes and care delivery (1, 2). Adoption of LHS practices remains a systemic challenge. Specifically, there is a lack of an interdisciplinary, informatics skilled workforce who understand how to utilize clinical data insights and are able to leverage the recent advances in data science, to design technologically innovative and feasible solutions to problems (3). Therefore, there is a need to develop tailored professional development training to foster a digitally enabled healthcare workforce (4). A few publications mention the design of LHS short courses (5) and evaluations of their LHS professional development programs (6). There are, however, limited descriptions of methods used to establish these types of programs in enough detail for others to consider adopting it to their contexts. The purpose of this paper is to outline the development, design, and implementation of a LHS short course for practicing inter-professionals (clinicians, researchers, health service managers, data scientists and IT professionals) working in healthcare.

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2. Methods

The first stage involved the education development team creating a conceptual curriculum framework based on the LHS model (7). A review and synthesis of competencies (8-11) articulated in the recent literature was conducted to ascertain workforce capabilities required for LHS implementation. The proposed curriculum framework was refined through rounds of consultation with subject and field experts.

After finalizing the curriculum framework, learning designers and instructors collaboratively identified and prioritized potential learning outcomes. Instructors ranked potential learning outcomes according to importance, relevance to the audience, difficulty, and current ability of the potential participants. We used a backwards design approach and workplace task analysis to develop learning activities (12). Next, the education designers worked with instructors to create a learning plan that met the objectives, and to identify a variety of learning resources, including simulations with real digital health platforms and apps, interactives, infographics, mind mapping, brainstorming, process mapping, data interrogation using Jupyter notebooks, interviews with expert practitioners, self-tests, application activities, and groupware. The curriculum was implemented in the format of an interdisciplinary, entirely online short course with asynchronous pre-work and synchronous sessions weekly (3).

For our first implementation of the short course (pilot), only 50 participants were chosen, on scholarship. Enrolments were selected on the basis of institutional recommendations and roles, so that a broad representation of likely LHS interprofessional participants was emulated. Subsequent iterations in the first year of the program were delivered through a paid model and had N=74 (May 2022) and N=99 (Sept 2022) participants enroll in fee paying places either as individuals or as group entries, through organizational sponsorship. These enrolments were drawn primarily from existing partnerships established in the pilot, word of mouth and referrals from attendees to colleagues.

3. Results

The resulting LHS competency-based curriculum framework consisted of three main domains of competency (Inquiry focus, Innovation focus, and Impact focus). The framework was incorporated into a 12-week professional development offering: The [Applied Learning Health Systems](#) (ALHS), combining independent study with synchronous group learning. The education team carefully formed diverse, five-person teams, based on their roles. Each team, known as simulated working groups, consisted of health professionals, one researcher, one data analyst or information systems person, and one health services management representative. The program design utilized a flipped classroom model (13). Each week, participants first completed three hours of self-directed readings and activities to meet knowledge-based learning objectives. The pre-class materials were heavily curated by instructors and re-designed by education designers on Canvas®, for engaging delivery. The pre-class materials prepared participants with the necessary background needed for live weekly 2.5-hour Zoom™ workshops. These sessions included mini-lectures, mind-mapping (individual and crowdsourced), audience response polls, small group work collaborative learning in breakout rooms, large-class discussion of small group debriefs, team debates and lightning presentations of lessons learned upon completion. Participants worked with the

same simulated working group each week for peer-to-peer learning through simulated activities and tools. In the final two weeks, participants were swapped and placed in new groups for each topic, to simulate real world team turnover, over a number of years in the case scenario. This also gave them the opportunity to meet new participants, access different expertise and hear new perspectives. In the third iteration of the program, we invited lived experience experts (consumers) to join the program on scholarship and co-learn with the professionals – to learn from, gain insights about the health system complexities and to share personal experiences of navigating the systems and processes. These consumers were chosen by a panel through a competitive selection process based on their level of interest and reasons for wanting to be involved in the program. Upon application, they were informed that they could participate in a focus group at the end of the course to share their experiences of learning with professionals.

One innovation of the short course was the employment of a Diabetes Case Scenario. Participants participated in a simulated Australian health-care system attempting to decrease hospitalizations for patients with diabetes. Participants undertook an activity of using a crowdsourced mind map to visualize the evidence synthesis of the field. Video interviews with actors playing patients and real clinicians helped participants understand the struggles of diabetes management and pain points for end users of self-care technologies. Using real-world, de-identified, patient data embedded in Jupyter Notebooks®, participants learned to clean datasets, transform them into research-ready formats and visualize aggregated data. They also analyzed machine learning models to identify predictors for hospitalization for patients with diabetes within the simulated health care system. Then participants pitched potential digital health solutions, developed clinical workflow process models, and built workflows to trigger messages to patients in an app, and to clinicians in a dashboard using the Datos® software. They then designed evaluation, implementation and scale up frameworks based on a real digital health application known as REMODEL (REthinking Model of Outpatient Diabetes care utilising EheaLth) (14).

