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Educating the Healthcare Workforce to Support Digital Transformation

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Abstract

Digital transformation of the healthcare workforce is a priority if we are to leverage the potential of digital technologies, artificial intelligence in clinical decision support and the potential of data captured within electronic health records. Educational programmes need to be diverse and support the digital novices through to the champions whom will be responsible for procuring and implementing digital solutions. In order to professionalise the workforce in this area, digital competencies need to be built into training from early on and be underpinned by frameworks that help to guide regulators and professional bodies and support educational providers to deliver them. Here we describe Manchester's involvement in the development of digital competency frameworks and our digital transformation education programmes that we have created, including a Massive Online Open Course and a professional development course for England's Topol Digital Fellows.

Keywords:

Data Science, Digital Transformation, Competency-based education.

Introduction

Digital transformation of healthcare encompasses the movement to paperless patient records through to digital technologies such as wearable devices, robotics and use of artificial intelligence (AI) in clinical decision support. In clinical practice it has been accelerated by the ongoing pandemic with a shift in healthcare utilisation, including tele-consultations, usage of healthcare Apps combined with large-scale data sharing [1]. Education and training of the workforce needs to keep pace and be equally transformational to maximise the potential from this progress and create a sustainable digital health ecosystem. A recent study that interviewed medical students from across Europe found that only 40% of 451 respondents felt suitably prepared to work in a digitised health system, and 84.9% respondents agreed or strongly agreed that digital health education should be included in the medical curriculum [2]. Very few undergraduate curricula contain the right content to enable this kind of change in healthcare and fully prepare our trainees for working in a digitally enabled health ecosystem. Professional bodies and regulators need a much stronger steer regarding the competencies that should be included related to digital health technologies, this in turn will influence the educational providers of these programmes to move in this direction and also to establish some consistency of what is taught. Here we describe our journey to create digital competency frameworks and transformative educational programmes where we have begun to test these competencies.

Methods

In this paper we will specifically focus on our work related to competency frameworks and education in the areas of artificial intelligence and digital health technologies undertaken in collaboration with Health Education England.

Our approach has been informed by a research informed methodology, delivered by an experienced team with evidence published in the literature.

Systematic Literature Review

We have undertaken a systematic literature review to reduce bias and provide a transparent and repeatable account of how data was obtained and selected. This included a systematic search of existing identified learning needs, competencies, curricular and frameworks related to AI and digital medicine. The search terms also capture the related sub-domains of these higher level concepts (for example AI -> machine learning). The review also included additional information sources in addition to academic literature such as information produced by various royal colleges and professional governing bodies (e.g. Nursing and Midwifery Council, General Medical Council etc.) as well as organisations such as Joint Information Systems Committee. The literature review explored these areas taking a transection across the clinical workforce, to include as diverse a representation of the workforce as possible. The initial findings of this review were collated into main topic domains and initial competencies as a basis for discussion in the workshops. The reviewers screened the literature against the inclusion/exclusion criteria and document agreement/resolve conflicts, before reviewing the final selection of documents and literature.

Facilitated workshops

A series of three workshops were undertaken with different stakeholders utilising nominal group technique (NGT) with focus groups, NGT is a structured activity used to facilitate decision making in groups [3]. This combination (Nominal Focus Group) offers advantages over focus groups alone [4], because NGT helps to rank solutions, thus ordering the competencies to determine which represent the most important (core competencies). A series of stages or phases, importantly allowing equal opportunity for participants to share ideas regardless of any power imbalances in the group were used. Ideas were shared and discussed leading to the formation of an aggregate group opinion and voting was used to order ideas by priority. The main stages are highlighted below:

Introduction to the workshop, findings of the review, purpose and process. If groups are large, sub-groups can be formed using breakout rooms (around 8 participants per group). The main stages/phases included:

- **Nominal phase** – Private consideration of the information presented from the review (or draft framework if a later workshop) and writing down notes/key points. It was important that the facilitator avoided influencing participants at this stage.
- **Item generation** – Each individual's ideas were then shared with the group in turn, with all ideas recorded verbatim. This was undertaken in rounds until no more ideas are generated.
- **Clarification and discussion phase** – Participants could ask questions and indicate agreement/disagreement with items on the list. Duplicates were removed and some items of similar kind were combined.
- **Voting phase** – Every participant could choose 10 items from the list and rank them in order of priority assigning values 1 (most important) to 10 (least important). These results were then shared with the participants so they are aware of the final outcome.

