

**FAC.DEV PILOT STUDY: TWITTER COURSE LEARNING EXPERIENCES**

**COMPARING LEARNER EXPERIENCES WITH QUEST- VS XMOOC-  
FORMAT MODULES IN AN ONLINE TWITTER COURSE FOR HEALTH  
PROFESSIONALS**

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A Thesis Submitted to the School of Graduate Studies in Partial Fulfillment of the  
Requirements for the Degree Master of Science - Health Science Education

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## DESCRIPTIVE NOTE

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## Abstract

**BACKGROUND:** Over the past decade, massive open online courses (MOOCs) have been used by healthcare professionals to develop their knowledge and skills. They are an attractive learning option due to their openness, accessibility, and flexibility regarding time and space, but have notably low completion rates. “Fac.Dev” is a platform for faculty development by McMaster’s Office for CPD offering online courses through a Query-based, Ubiquitous Educator and Scholars Training (QUEST) model. QUEST modules use task-based activities and authentic assessment in their instructional design, in contrast to the traditional MCQ assessment methods in MOOCs.

**PURPOSE:** This study aimed to compare learner engagement and experiences of health professionals enrolled in a one-month Twitter skills online course delivered on the Fac.Dev platform through QUEST-format modules versus xMOOC-format modules.

**METHOD:** This study was conducted as a randomized controlled trial. 27 participants were randomized into either learning Twitter skills through a course with QUEST-formatted or xMOOC-formatted modules. Quantitative and qualitative methods were used to analyse the outcome measures, which included completion rates, barriers to completion, self-rated Twitter proficiency, self-perceived achievement of learning outcomes, likelihood of recommending to a peer, and suggestions for module improvement.

**RESULTS:** Quantitative findings revealed that no significant difference in the completion rates of the course delivered through QUEST or xMOOC format. Lack of time was the primary barrier to course completion. Participants in both arms reported an improvement in their Twitter proficiency and were similarly likely to recommend the course to a peer. Thematic analysis of participant feedback revealed incorporating interactivity, increased use of video and media elements, and providing more time for completion would improve their experience.

**CONCLUSION:** Participants’ feedback for improving the modules were consistent with best practices for digital learning for faculty recommended in literature, which can be implemented in future Fac.Dev course offerings to support and improve learner engagement.

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## Chapter 1. Introduction

### Study Background

Social media is a ubiquitous platform for knowledge exchange and communication. The COVID-19 pandemic has further highlighted its impact on the dissemination of scientific information and the ability to increase engagement of learners and the public (Choo et al., 2015; Topf & Williams, 2021). Over the past decade, Twitter has emerged as one of the most prominent social media tools used by healthcare providers to enhance their research and teaching practices (Choo et al., 2015). It has been used to support digital scholarship by enhancing collaboration, professional development, career advancement and networking, and supportive learning communities (Cheston et al., 2013; Choo et al., 2015; Ventola, 2014). Evidence in literature has also supported the efficacy of social media tools in enhancing medical education by increasing active learner engagement through user-generated content, facilitating communication and feedback, and providing access to resources and interaction without geographic restrictions (Cheston et al., 2013).

While there is an abundance of benefits to utilizing social media professionally, some of the pitfalls associated with its use include potential violation of ethical standards, patient privacy, confidentiality, and professional codes of practice (Iii et al., 2014). Although the number of these violations by physicians is small, uncertainty about how to approach these issues, a lack of formal social media training, and contradictory policies surrounding whether professional bodies support or condemn its use contribute to a hesitancy to engage in the digital space (Campbell et al., 2016; Iii et al., 2014).



Nevertheless, with the growing body of evidence demonstrating the benefits of social media use in medicine, these tools can no longer be ignored or minimized by health professions. Developing educational resources and training should be a priority for academic health sciences centers to support their employees' professional use of social media and address their hesitations (George, 2011). Although international societies have published guidelines for social media use and online professionalism, there were no previously existing social media curricula with well-defined, evidence-based learning objectives (Yilmaz et al, 2022). A recent multi-phase, expert, modified Delphi study by Yilmaz et al. (2022) at McMaster University served to address this by defining core social media competencies that could inform the development of a formal social media curriculum for healthcare professionals (Iii et al., 2014).

The next step in developing a social media curriculum for faculty development and continuing education must be to consider what the most effective instructional design method would be to deliver this curriculum through a web-based course, with the potential for participants to gain a micro-credential. In an era of competency-based education in medicine, research has yet to be done on how this assessment-driven, outcomes-based model of education can be applied to teaching social media skill sets to physicians.

Many professionals may turn to Massive Open Online Courses (MOOCs) for knowledge and skills training to address emerging industry needs and gain micro-credentials for professional development; from 2012 to 2020, enrolment exploded from 8 million to 180 million learners (Ela Akgun Ozbek & Bozkurt, 2019; "The Second Year of

The MOOC,” 2020). However, these courses are notorious for having low course completion rates (Kizilcec & Halawa, 2015). Even with “plan-making” interventions at the beginning of MOOCs prompting students to outline a personalized timeline to complete coursework, researchers failed to demonstrate that it would boost course completion rates (Kizilcec et al., 2020). Most MOOCs, including existing MOOCs about social media in healthcare, are structured with video-based lectures and assigned readings, followed by in-video quizzes, discussion forum participation, homework assignments, multiple-choice quizzes, tests, and exams (Atique et al., 2016; FutureLearn, n.d.). These traditional assessment methods tend to measure recall of terminology rather than applied knowledge or skill; this is problematic for courses designed to teach specific skill sets that must be demonstrated, such as engaging in knowledge translation strategies on social media as a healthcare professional.

In contrast to traditional assessment methods, an outcomes-based curriculum calls for *authentic assessment* where assessment tasks closely resemble the skills, activities, and functions that learners must demonstrate in the real world (Malan, 2000). According to Fraser (1999), this means that assessments become a learning experience themselves where learners have the opportunity to integrate and apply their knowledge, skills, and values (Malan, 2000). A social media curriculum that follows this approach would provide students with scaffolded tasks that require them to complete a set of actions thought to represent competence in social media skills. Students must engage with social media platforms in their teaching and learning activities and be assessed by their performance of those activities. To the best of our knowledge, there are currently no

evidence-based social media curricula aimed at healthcare professionals that are web-based and utilize this competency-based/outcomes-based learning approach.

## Project Objectives and Scope

This thesis project utilized the existing Fac.Dev platform, a project created by McMaster's Program for Faculty Development, to pilot a social media curriculum that fills this gap. Specifically, a beginner's Twitter curriculum for healthcare professionals was developed. Currently, Fac.Dev offers online, open-access learning modules on Inspired Teaching, Creativity and Humanism, and Orientation. Other topics such as Scholarly Practice and Leadership & Management are in development, including Social Media & EdTech.

The programming on Fac.Dev is delivered through "QUESTs". The QUEST program stands for "Query-based, Ubiquitous Educator and Scholars Training", which uses a competency- and inquiry-based approach allowing students to immediately contextualize their learning through digital prompts and computer-based coaching (*Fac.Dev: About the Project*, n.d.). Each QUEST aligns with the principles of Kolb's experiential learning theory: learners are asked to engage in 'learning-by-doing' through action and reflection of each module to see how the content and skills are relevant to their own goals and practice. Concrete experiences are created through scaffolded tasks that require learners to apply the tutorials in their professional contexts to create social media profiles that they can strengthen and maintain after course completion (Kolb et al., 2001). For example, they could be asked to discover hashtags that are commonly used in their field of expertise, and then use these hashtags to engage others. This personalized

approach to learning and application of knowledge may increase learner motivation and result in better course completion rates than courses designed with traditional assessment methods.

This study is titled “The QUESTION Study”, which stands for **Q**uery-based **U**biquitous **S**cholars and **E**ducators **T**raining (**Q**UEST) versus **I**nstructional **O**Nline modules. It aimed to evaluate if a QUEST format approach to online curriculum design would demonstrate an increased course completion rate in comparison to traditional instructional online modules modeled after xMOOC format. As a pilot study, it provides insight into how QUEST-based learning can be used for future faculty development courses and micro-credentialing of nonclinical professional skill sets. By conducting a randomized controlled trial (RCT) study to compare the QUEST-based approach to a traditional instructional approach in delivering a social media curriculum, this project provides high-quality evidence regarding how to best teach clinicians to use social media on Fac.Dev and provides insight into future recommendations for the implementation of open, asynchronous, self-paced courses on this platform for nonclinical professional development.

### Research Question

To summarize, the primary goal of this study was to answer the following research question through quantitative research methods:

- How will the delivery of a one-month Twitter curriculum for healthcare professionals and trainees through online, asynchronous, self-paced QUEST

modules impact **course completion rates** compared to the same curriculum delivered through xMOOC-formatted modules on Fac.Dev?

The following questions are also addressed to evaluate secondary research outcomes through both quantitative and qualitative measures:

- What barriers to course completion do participants encounter when enrolled in a one-month curriculum for Twitter skills on Fac.Dev?
- Do participants find the course useful and effective, based on self-perceived achievement of learning outcomes and retrospective pre-post Twitter proficiency ratings?
- Based on course participant feedback, how can future online course offerings for nonclinical professional skill development on Fac.Dev be improved to encourage participant engagement?