Given that we are still in the data collection process, our evaluation plans to assess several aspects. Participants complete surveys pre-course, and, post-course, with short weekly feedback opportunities. Weekly feedback consists of rating scales for usefulness, engagement, free text for what to keep and change, and possible applications to their workplace. Pre and post surveys were modelled on the Kirkpartrick evaluation framework (15). The surveys consist of rating scales and open text response questions. There are self-confidence scales mapped against the learning outcomes for each topic, compared pre-post. Rating scales assess satisfaction, value and applicability of various course aspects: instructors, collaborative learning, pre-class activities, in-class activities, diabetes case scenario, Jupyter Notebooks, Canvas (learning platform) and discussion boards. Free text captures future applications and perceived role in digital health, as well as suggested benefits and improvements. These will be assessed through thematic analysis. The weekly feedback on the course will be collated, summarized and fed back into quality improvement cycles after each iteration. We conducted interviews with participants at the conclusion of the course (pilot only) – 27 of 50 participants volunteered. The aim of the interviews are to get a more in-depth understanding of the participants experiences of attending the short course; motivations and drivers for wanting to be involved in an LHS; enablers and barriers to engagement with the framework, and understanding and exploring their ability to situate themselves and their role in the context of an LHS, as well as their digital health identity, as defined in the roadmap (Australian Digital Health Agency, 2020). The aim is to follow up with these

participants in 1, 2 and 5 years to track their progress. Once data collection is complete, the analysis and results of these evaluations will be presented in future manuscripts.

4. Discussion

We developed this LHS program in collaboration with various subject matter experts and education specialists. This partnership is crucial when developing programs targeted at multiple professions. Each party brings unique content and domain expertise, which complements when creating a well-rounded program. As the program was wholly online, it required us to employ multiple modalities to cater for different learning preferences. We also needed to incorporate enough hands-on active learning opportunities to keep learners engaged throughout. The decision to continue the program in the wholly online, format post lockdowns was driven by the idea that it enabled equity of access – professionals with families and full workdays could attend after hours, and it also opened the course up for participation from interstate and international audiences, which also led to richer and more meaningful perspectives of health systems, globally. Moreover, it is clear that organizational buy-in for 'digital transformation' and understanding of the need to upskill, is essential to inspire the workforce to willingly participate in such 'systems change' programs together.

The flipped classroom model allowed us to maximize the peer-to-peer learning time. This model enabled the flexibility to provide enough background to get different professions on the same knowledge baseline, and to give learners the flexibility to engage with as much or as little content that was needed to complement their pre-existing expertise. The in-class group work is an essential component of the LHS framework as it allows participants to be involved in a simulation that mimics their real-world team interactions. This forum was a safe space to share perspectives and learn with and from each other's expertise and experiences. These insights were integral to the learning experience. Moreover, it is important to have instructors with expertise in the area to guide learners through the activities, to provide feedback on group work and expert responses weekly. Additionally, the use of one case study (diabetes) weaved throughout the course enabled participants to see the steps involved from start to finish in implementing a digital technology in the patient care workflow. This gave them an example to compare against their own workplace projects. Each week we asked participants to consider how the activities and tasks undertaken could be applied to their own contexts. This was an important reflective exercise, that forced them to think practically about their everyday work. Future iterations could consider developing specific case studies for different audiences, however, the course is built in a stepwise manner and provides a toolkit that can be applied to any context. Finally, having weekly feedback opportunities allowed us to take those recommendations and make changes to improve the program in real time between each iteration. The long-term evaluation strategy will also allow us to follow participants into the future, to map how their career pathway and digital health identity evolves as a result of participation in the program.

5. Conclusions

A short course of this nature should provide an efficient and effective means for professionals to better understand and apply LHS concepts. It is not expected that all

participants will complete the short course with the ability to independently conduct data analysis, build digital interventions, or implement a pilot evaluation. However, participants should leave with a greater awareness and understanding of the whole process, ultimately becoming better collaborators, by designing healthcare solutions in broad consultation with complementary domain knowledge experts, or by seeking to further educate themselves in specific areas of LHS core competencies. With this narrative, we aimed to inform readers on how to develop, design, and implement future training programs in LHS by anchoring theoretical learning with applied case scenarios and simulated real-world tasks. With successful training and adoption of these principles into practice, our healthcare systems can continue to evolve into learning health systems.

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