These lists were shared using Miro (https://miro.com/login/) boards, an online facilitation tool. The draft framework has been shared in survey format online for further comment and iteration from the healthcare community.

Design of blended learning courses

The educational team at Manchester co-designed a Massive Online Course (MOOC), using the FutureLearn platform to host the course: https://www.futurelearn.com/courses/artificial-intelligence-in-healthcare. The course structure is designed around the pedagogy of social learning, embracing conversation and discussion throughout. This is a powerful way of provoking debate with fellow learners and listening to views related to the benefits and challenges of the use of AI in healthcare. Course materials also included short videos, quizzes, clinical case studies and data sets for students to test their learning.

We have also designed a programme of professional development for the Topol Digital Fellows, a cohort of healthcare professionals, undertaking a specific training programme with Health Education England to develop digital capabilities and act as champions in the workplace. This course has been designed using a mixture of synchronous and asynchronous learning. Online course materials have been provided to the learners in an asynchronous manner, such as Jupyter Notebooks covering machine learning methodologies are held within a bespoke E-lab environment. Jupyter Notebooks enable technical content to be taught related to data science, machine learning or programming, and also additional content that explains the algorithm, poses a question or presents the solution is easily integrated. In addition additional supporting materials related to introducing the foundations of machine learning were provided in Articulate Rise which was easily embedded into the E-lab infrastructure. Our bespoke E-lab has been designed to support functionality of the Jupyter Notebooks that many traditional learning management systems would be unable to support. Synchronous sessions were used to trouble shoot any issues in particular with Jupyter Notebook content and also three sessions were provided to scaffold the online learning including: introducing the workshop, introducing the Jupyter Notebooks and also a final wrap-up session enabling the learners to interact with practitioners that had implemented machine learning into clinical practice.

Results

Competency Framework Update

Currently the framework is open for review via an online survey. After the survey phase closes, further revisions will be undertaken and then the framework will be formally released by Health Education England with accompanying guidance documentation.

Massive Online Open Course (MOOC)

The first run of the course was launched in February 2020 and attracted 4,280 enrolments, 2,278 were from the UK, likely reflective of Health Education England marketing reach. The course developed active discussion, averaging 60 comments per step in the course. Of those that responded to the end of course survey (201), 93% said they'd gained new knowledge or skills and 70% said they'd shared their learning. Over 330 survey respondents indicated they wanted to learn more about AI, including more videos, case studies, glossaries and wikis.

Machine Learning in Service Delivery Course

In the final session with the Topol Digital Fellows we undertook a short evaluation exercise, using the approach of: 3 things they learnt, 2 things they wanted to find out more about and 1 thing they will take on board, captured using a Miro board. Key learning points included: insights into the different types of machine learning. The fellows were keen to discover more about integrating machine learning solutions into clinical practice and how to assess for the readiness of their organization to adopt machine learning.

Discussion

The provision of education and training to support digital transformation in healthcare needs to be comprehensive and inclusive, addressing the needs of digital novices, through to those wishing to lead and develop digital health innovations. While not everyone needs to understand the fine detail of how a machine learning algorithm works, an appreciation of the requirements, opportunities and limitations of such approaches by healthcare professionals is critical. At the basic level developing a shared common language to enable interdisciplinary teams to effectively co-create digital health technology solutions centered around areas such as machine learning will be key to implementation into practice. Furthermore, it is important to increase the cohort of digitally-literate clinicians, clinical informaticians and data scientists that are able to interrogate, evaluate and also procure digital health solutions, software and devices to address real clinical problems, ensuring they are implemented in a safe and secure way that benefits patients.

Conclusions

The University of Manchester has collaborated with Health Education England to develop competency frameworks to embed digital competencies to underpin the education of healthcare professionals. We have shown that digital education can be delivered through a diverse range of educational interventions including free and open access courses delivered to thousands of learners through to more bespoke specialist skills delivered to digital champions using immersive teaching environments such as Jupyter Notebooks. Our challenge for the future will be to

carefully map the education to the competency frameworks developed to ensure the educational intervention is appropriately pitched to address the appropriate level of competency for a particular job role or profile. We are aware of the need to discern expert and more generalist competencies and also to align with specific personas and roles in healthcare. This refinement will help to further hone our educational interventions for the future.

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