## Chapter 2. Literature Review

### Continuing Professional Development and Faculty Development

Sargeant et al. (2013) describe continuing professional development (CPD) as the educational activities that healthcare professionals engage in to “maintain and enhance their knowledge, skills, performance, and relationships in the provision of healthcare”. The knowledge and skills targeted by CPD are not only limited to medical expertise, but also in enhancing professionalism, team building and collaboration, leadership and management, advocacy, interpersonal communication, and scholarly practices (Filipe et al., 2014). These are competencies outlined in the CanMEDs framework that describe the abilities physicians require to meet and serve the needs of their patients (*CanMEDS Framework: The Royal College of Physicians and Surgeons of Canada*, 2015). CPD is inclusive of faculty development, enriching the relevant nonclinical skills of faculty with roles as educators, researchers, scholars, and leaders. As the landscape of healthcare continues to evolve with technological innovations, scientific research advances, health policy reform, and changing patient and consumer demands, CPD is an integral part of healthcare professionals’ career responsibilities to ensure delivery of up-to-date, high-quality, evidence-based care.

CPD activities delivered to health professionals by their professional societies and/or academic health sciences institutions can include training events (workshops, conferences, webinars etc.), accredited courses or modules (online or in-person), compiled bank of learning resources and materials, supplementary information and

reference resources, and administrative and support services (Klein & Ware, 2003; Phuong et al., 2020). Other CPD activities driven by the learner include private reading of relevant new topics in their field, active reflective practice of their experiences, and recording these activities in a personal learning portfolio (Klein & Ware, 2003). While CPD is learner-driven, regulatory colleges, societies, and academic institutions should accept responsibility for establishing effective strategies to support healthcare professionals, trainees, and faculty by developing educational resources and fostering learning activities. This requires the implementation of best practices in the delivery of learning services that contributes to the most effective learning outcomes and, at its core, optimize self-directed, lifelong learning.

### The Landscape of Online Learning for CPD and Faculty Development

Self-directed learning activities for healthcare professionals and trainees have been acknowledged in faculty development literature over the past decade to play the most important role in individual professional development (Phuong et al, 2020). A significant barrier to self-directed learning for healthcare professionals and faculty for completing CPD activities is time constraints due to busy schedules and demanding workloads, outlining the importance of having individualized, flexible mediums for their delivery (Jeong et al., 2018). Digital technologies for online teaching and learning are becoming ubiquitous in health professions education, offering learner benefits that include flexibility regarding time and space and making it an appropriate, attractive option for self-directed learning engagement (Berndt et al., 2017; Rizzuto, 2017). As academic institutions emerge from the COVID-19 pandemic, the role and potential of

remote learning and online education for CPD and faculty development have particularly evident as they adapted to the emerging needs in a socio-technological era of healthcare (Hlede, 2022; Rizzuto, 2017).

Examples of web-based faculty development initiatives include online programs, webinars, and asynchronous e-modules and courses (Brancaccio-Taras et al., 2016; Yilmaz et al., 2021). These online delivery methods allow institutions decentralize activities outside the university setting, embed interactive components within the technology, and individualize programs to target specific needs (Steinert, 2020; Yusuf et al., 2022). Furthermore, they provide cost-effective, equitable opportunities for engagement in education and professional development activities and can enhance faculty efficiency and effectiveness (Frehywot et al., 2013; Thoma et al., 2019). Specifically, asynchronous, self-paced online faculty development offerings are described in the literature to offer increased learner autonomy, flexibility, scalability, and participation (D. Kay & Pasarica, 2019; Kyalo & Hopkins, 2013; Rizzuto, 2017). Thus, despite the time- and cost-intensive resources required to build these online courses for healthcare professionals to support their professional development, literature generally supports their use (Feldacker et al., 2017; Harden, 2005; Kyalo & Hopkins, 2013; Rizzuto, 2017).

### Massive Open Online Courses: A Promising Intervention for CPD and Faculty Development?

In the past decade, Massive Open Online Courses (MOOCs) have been considered to be a disruptive and revolutionary educational innovation due to their high scalability to thousands of participants and wide availability to the public. They democratize access to



higher education and serve as a form of continuing education, allowing asynchronous learning without geographic or time zone barriers (Evans & Myrick, 2015). Because of these advantages, MOOCs are transforming the medical education and distance learning landscape, and many institutions offer professional development courses in healthcare and education. By 2021, MOOCs have been used by over 220 million learners around the globe, excluding China, with the two most popular MOOC platforms being Coursera and edX (Shah, 2021).

MOOCs can be categorized as connectivist MOOCs (cMOOCs) and extended MOOCs (xMOOCs). The original MOOCs format dating to 2008 was cMOOCs; they are characterized by their “connectivist” pedagogical approach with aggregated learning material and a high degree of social networking via discussion boards that rely on participant interaction, communication, and participation (Kennedy, 2014; Rodriguez, 2012). McAuley et al. (2010) describe these original MOOCs as “build[ing] on the active engagement of several hundred to several thousand ‘students’ who self-organize their participation according to learning goals, prior knowledge and skills, and common interests”. On the other hand, xMOOCs) are a newer development dating to 2013 that reverts to a more traditional “instructivist” course structure (Baturay, 2015; Bayne & Ross, 2014). In xMOOCs, instructors determine course content and activities focused on knowledge acquisition through content transmission via learning materials (i.e. video-based lectures, web resources, readings), repetition, and quiz testing (Bayne & Ross, 2014).

Due to high MOOC course enrolment volume, it would be logistically challenging for course instructors to evaluate and assess individual student assignments. Thus, automated assessment tools are well-suited for MOOCs and are widely used. These tools involve the examination of answer inputs by computer tools implementing prefixed algorithms (Acosta & Otero, 2014). Of these tools, the use of traditional assessment methods such as multiple choice question (MCQ) quizzes are the most common key element of MOOC assessments, in addition to other computer-scored tools such as formulaic problems with correct answers and vocabulary activities (Balfour, 2013; Costello et al., 2018). Most xMOOCs use either MCQ alone or in conjunction with peer review; cMOOCs may also utilize peer assessment and collaborative learning (Acosta & Otero, 2014).

Despite the benefits of MOOCs as widely used, universally available, low-cost courses, their completion rates are notoriously low. Multiple studies cite that less than 10% of students who register in MOOCs complete all the required course activities to reach certification (Alraimi et al., 2015; Jordan, 2014). Much of the literature on MOOCs evaluates rates of noncompletion, retention, and attrition; factors contributing to this phenomenon, including learner's motivations, engagement, behaviours, and perceptions (Blum et al., 2020).

The role of MOOCs in health professions education and continuing professional development has been explored in literature. Although there is moderate enthusiasm about the utility of MOOCs for healthcare professionals, there is minimal robust evidence to support the use of MOOCs in this context (Player & Rodriguez, 2020). A systematic

review by Rowe et al. (2019) evaluated the literature on health professions MOOCs for their effectiveness (increase in learner knowledge), learner perceptions (opinions/attitudes), acceptability (feasibility/usability), pedagogy, and economics. The authors highlight the lack of high-quality evidence in current research to either support or refute the effectiveness of MOOCs in health professions education. Ultimately, they conclude that implementation of MOOCs in this context cannot be soundly upheld until further research demonstrates clear positive outcomes (Rowe et al., 2019). Walsh (2014) also warns against “hying” new educational innovations in online learning like MOOCs without citing real outcomes achieved, stating that this overenthusiasm without evidence has been a recent phenomenon in pedagogical research.

Mahajan et al. (2019) also discuss the utility of MOOCs for skill development in health professions. The authors acknowledge that the use of MOOCs to teach medical sciences and clinical skills may be limited due to the importance of supervised practice with in-person human interaction. However, they argue that MOOCs should be considered for supporting faculty development and continuing professional development by improving nonclinical soft skills such as leadership and management, professionalism, social media, and research. Despite their enthusiasm, there is still a lack of empirical evidence supporting these claims.

### **Fac.Dev: An Emerging Platform for CPD and Faculty Development**

While MOOCs may be a convenient option for self-paced, asynchronous online professional development, it is imperative that evidence-based best practices for

technology-enhanced CPD and faculty development offerings are prioritized. With the increasing attention being placed on competency-based and outcomes-based pedagogical practices within health professions education, online CPD and faculty development programs must reflect these approaches to curriculum design when professionals and faculty are the learners (Lockyer et al., 2017). Currently, structured online CPD offerings are still lacking in sophisticated and robust design and implementation (Berndt et al., 2017; Rizzuto, 2017; Yilmaz et al., 2021).

Fac.Dev is a recent online faculty development initiative by McMaster's Office for Continuing Professional Development that utilizes the Moodle learning management system to deliver evidence-based pedagogical practices and just-in-time (JiT) learning, catering to health professionals and faculty. Their tagline, "Current. Customized. Contextualized. Certification. Connected.", expresses its implementation of up-to-date best practices in delivering on-demand course-based learning for this targeted audience to support learner engagement and program sustainability (*Fac.Dev: About the Project*, n.d.). Fac.Dev offers task-based assessment activities through modules known as "QUESTs", requiring learners to translate new knowledge into action by contextualizing content so that it is immediately relevant to their workplace and practice (*Fac.Dev: About the Project*, n.d.). The use of these QUESTs aligns with authentic assessment principles that validate learning outcomes under the outcomes-based education (OBE) model, contrasted with the way xMOOCs primarily utilize traditional MCQs in assessing professional skills through their course offerings for faculty development (Costello et al., 2018; Malan, 2000).

Fac.Dev also offers digital badging and micro-credentialing to demonstrate and verify user skills and achievements through their online course offerings, which are being increasingly used in competency-based education (Yilmaz et al., 2021). To date, literature has yet to explore how the use of OBE curriculum design for nonclinical professional skill development targeted at healthcare professionals and trainees may influence learner engagement, experience, and learning outcomes within an asynchronized, self-paced course.

## Summary

This literature review provides context to how CPD and faculty development activities are essential aspects of a healthcare professional's career responsibilities to engage in self-directed, life-long learning. The use of online learning for CPD and faculty development is widespread. Healthcare professionals may turn to MOOCs for this purpose due to their asynchronicity, openness, and flexibility; however, they have notoriously low engagement rates and use traditional assessment methods that are outdated in an era of competency-based medical. There is a gap in literature exploring how authentic assessment tasks versus traditional assessments in the delivery of a course for healthcare professionals may impact completion rates and affect participant learning experiences. Fac.Dev is a novel project by McMaster's Program for Faculty Development that introduces online learning modules that use authentic assessment tasks called "QUESTs", which require learners to apply and contextualize content built around learning outcomes to their professional lives and workplaces. This pilot study will be the first to evaluate the novel Fac.Dev digital ecosystem and learning experience through the

delivering and comparing a Twitter curriculum for healthcare professionals in QUEST module format and xMOOC module format.

## Chapter 3. Methodology

### Study Design

This study is a randomized controlled trial (RCT) conducted to evaluate how the delivery of a one-month Twitter course for health professionals, trainees, and academics through a QUEST-based curriculum design compared to an xMOOC-like curriculum design impacts course completion rate as the primary outcome measure. As a pilot study, this research aimed to determine how instructional designers can encourage engagement and completion of nonclinical professional development opportunities on platforms such as Fac.Dev, understanding that self-directed learning is a critical component of continuing professional development.

Secondary outcome measures included participants' self-reported Twitter proficiencies following course completion, measured with retrospective pre-post Likert scale ratings. In addition, participants were asked about potential barriers to course completion, enjoyment of the course, perceived achievement of learning outcomes, and suggestions for improvement; these data were collected, measured, and qualified through both Likert-scale ratings and open-ended survey questions. Through the measurement of these secondary outcomes and the use of self-report surveys, this study aimed to determine how module design impacts the learning experience through the lens of the

learner. This dataset supplements understanding of how these course elements can impact course engagement and completion and vice versa, captured by the primary outcome measure.

Participants were randomized into learning through one of two module designs: Group A (QUEST modules) and Group B (Instructional Online “xMOOC” modules). It was not possible, however, to blind the participants to the arm they were assigned to due to the nature of educational interventions. Chapter 5 under Limitations discusses the consequences of the non-blinding of the interventions. Following randomization, participants were emailed instructions on registering for an account on Fac.Dev and enrol in their assigned course. The course start date began March 20 2022 and was open for one month (four weeks) until April 16 2022, when data collection of the course completion rate occurred. On April 17 2022, an exit survey was administered to all participants via email regardless of whether or not they had completed the full course. Participants had one week to complete the survey and were reminded daily via email.

### *Ethical Considerations*

This study was granted ethics approval by the Hamilton Integrated Research Ethics Board with a reference number of HIREB-#14426 on February 4 2022 (Appendix A). Participants provided their informed consent electronically by completing the Consent and Demographics Survey on Limesurvey. The first page of the survey provided participants with study information, including its purpose and objectives, participant selection and involvement, risks and inconvenience, benefits, compensation, identity, confidentiality, dissemination of results, data sharing, and contacts. This page also

identified that participants may withdraw from the study at any time without consequence or explanation. Demographic information (age, gender identity, profession, Twitter account followers if applicable) was collected in this survey to determine participant eligibility. To protect participant identities, they were asked to generate a unique identifier at the end of the consent form (10-digit code consisting of graduation year from their first degree or diploma, first three letters of the street where they grew up, and last three digits of their cellular phone number). Participants were asked to provide their unique identifier again during the exit survey administered after the one-month course period. This was to ensure responses were limited to study participants and to prevent duplicate responses.

Confidentiality of participant information was protected by data being stored securely within McMaster University's Limesurvey tool and the Fac.Dev learning management system. All raw data (Limesurvey results and descriptive statistics) were collected, de-identified, coded and stored on the student investigator's password-protected computer, with the files being password-protected as well. Only the student investigator, supervising investigator, and co-investigators had access to view and analyze the study data.

### *Eligibility*

Eligible participants for this study included health professionals, trainees, and academics who sought to increase their social media proficiency on Twitter. This may include those in the fields including, but not limited to: medicine, dentistry, midwifery, nursing, paramedics, physiotherapy, physicians' assistants, occupational therapy, speech



language pathology, and more. They must have limited experience using Twitter for professional use (with either no existing Twitter account or less than 250 Twitter followers at the course enrolment time) and be interested in using Twitter to create a professional online presence.

Researchers and academics in health sciences were included in the eligible participant pool. Our study considers researchers as professionals, consistent with Emmerich (2020)'s argument that research should be recognized as a profession. In his essay, Emmerich (2020) defines a profession as involving “an ideal of service and responsibility to the public good; virtue on the part of professionals, and a special sort of fiduciary obligation.” In this view, those in health professions promote health as a public good, and researchers promote knowledge as a public good similarly. These domains overlap in promoting knowledge translation of the health sciences and pedagogical responsibilities. Furthermore, research ethics are considered a form of professional ethics; Emmerich (2020) parallels the requirement for health professionals to shelve their private lives in taking a social role that puts patients' best interests above all else to that of researchers and their study participants. Our Twitter curriculum covered topics relevant to both professions as they undertake a role in knowledge translation of health information on social media and adhering to e-professionalism practices.

### *Participant Recruitment*

The participant recruitment and consent survey was created on McMaster's Limesurvey platform (Appendix B). An infographic was created to summarize study details; it outlined the study purpose, reasons to enrol in the study, eligibility criteria,

voluntary participation involvement, and compensation (Appendix C). On March 1 2022, the survey was activated and a shortened URL was created via bit.ly to share with prospective participants through the various social media channels outlined below. In all posts shared through these channels, recipients were invited to forward the information to colleagues and peers who may be interested.

- **Twitter:** The thesis supervisor created 4 Tweets with the survey link and infographic on her professional Twitter account with over 14,800 followers. The Tweets were collectively ‘retweeted’ 53 times.
- **Facebook:** Facebook posts about the study and recruitment information were created within student groups, such as active student cohort groups in McMaster’s Michael G. DeGroot School of Medicine, to encourage trainee participation.
- **Slack:** An announcement was created to promote study recruitment in the Technology, Education, and Collaboration Hub (TEaCH) Slack workspace, a communication hub managed by the thesis supervisor for 160 professionals and trainees with backgrounds in healthcare, academia, and education.
- **Email:** An email was sent to McMaster’s Health Sciences Education active student cohort and faculty mailing list with study recruitment information (Appendix D).

### *Participant Sample*

The required sample size was estimated using simplified formula  $n = 16(1/\text{effect size}^2)$  that assumes  $\alpha = 0.05$ , power  $(1 - \beta) = 0.8$ , and an effect size = 0.968 (McConnell et al., 2019; Yusoff et al., 2014). The effect size was derived from a 2014 meta-analysis

on the achievement of program outcomes in outcomes-based education implementation.

The calculation resulted in a total sample size of 34 participants; thus, we aimed to recruit 17 participants in each arm of the study.

The recruitment survey was open for approximately two weeks until March 16 2022, when responses stagnated. A total of 40 participants completed the survey. Of these 40 participants, 37 were deemed eligible and were randomized into Group A (QUEST modules; 18 participants) or Group B (Instructional Online modules; 19 participants) using Excel's random number generation function. These eligible participants were then emailed instructions on registering on Fac.Dev and enrol in their assigned course arm. Fourteen participants of Group A enrolled in the QUEST-formatted course, and 13 participants of Group B enrolled in the Instructional Online course, providing us with a total sample size of 27.

The final sample size of enrolled participants did not meet the targeted number of 34. Loss to follow-up was an anticipated concern as the participant pool consisted of busy health professionals and academics. Reminder emails were sent out two days after the course start date to participants who have not yet enrolled in their assigned course to mitigate attrition. Three weekly emails were sent out every Monday morning following the course start date to all participants to remind them of the course deadline and prompt engagement. On April 17 2022, the exit survey was emailed to all participants, and they were reminded daily for one week of the necessity to complete it.

*Development of Modules*

The curriculum was informed by a recent modified Delphi study by Yilmaz et al. (2022), which utilized Kraiger’s Knowledge, Skills, and Attitudes (KSA) framework to identify appropriate items for inclusion in a social media curriculum targeted at health professionals. Social media experts who participated in building consensus on the inclusion of these items through three rounds of surveys were recruited based on meeting one of the following three criteria (Yilmaz et al., 2022):

1. Delivered workshops or national/international presentations teaching others how to use social media in a professional healthcare or educational setting; or
2. Published at least three papers on the use of social media in medicine; or
3. Developed a blog, podcast, and/or social media handle that is widely followed within medical education based on prior work

Based on the results of their consensus-building, the following intended learning outcomes were categorized into knowledge, skills and competencies, and attitudes towards social media use in Table 1 below.

<b>Twitter Course Intended Learning Outcomes</b>	
<i>Upon completion of the online curriculum, successful students should be able to...</i>	
Knowledge	<ul style="list-style-type: none"> <li>● ... articulate how Twitter can be used to advance their educational practices by sharing novel academic ideas, increasing online learning engagement, and foster online academic group discussions</li> <li>● ... articulate how Twitter can be used to advance their research and scholarly pursuits through dissemination of research findings, staying updated on new literature, and communicating with peers and colleagues in their field</li> </ul>

Skills and Competencies	<ul style="list-style-type: none"> <li>● ... create a Twitter account and profile with an appropriate photo, biography, and user handle that reflects a professional digital identity for engagement</li> <li>● ... construct microcontent (Tweets) about their area of research or content expertise, including the usage of acceptable hashtags, visuals, threading, and tagging of others where relevant on Twitter</li> </ul>
Attitudes	<ul style="list-style-type: none"> <li>● ... demonstrate e-professionalism practices on Twitter, including components for posting content (peer-reviewing content prior to sharing, patient privacy) as well as to responding to others (handling trolls, online threats)</li> </ul>

Table 1. Intended Learning Outcomes for the Twitter Course for Healthcare

Professionals, organized by Kraiger’s KSA Framework

These intended learning outcomes were created with action verbs (articulate, create, construct, and demonstrate) that express observable and assessable behaviour to create relevant teaching and learning activities and develop assessment tasks, as per Biggs’ (1996) constructive alignment model. The teaching and learning activities for both arms of the modules were the same: students were provided with readings, case studies, webpages, written tutorials, and video modules surrounding each unit topic. The unit topics were organized sequentially as follows:

1. List the advantages of using Twitter for academic exchange
2. Articulate your own goals for utilizing Twitter as a healthcare professional/trainee
3. Create a Twitter Profile
4. Build and Monitor your Twitter Community
5. Engage with your Twitter Community
6. Create and Add Visuals to your Tweets

7. Construct Tweetorials
8. Demonstrate e-Professionalism on Twitter

For the QUEST arm, students were required to complete tasks which involved creating a professional Twitter profile, following accounts, and searching for hashtags relevant to them, constructing Tweets, creating Twitter lists and “Tweetorials”, and more. Students were also required to complete short answer reflections in which they related topics within the readings to their professional practices. In the xMOOC arm, students were to complete multiple-choice answer quizzes of four to six questions based on the learning material. These multiple-choice questions were built with reference to Haladyna & Downing (1989)’s best practices for multiple-choice item writing, and were reviewed by the supervising investigator. Participants had unlimited attempts to complete the quiz to achieve a perfect score; answers were automated into the learning management system to give immediate feedback upon completion of the quiz.

## Data Collection and Analysis

### *Data Collection*

To measure the primary outcome, course completion rate, data were collected from the Fac.Dev learning management system (LMS) based on participant enrolment and completion of the course. Completion of the course was determined by whether participants unlocked the Certificate of Completion, which had restricted access based on submission of all the required assessments (tasks and/or quizzes) per unit for all eight units. Participants were required to navigate sequentially through the module units, as the

submission of a module's assessment activity unlocks access to the next module's assessment activity. These requirements are explicitly stated on the course page. At 11:59pm EST on the course end date, April 16 2022, the final list of participants who completed each arm of the course was exported as an Excel file from the course's activity report and logs page, accessible to the student investigator who held the role of Manager for both courses.

To measure the secondary outcomes, participants' self-reported Twitter proficiencies after the one-month curriculum and participants' learning experiences (barriers to course completion, enjoyment of the course, perceived achievement of learning outcomes, and suggestions for improvement) were measured with a self-report exit survey administered on McMaster's Limesurvey tool (Appendix E). This survey was administered on April 17 2022 following the course end date, and participants had one week to submit it regardless of whether they were able to complete their assigned course. Participants who completed the course early (i.e., before the April 16 deadline) were also able to unlock access to the exit survey through the course page, which restricted access to the survey in the same way the Certificate of Completion was locked.

Self-reported Twitter proficiency change over the course period was measured through a retrospective pre-post Likert scale ratings from 1 (not proficient at all) to 9 (proficient enough to confidently engage in Twitter for professional use). The retrospective pre-post design approach involves administration of the self-assessment survey at the end of the course to collect current and retrospective answers around perceived changes in Twitter knowledge and skills (Bhanji et al., 2012). In the survey,

participants were asked to think back to before they started the modules and rank their proficiency, and then rank their proficiency after completing/starting the modules. In doing so, participants share the same frame of reference having been exposed to the course; this method can prevent the over- or under-estimation of baseline levels in a pre-test in reference to the post-test, as well as reduce response shift bias (Chang & Little, 2018).

Lovato & Peterson (2018) emphasize the importance of designing programme evaluation questionnaires with a variety of question types (closed- and open-ended questions, Likert scales, tick boxes, etc). This prevents non-response from lack of prompted or pre-coded responses, but still sufficiently accommodates all potential answers if participants hold a view unrepresented in pre-coded options. In measuring participants' learning experiences, participants were asked to check tick boxes from a list of potential barriers to course completion that were relevant to them, type a free text response to how the modules could be improved to better enable their completion, provide a Likert-scale rating from 1 (very unlikely) to 9 (highly likely) for likelihood of recommending the course to a peer, check tick boxes for perceived achievement of learning outcomes, and type free text responses for other learning outcomes met and suggestions for improvement of the modules. With the variety of survey question types, we aimed to provide participants with a comprehensive opportunity to share their true perceptions of the course and facilitate the ease and timeliness of responding.



## *Data Analysis*

### Quantitative Methods

A chi-square test of independence was conducted to compare the primary outcome of completion rates of the QUEST module arm to that of the xMOOC arm of the Twitter course on IBM® SPSS® Statistics, with  $P < 0.05$  considered significant.

An independent-samples Mann-Whitney U Test was utilized to determine whether participation in the Twitter course with QUEST modules versus with xMOOC modules affected the likelihood of recommending the course to a peer. This non-parametric test was used since the Likert scale dataset for the dependent variable, likelihood of course recommendation, was treated as ordinal.

To determine whether participation in either Twitter course affected self-assessed Twitter proficiency, participants' retrospective pre-post Likert ratings were analyzed with IBM® SPSS® Statistics using a paired samples t-test and a  $P < 0.05$  value for significance. Differences between participants' pre- and post-course ratings were calculated for each group, then compared using an independent-samples test to identify if there was a significant difference between the improvement in Twitter proficiency in the two groups after the course.

Multiple response frequency tables were generated using IBM® SPSS® Statistics for survey questions that prompted participants to “check all that apply”, including barriers to course completion and perceived achievement of intended learning outcomes.

### Qualitative Methods

Questions in the exit survey that were open-ended free responses included 1) Were there aspects of the modules that you enjoyed? Please specify; 2) Are there any other learning outcomes that you achieved during this module? (optional); and 3) Please list any other suggestions for improving these modules (optional). To analyze this data, the student investigator independently conducted a qualitative thematic analysis of survey responses through coding and theme identification. The themes were reviewed and refined by the supervising investigator (Braun & Clarke, 2012). A CONSORT flow diagram of the overall study procedure is illustrated in Figure 1.

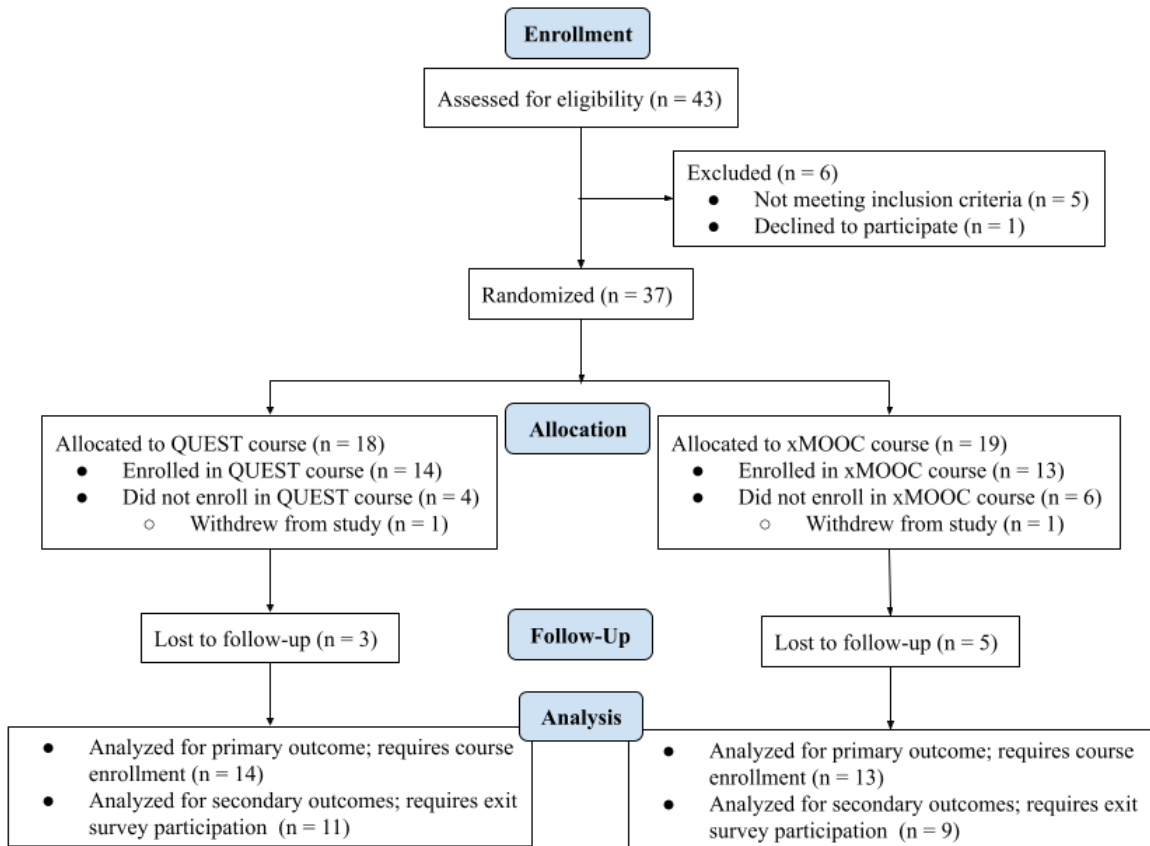


Figure 1. CONSORT Flow Diagram of QUESTION Study Procedure (enrolment, intervention allocation, follow-up, and data analysis)

### *Rigor and Trustworthiness*

Because this study involves quantitative and qualitative methods, rigor and trustworthiness in both these methodologies must be prioritized to ensure high-quality educational scholarship. The qualitative components of this study were framed by an interpretivist approach; this aligns best with the user-experience driven paradigm examining and interpreting learner perceptions to improve subsequent methods for teaching online through Fac.Dev. Morse et al. (2002) defined rigor as the appropriateness of the methodological research design in addressing the research questions and purpose.

Since the primary research question aimed to compare the outcomes of a new intervention (QUEST modules) with the conventional alternative (xMOOC modules) the randomized controlled trial design was chosen as the gold-standard study design which allows us to assess the instructional design effectiveness in achieving completion rates. As such, the CONSORT statement was used to guide the reporting of methods and results in this randomized controlled trial to facilitate clarity, completion, and transparency of data reporting (Schulz et al., 2010).

Curtin & Fossey (2007) describe trustworthiness in qualitative research as, “the extent to which the findings are an authentic reflection of the personal or lived experiences of the phenomenon under investigation”. This can be achieved through the use of triangulation strategies, involving data triangulation, researcher triangulation, and methodological triangulation. Data triangulation involves the use of various sources of data to capture a holistic and diverse view of the phenomenon being studied. In this study, data triangulation was achieved through the collection of data from both learner activity reports Fac.Dev’s learning management system, and self-reported responses to an exit survey. The student investigator ensured consistency of information between both sources across different times during the study period by comparing and cross-checking participant feedback and attitudes from the exit survey with their actual course engagement statistics. Researcher triangulation occurs when multiple researchers are involved in the analysis of data to eliminate single-researcher bias and increase the credibility of the results (Curtin & Fossey, 2007). This was established through the consultation of supervisory committee members during quantitative and qualitative

analysis, in which the supervisory investigator reviewed and refined coded themes from participant exit survey responses. Methodological triangulation involves the use of two or more research methods in one study and was achieved through the use of both quantitative and qualitative approaches in collecting and analyzing data to explore learner experiences on Fac.Dev (Curin & Fossey, 2007).

Commitment to reflexivity to support trustworthiness and reduce researcher bias involved the research team's acknowledgement and critical self-reflection upon their own biases, assumptions, perspectives, and positions. The team consisted of four researchers (VT, TC, SD, IB). The student investigator, VT, is a master's student in health sciences education with social media research experience. The supervising investigator, TC, is a practicing emergency physician and faculty member at McMaster University, acting as associate dean for continuing professional development. She is also on the leadership and development team for Fac.Dev and holds an extensive research background in digital teaching and learning, educational assessment and evaluation, and social media. SD and IB are education scientists and faculty at McMaster University who were consulted regularly during the research process due to their expertise in educational research methodologies, learning cognition, and e-learning to support faculty development.

## Chapter 4. Results

### Participants Demographics

<b>Demographics</b>	<b>Group A: QUEST Modules</b>	<b>Group B: xMOOC Modules</b>	<b>Total</b>
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<b>Number of participants, n</b>		14	13	27
<b>Mean age, years (<math>\pm</math>SD)</b>		36.5 ( $\pm$ 13.7)	41.5 ( $\pm$ 10.1)	38.9 ( $\pm$ 12.2)
<b>Program, n</b>	Medicine	10	9	19
	Nursing	1	1	2
	Massage therapy	1	1	2
	Dentistry	1	0	1
	Respiratory therapy	1	0	1
	Non-clinical teaching	0	1	1
	Health sciences graduate studies	0	1	1
<b>Gender, n</b>	Cisgender Man	7	3	10
	Cisgender Woman	6	9	15
	Demiwoman	1	0	1
	Non-binary/Non-gender conforming	0	1	1

Table 2. Participant Demographic Characteristics

Following the intake survey and consent form, a total of 27 participants registered on Fac.Dev to enrol in the modules with 14 in the QUEST arm and 13 in the xMOOC arm. These data are summarized in Table 2. The mean age of participants in the QUEST arm and the xMOOC arm were 36.5 and 41.5 years old, respectively. Overall, participants had a mean age of  $38.9 \pm 12.2$  with a range from 22 to 58. Most participants affiliated with a professional background in medicine (70.4%). Other backgrounds included nursing

(7.4%), massage therapy (7.4%), dentistry (3.7%), respiratory therapy (3.7%), non-clinical teaching (3.7%), and health sciences graduate studies (3.7%). Most participants identified as cisgender, with 10 cisgender men and 15 cisgender women total. One participant identified as a demiwoman and another identified as non-binary/non-gender conforming.

### Course Completion

Course Completion	Group A: QUEST Modules	Group B: xMOOC Modules	Total
Yes, n	5	5	10
No, n	9	8	17
Total, n	14	13	27

Table 3. Number of Participants Completing QUEST and xMOOC Modules

Course completion was defined as meeting all of the requirements to unlock the “Certificate of Completion” at the end of the course within the specified one-month period. This certificate was only unlocked once participants submitted all of the required tasks, quizzes, and/or questionnaires associated with their study arm’s modules. The final number of participants completing each course is presented in Table 3. Of the 14 participants enrolled in the QUEST modules, five participants completed the course, resulting in a course completion rate of 35.7%. In the xMOOC group, five of the 13 participants completed the course, resulting in a course completion rate of 38.5%. A chi-square test of independence was performed to examine the relation between course completion rate and module design groups. The test showed that there was no significant association,  $X^2(1, N = 27) = 0.022, p = .88$ .

### Likelihood of Recommending the Course to a Peer

Participants were asked to rate their likelihood of recommending their assigned course arm to a peer on a scale of 1 (highly unlikely) to 9 (highly likely). For those who participated in the QUEST arm of the modules, the mean rating was 6.18 ( $\pm$  2.79). For those who participated in the xMOOC arm, the mean rating was 5.56 ( $\pm$  3.32). The maximum range of scores from 1 to 9 for participants was observed in each arm, attributing to the high standard deviation of ratings. This suggests that regardless of the arm participants were assigned, there was a wide range of opinions regarding whether or not they would recommend the course. Their recommendation rating may reflect how much they enjoyed the course and/or how effective they felt it was. An independent-samples Mann-Whitney U Test did not show a significant difference between the mean likelihood for course recommendation of the QUEST arm and the xMOOC arm ( $U = 45.5, p = .77$ ).



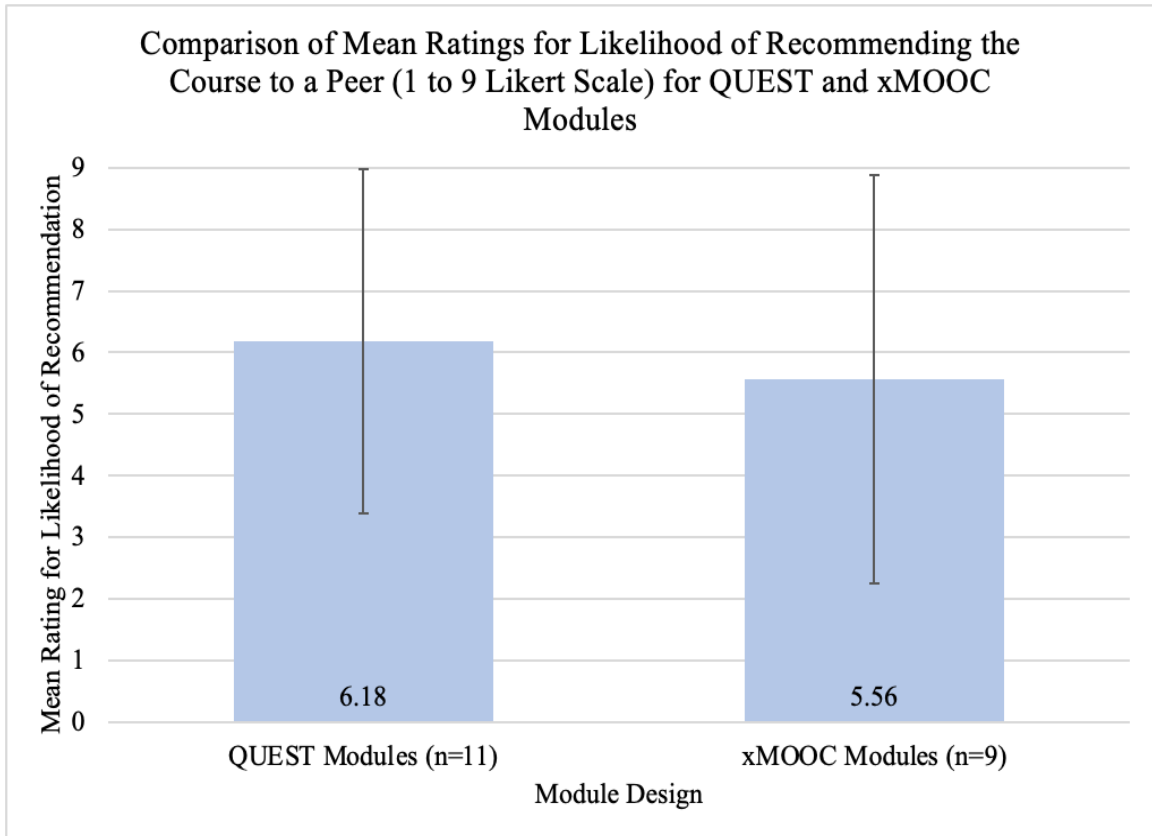


Figure 2. Comparison of the mean ratings for likelihood of recommending the course to a peer based on a 1 to 9 Likert scale (n = 20) between those assigned the QUEST modules and xMOOC modules.

### Improvement in Twitter Proficiency

	Group A: QUEST Modules	Group B: xMOOC Modules
<b>Pre-Course Twitter Proficiency, mean (<math>\pm</math>SD)</b>	3.73 ( $\pm$ 2.15)	2.89 ( $\pm$ 1.90)
<b>Post-Course Twitter Proficiency, mean (<math>\pm</math>SD)</b>	6.18 ( $\pm$ 1.72)	5.67( $\pm$ 1.80)
<b>Pre-Post Twitter Proficiency rating differences, mean (<math>\pm</math>SD)</b>	2.45 ( $\pm$ 3.13)	2.78 ( $\pm$ 2.33)

Table 4. Retrospective Pre-Post Ratings (1 to 9 Likert Scale) of self-perceived Twitter Proficiency

Participants completed retrospective pre-post self-rating of their perceived Twitter proficiency before starting the course and after having enrolled for one month, regardless of whether or not they completed all the required elements for a certificate of completion. A paired-samples t-test showed a significant difference in the mean self-ratings of Twitter proficiencies before the QUEST modules ( $M=3.73$ ,  $SD=2.15$ ) and after the QUEST modules ( $M=6.18$ ,  $SD=1.72$ ) ( $t(10)=-3.02$ ,  $p = 0.006$ ). A paired-samples t-test also showed a significant difference in the mean self-ratings of Twitter proficiencies before the xMOOC modules ( $M=2.89$ ,  $SD=\pm 1.90$ ) and after the xMOOC modules ( $M=5.67$ ,  $SD=1.80$ ),  $t(8)=-3.57$ ,  $p = .004$ . These results suggest that one-month participation in both QUEST and xMOOC of the Twitter course is correlated with a self-perceived increase in Twitter proficiency. An independent samples t-test showed that there is no significant difference between the improvement of Twitter proficiency self-ratings pre-course and post-course between the QUEST ( $M=2.45$ ,  $SD=3.13$ ) and xMOOC groups ( $M=2.78$ ,  $SD=2.33$ ),  $t(18)=0.75$ ,  $p = .23$ .

## Meeting Learning Outcomes

Learning Outcomes Met	Group A: QUEST Modules (n = 11)	Group B: xMOOC Modules (n = 9)	Total (n = 20)
I can articulate how Twitter can be used to advance my educational practices, n (%)	8 (73%)	8 (89%)	16 (80%)
I can articulate how Twitter can be used to advance my research practices, n (%)	5 (45%)	4 (44%)	9 (45%)
I can create Tweets relevant to my professional context, n (%)	8 (73%)	6 (67%)	14 (70%)
I can employ engagement tactics to increase the reach of my Tweets, n (%)	4 (36%)	6 (67%)	10 (50%)
I can engage with others professionally on Twitter, n (%)	6 (55%)	4 (44%)	10 (50%)
I can identify when another individual is being professional on Twitter, n (%)	6 (55%)	5 (56%)	11 (55%)
I am comfortable on Twitter and know how to respond in most situations, n (%)	7 (64%)	1 (11%)	8 (40%)

Table 5. Participants' self-perceived achievement of individual learning outcomes after one-month course enrolment

Of the 11 respondents who participated in the QUEST arm, eight selected that they felt they could articulate how Twitter could be used to advance their educational practices, in addition to being able to create Tweets relevant to their professional contexts. Of the nine respondents who participated in the xMOOC arm, eight selected that they felt they could articulate how Twitter could be used to advance their educational practices as well, whereas only six felt they could create Tweets. In contrast to seven respondents in the QUEST arm agreeing that they feel comfortable and know how to respond in most situations on Twitter, only one respondent in the xMOOC arm felt this

was a learning outcome that was met. These results may highlight how the use of authentic tasks and actual practice on Twitter with QUESTS versus multiple-choice questions play a role in a learner's comfort with their skill achievement, especially as comfort and confidence are integral components of competency assessment.

Interestingly, the learning outcomes presented in this survey question were ordered consecutively as with the course activities in the modules. Assessment activities, whether task-based or MCQ-based, were aligned with each learning outcome in the units as ordered in the table above, and course participants were instructed to progress through these activities as they were presented. However, the responses to whether participants felt they met these intended learning outcomes did not taper in number towards the end of the list, which would parallel participation behaviour in the modules. For example, the later learning outcomes of being able to identify when another individual is being professional on Twitter and knowing how to respond in most situations is aligned with the e-professionalism unit at the end of the course, which only five participants completed in the QUEST arm. Yet, six and seven participants in this arm, respectively, felt that they had achieved these learning outcomes without completing the course activities associated with them.

At the end of this question, participants were able to specify any other learning outcomes they felt they achieved during their modules. One participant who completed the QUEST arm noted, *"I can somewhat efficiently navigate Twitter and I now understand Tweets and how they work"*. In the xMOOC arm, a participant shared, *"The tweets from the tweeps (I was following) have offered me multiple opportunities to attend*

*interesting webinars and participate in tweet chats*”, demonstrating that course participation contributed to their ability to network professionally on Twitter to gain opportunities for career development. Another participant in the xMOOC arm noted that participation in the course sparked *“research ideas about social network impact in medical education”* in their country.

### Barriers to Course Completion

<b>Barriers to Completion</b>	<b>Group A: QUEST Modules (n = 11)</b>	<b>Group B: xMOOC Modules (n = 9)</b>	<b>Total (n = 20)</b>
Time (I did not have time), n (%)	6 (55%)	6 (55%)	12 (60%)
Motivation (I did not feel motivated), n (%)	3 (27%)	2 (22%)	5 (25%)
Disinterest (I am not interested in the content), n (%)	1 (9%)	0 (0%)	1 (5%)
Relevance (The content is not relevant to me), n (%)	2 (18%)	0 (0%)	2 (10%)
Difficulty (I felt it was too difficult), n (%)	0 (0%)	0 (0%)	0 (0%)
Ease (I felt it was too easy), n (%)	1 (9%)	0 (0%)	1
Platform (I found it difficult to navigate the learning platform), n (%)	0 (0%)	0 (0%)	0 (0%)

Table 6. Participants’ reported barriers to course completion after one-month enrolment

Regardless of whether participants completed the course or not, they were asked about what barriers they encountered. For those who completed their course, the question was worded as, *“Were there any barriers or challenges you faced while completing the module? Check all that apply”*. For those who did not complete their course, the question

was worded as, “*What barriers or challenges did you face that contributed to lack of completion? Check all that apply*”.

The primary barrier to completion for both groups was the lack of time to complete the course. Participants were given one month to complete eight units and their associated tasks, with a recommended timeline provided by the study team of completing two units per week for the four weeks. Based on most of the participant responses, one month was an insufficient amount of time to complete these activities. The second most-selected response in both groups was lack of motivation to complete the modules, with a total of 25% of participants agreeing it was a factor. Some participants who were enrolled in the QUEST noted other barriers such as disinterest in the content, lack of relevance of the content to themselves, and content easiness. For those in the xMOOC, no other barriers to completion were applicable to participants. No participants in either arm felt that content difficulty and navigation of the LMS on Fac.Dev hindered their completion of the course.

Participants were also given the opportunity to describe other specific barriers to course completion outside the defined options above. In the QUEST arm, one participant noted that they felt shy to do some of the modules, referring to an example of the task in which they are asked to Tweet an introduction about themselves on their professional Twitter account. Another participant elaborated on the lack of time, noting that motherhood served as a personal significant barrier for engaging in the course. In the xMOOC arm, one participant stated, “*I did not find the content delivery engaging. After the first two modules were just papers with an associated quiz, I lost all motivation*”.

## Module Enjoyment

Participants were asked about aspects of the modules that they enjoyed through open-ended text responses. Participant quotes were organized into themes about the enjoyment of the content, delivery of the learning material, and the assessment activities. The course content and delivery of learning material were nearly identical for each course, with only the assessment activities differing heavily between QUEST (task-based) and xMOOC (MCQ-based).

Regarding content, participants in both the QUEST arm and xMOOC arm identified a variety of specific units within the modules that they enjoyed, such as the modules about creating a Twitter profile, articulating one's motivations for using Twitter, and building, monitoring, and engaging with one's Twitter community. The usefulness of the information provided by the course content through "*helpful articles*" and "*[advice] from experts that really work on the topic*" was also brought forward.

Participants in both QUEST and xMOOC mentioned enjoyment of the videos embedded within the modules when it comes to delivery of the learning material. One participant described them as "*good to watch and instructed well*"; another noted that use of videos in conjunction with journal articles diversified the methods of teaching. Participants in the xMOOC arm also mentioned the sequencing of modules in a way that was "*progressive in introduction of concepts*" and helped them "*go through a step-by-step process on what to expect, and how to go from a consumer of Twitter to a contributor of Twitter*". One participant enrolled in the QUEST module shared that it was

enjoyable “*to know that there is another world of teaching alternative to death by [PowerPoint]*”.

Only one participant in the QUEST modules specifically mentioned assessment activities, noting the reflection questions as enjoyable. No participants in the xMOOC modules mentioned any of the xMOOC-associated quizzes.

	<b>QUEST Module Participant Quotes</b>	<b>xMOOC Module Participant Quotes</b>
<b>Course Content</b>	<p><i>“Simple, helpful articles”</i></p> <p><i>“The content was interesting”</i></p> <p><i>“Understanding the Twitter Analytics”</i></p>	<p><i>“Creating a Twitter profile, building and monitoring your Twitter Community, Engaging with your Twitter Community, Adding Visuals to your Tweets, [and] Constructing Tweetorials”</i></p> <p><i>“Very useful information, advices from experts that really work on the topic”</i></p> <p><i>“The motivation section (the ‘why’) Module 2 and 3”</i></p>
<b>Delivery of the learning material</b>	<p><i>“It was comprehensive for a first-time user who was naive to Twitter”</i></p> <p><i>“To know that there is another world of teaching alternative to death by PowerPoint”</i></p> <p><i>“Videos and instructional guides”</i></p>	<p><i>“I suppose it was nice to have selected pieces of literature to read, but beyond identification of potentially relevant papers, there was little to enjoy”</i></p> <p><i>“The supplementary videos... were good to watch and instructed well. The more practical modules starting from #4 were nice.”</i></p> <p><i>“There was breadth of scope and the modules used different teaching methods like journal articles, videos, etc.”</i></p> <p><i>“The articles, websites, and other references embedded within my course helped me go through a step-by-step process on what to expect, and how to go from a consumer of Twitter to a contributor of Twitter”</i></p> <p><i>“A very well designed course, helped me achieve all learning outcomes easily. The modules were very well sequences and progressive in introduction of concepts.”</i></p>



<b>Assessment activities</b>	<i>“Reflection questions”</i>	N/A
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Table 7. Participant quotes of aspects of the Twitter course modules they enjoyed.

## Suggestions for Improvement of Modules

Participants had the opportunity to provide suggestions for improving the modules through two questions. For participants who did not complete their assigned course, they were asked *“What could we have changed about the modules to make it more likely for you to complete it?”*. At the end of the survey, all participants (regardless of whether they completed the modules or not) had the option to share any additional suggestions for improving the modules.

Three themes were constructed by the research team during analysis of the participant suggestions for improving the course regarding the delivery of learning materials: reduction of reading material quantity, increasing the use of visuals and media, as well as increased module interactivity. A common sentiment shared by participants was the disdain for the amount of reading required for the assessment activities. Participants enrolled in the xMOOC modules noted that the readings felt *“dry”*, with one participant sharing that it *“does not create any joy in reading the material which makes it hard to be motivated”*. Some participants suggested converting some course content into video formats, adding more pictures to instructional guides, and graphic flowcharts for different course activities. A total of six participants mentioned their desire for more interactivity in the modules: two participants in the QUEST arm and four participants in the xMOOC arm.

Interestingly, there were no suggestions for improvement of the modules from those who were enrolled in the QUEST course regarding the assessment tasks; however, there were multiple suggestions from those in the xMOOC arm. For those in the xMOOC arm, two participants mentioned how the lack of opportunity to practice their Twitter skills through coaching of Tweets and actually creating a Tweetorial in a safe space. Two xMOOC participants also described issues with the MCQ quizzes: one feeling that the true-or-false quizzes were difficult to complete, and another feeling that content quizzes contributed to a lack of motivation to continue.

Lastly, participants in both QUEST and xMOOC agreed that a longer time frame to complete the course may have made it more likely for them to complete the course and could help improve its delivery for the future. With their career workload and personal life, participants found it difficult to balance it with this course, which became a last priority. This is consistent with the results from the previous survey question about barriers to course completion, in which the primary barrier for both groups was time.

		QUEST Module Participant Quotes	xMOOC Module Participant Quotes
<b>Course content should be relevant and timely</b>		<i>“I found the sections on Tweetorials to be beyond what I was interested in, though I understand the value of including the material for other folks”</i>	<i>[about the supplementary video with Simon Sinek on the WHY theory]: “The WHY theory came out many years ago, you hear it in so many courses... it is still valid, yes, but the constant repetition of this simple underlying idea is nothing new.”</i>
<b>Delivery of the learning material</b>	<b>Reduce the quantity of reading material</b>	N/A	<i>“Nearly everything was reading material. I have to read so much for my job, therefore I felt a bit frustrated to read much more on top”</i>

			<p><i>“The online course content is incredibly dry and does not create any joy in reading the material which makes it hard to be motivated”</i></p> <p><i>“[I] found only dry and relatively old literature”</i></p>
	<p><b>Use visuals and media often and effectively</b></p>	<p><i>“Adding pictures to your ‘how to’ instructions would be helpful”</i></p> <p><i>“Maybe some content as a YouTube video demonstrating what to do in real-time”</i></p> <p><i>“Create abridged versions of the papers we had to read, maybe in video format”</i></p>	<p><i>“A few graphic step by step flowcharts for different activities might be helpful”</i></p> <p><i>“Some videos are too long”</i></p>
	<p><b>Interactivity is desired</b></p>	<p><i>“More interactive modules vs just reading assigned papers”</i></p> <p><i>“I was looking for an interactive session and not just reading articles”</i></p>	<p><i>“Create more interactive modules”</i></p> <p><i>“More interactive format would have been helpful - video clips of people talking about social media use, or even breaking up the articles to integrate quiz items between articles or within articles would have been more interesting”</i></p> <p><i>“At least 1-2 points of direct interaction”</i></p> <p><i>“No change for interaction when learning/participation in an online course about social media is a bit strange to me.”</i></p>
<p><b>Assessment activities</b></p>	<p>N/A</p>		<p><i>“Some of the questions in the quizzes with the answer FALSE were difficult to complete.”</i></p> <p><i>“Linking papers to read and then completing a content quiz created no motivation to continue with the additional modules”</i></p> <p><i>“Include some coaching on Tweets”</i></p>

		<i>“Practice [for] creating a Tweetorial in this group. I am personally better with actually engaging and practice in a ‘safe space’”</i>
<b>More time and flexibility is needed to complete the modules</b>	<p><i>“More time to finish [the modules]”</i></p> <p><i>“More time. A week ... is too little for an ER doctor with 24h shifts and 2 kids”</i></p> <p><i>“More spaced out than 4 weeks -- the inpatient ward ended up being extremely busy and I simply could not get to it”</i></p>	<p><i>“Allow more flexibility to completion with longer a longer time frame.”</i></p> <p><i>“I might have continued to do the modules if I had more time, but they quickly fell to the bottom of my priority list”</i></p> <p><i>“More time to complete”</i></p> <p><i>“A longer time frame is required to complete the course, it is very hard to fit in with all the other clinical and life obligations in such a short time frame”</i></p>
<b>Interface (Fac.Dev LMS)</b>	N/A	<i>“The interface present for the content in a way that allows easier ‘back and forth’ [between modules/activities]”</i>

Table 8. Participant quotes of suggestions for improving the Twitter course modules.

## Chapter 5. Discussion

### Course Completion

This study was conducted to determine whether the delivery of a Twitter course for healthcare professionals through Fac.Dev's QUEST module design would have an increased course completion rate in comparison to the same course delivered through xMOOC modules. The results suggest that there was no significant difference in the course completion rates in both arms. However, the completion rates for the QUEST and xMOOC modules were 35.7% and 38.5%, respectively, which are both higher than the average completion rate of less than 10% reported in existing literature for MOOCs in general (Alraimi et al., 2015; Jordan, 2014). There is currently no literature evaluating the completion rates of existing QUEST-based courses offered on Fac.Dev to compare, but higher completion rates may also reflect other motivational factors influencing MOOC continuance, as discussed next.

### *Motivations for Enrolling*

In this study, participants were not asked about their motivations for enrolling in the Twitter course for healthcare professionals. However, inclusion criteria outlined in the consent form included being interested in optimizing a professional Twitter presence. Because participation in the course was completely voluntary, motivational factors for enrolling may have played a strong role in completion rates. These factors have been identified in the literature as critical for MOOC course engagement and subsequent completion (Xiong et al., 2015). The main reasons for enrolment in MOOCs include

satisfying curiosity and career advancement in a current job (Christensen et al., 2013). Other motivations include relevance to one's current academic program, preparing for future employment and career prospects, and interest-related reasons (interest in the topic, the professor, or the institution offering the MOOC) (Kizilcec & Schneider, 2015; Xiong et al., 2015; Zhang et al., 2019). Furthermore, participants in this course were told they would be earning a course certificate on Fac.Dev upon completion, which is an extrinsic motivator that has been shown in research to play a significant role in course engagement, especially for more junior faculty or trainees who perceive certification as a way to advance their careers (Yilmaz et al., n.d.; Zhang et al., 2019). In future studies, it would be valuable to ask participants about their motivations behind deciding to participate in a Fac.Dev course and evaluate if there is a correlation with completion rates.

### *Barriers to Completion*

Most participants noted time as being a barrier to completing course activities. With voluntary participation in the course and QUESTION study, it was anticipated that time would be a barrier for busy health professionals, especially during the ongoing COVID-19 pandemic that has increased the demand and workload for healthcare workers on the front lines. The course study period also coincided with the Canadian Residency Matching Service (CaRMS) application process for participants who are medical students in their final year and other health professionals or faculty involved in that process.

Time being reported as the primary barrier to completion of the courses is consistent with existing literature exploring factors influencing engagement in self-directed learning for CPD. A scoping review published by Jeong et al. (2018) studying

these factors found that the top-cited barrier for Canadian physicians was time constraints. This perceived barrier to CPD engagement has also been found in similar studies to be universal in other health professions such as nursing, dentistry, and pharmacy (Marriott et al., 2007; Shahhosseini & Hamzehgardeshi, 2015). These results corroborate the literature by underscoring the need for academic institutions to develop CPD activities that address the unique needs of healthcare professionals and their perceived barriers and facilitators to self-directed learning in CPD. This can be achieved partly by being convenient and flexible regarding time and space, as well as employing principles promoting self-directed learning (Davis & McMahan, 2018).

It is not surprising that online learning has been growing in implementation within CPD and faculty development, with its perceived advantages being that it can be flexible, accessible, and asynchronous - appropriate for the busy healthcare professional (Sklar et al., 2021). The online Twitter course demonstrated that one month was too short of a time frame for most to complete the modules. Although the course is already asynchronous and self-paced, lengthening the duration that participants must engage with the material to several months may allow even more flexibility for health care professionals to engage when it is convenient.

### Participant Outcomes

Through this study, it was found that one-month participation in both QUEST and xMOOC of the Twitter course is correlated with a statistically significant self-perceived increase in Twitter proficiency. However, there was no significant difference in the increase of their Twitter proficiency when comparing both groups to each other. Lastly,

our study found no significant difference between the mean ratings of likelihood for course participants in each arm to recommend their assigned course to a peer. These quantitative findings may indicate that both arms are similar in enabling moderate completion rates and increasing self-perceived Twitter proficiency in participants. Thus, this study may serve as insight that it may not be a question of how the design of modules (QUEST vs xMOOC) impacts these outcomes, but rather utilizing the qualitative data to ask: *how can we improve the student learning experience of these modules for future participants?*

### Teaching and Learning Activities

The content delivery via the teaching and learning activities in both QUEST and xMOOC courses was nearly identical for each. For every module unit, participants were provided a set of resources that may have included required journal article readings, video lectures, website links, instructional how-to guides, and/or e-professionalism case studies. These activities were constructively aligned with the targeted learning outcomes articulated in the module titles. The primary suggestions for improving the teaching and learning activities include implementing more interactive module components and adding more media-based content (e.g., photos, videos).

### *Lack of Interactivity*

Lack of interactivity within the modules was a common theme brought forth by QUEST and xMOOC module participants when asked how the modules could be improved in the future. One participant highlighted the irony of engaging in a Twitter



course yet having no opportunity to interact with other students on Fac.Dev, sharing, “No chance for interaction when learning [and participating] in an online course about social media is a bit strange to me.” These views are consistent with what has been said in prior literature, which suggest that interactivity and networking are strong facilitators for engagement in self-directed learning for continuing professional development for Canadian physicians, and lack of social interaction in these program activities contributes to less effective self-directed learning outcomes (Goulet et al., 2013; Jeong et al., 2018; Kitto et al., 2018).

Although Fac.Dev allows peer-to-peer and peer-to-instructor communication via the Fac.Dev community chat function, there were no interactive components within both modules that explicitly encouraged or instructed participants on how to communicate with each other. This would be easy to implement in future courses on Fac.Dev using the LMS’s available module features. Course managers can add a “forum activity” module that enables participants to engage in asynchronous discussions over an extended period of time. Participants would be able to start a new discussion to ask questions, discuss course content, exchange ideas, and network with each other.

Introducing interactive components through forum activities could address another challenge to engaging with course material brought forth by participants. One participant in the QUEST arm said they felt shy to do some of the modules, which required them to create and publish a Tweet to their public Twitter profile introducing themselves. Another participant in the xMOOC modules mentioned their desire for a safe space to practice Twitter skills within the course. These opinions may reflect how it can be daunting or

uncomfortable to publish public content on a widely used social media platform as a beginner who may not feel confident in their proficiency yet. In the future, an interactive forum activity could provide a playground where users could ask peers for feedback on drafted Tweets or Tweetorials to overcome these barriers. They could potentially share usernames and support each other's Tweets and content through retweeting, liking, and replying to increase each other's confidence.

### *Opportunities for Blended Learning*

Another possible way of increasing interactivity is to supplement the asynchronous, self-paced course with a synchronous interaction session for all participants in a blended-learning approach to teaching social media skills on Fac.Dev. Previous research has shown that blended learning contributes to effective self-directed learning outcomes for continuing professional development and can encourage distributed participation (Kitto et al., 2018; Ladhani et al., 2011). It would also provide an avenue for networking and collaboration to increase engagement in self-directed learning activities (Jeong et al., 2018).

This would be feasible for future offerings of the Twitter course, considering that McMaster's Program for Faculty Development has previously offered workshops on using Twitter effectively to build a network and collaborate that are now available on MacPFD Team Site's video archives. Through these workshops, expert social media users acted as facilitators to demonstrate Twitter tactics to drive engagement, and participants engaged in a hands-on Tweeting activity with real-time feedback, which may be helpful to re-offer as a synchronous session during the course period (Bal & Duque,

2020). Future studies on Fac.Dev may consider using blended learning in partnership with MacPFD workshops to understand how it impacts participant engagement, satisfaction, and achievement of learning outcomes.

### *Use of Visuals and Media*

Besides the desire for more interactive modules, participants in both module arms expressed enjoyment of the supplementary videos provided in the teaching activities. They suggested using even more videos and graphics could improve their course experience. There is ample evidence in the literature showing that videos are a highly effective educational tool, especially as it is so prevalent in online courses and most MOOCs already (Brame, 2015; Guo et al., 2014; R. H. Kay, 2012). However, to maximize their utility in e-learning for health professionals, best practices for video design and implementation must be considered, including addressing elements of cognitive load theory when using multimedia (de Jong, 2010).

One participant shared that they felt the length of some of the videos was too long. Guo et al. (2014) conducted an empirical study of videos embedded in MOOCs to determine how their production affected student engagement. The authors found that out of 6.9 million video-watching sessions among four edX MOOCs, the optimal video length that resulted in an engagement rate near 100% was less than six minutes. Once videos reached 9 to 12 minutes long, median engagement time dropped to approximately 50%, and dropped even further down to 20% once they reached 12 to 40 minutes (Guo et al., 2014). The videos in the course modules ranged from approximately 10 to 20 minutes, which could have contributed to a lack of participant engagement and loss of attention.

Participants' desire for more shorter media-based content may also reflect attitudes preferring microlearning and microcontent, which have been previously recommended in literature to be used in the delivery of faculty development learning activities. Especially when time constraints are a significant barrier to self-directed learning for CPD, having microcontent available as "learning fingerfood" can encourage on-demand learning for faculty engagement (Heydari et al., 2019).

As a next step, short video lectures can be commissioned from social media experts with specific evidence-based guidelines that promoting effective learning experiences (Brame, 2015). Experts should be instructed to keep videos brief, not exceeding six minutes in length, and use interactive features such as "chapters" on YouTube to promote student engagement and active learning (Brame, 2015; Mayer, 2008; Zhang et al., 2019). Informal talking-head videos with the use conversational language and enthusiastic tone have also been shown to be more engaging to learners (Guo et al., 2014). These videos can replace some of the assigned journal article readings since some participants found the amount overwhelming.

### Course Assessment Activities

Course assessment activities are where the QUEST and xMOOC modules differed. QUEST-based tasks implemented authentic assessments, which involve complex tasks and performance tied to real-world contexts, compared to traditional MCQ-type assessments, which require single correct responses that are usually easily scored (Wiggins, 1998). QUEST-based tasks were aligned with the principles of Kolb's

experiential learning theory by providing students the opportunity to practice, apply, and contextualize Twitter skills to their professional practice and engage in the Twittersphere.

In regard to suggestions from participants for the improvement of the assessment activities, xMOOC participants noted that there was a lack of opportunities for practice of skills (e.g., creating a Tweet) that were taught in the instructional guides provided in the reading material. Specifically, two participants mentioned they would have benefited from Tweet coaching and being able to practice creating a Tweetorial, rather than only completing a content quiz about Tweet and Tweetorial creation guidelines. Interestingly, these suggestions for authentic assessment are already elements of the QUEST modules. For those units, QUEST participants were coached on creating a specific self-introduction Tweet for their profile and asked to link their Tweet to the assessment questionnaire as practice. This feedback, coupled with the fact that participants in the QUEST arm did not provide any suggestions for improving their assessment tasks, may suggest that participants would value the use of authentic, task-based assessments for a Fac.Dev courses teaching Twitter-based social media skills for a healthcare professional.

Furthermore, the fact that participants had to consistently engage on Twitter as part of their assessment tasks may have contributed to explaining why 64% of QUEST exit-survey respondents felt that they met the learning outcome of being comfortable on Twitter and knowing how to respond in most situations, compared to only 11% of xMOOC exit-survey respondents. Since those in xMOOC arm were only assessed with MCQ quizzes that did not demand interaction on Twitter, this may have provided indirect evidence of meeting the learning outcomes compared to using authentic assessment,

which provides direct evidence (Mueller, 2005). Even if the multiple-choice question asked participants to apply Tweet creation and e-professionalism guidelines to different scenarios and case studies rather than pure factual recall, there exists an element of uncertainty behind the justification for response selection and whether it was up to luck, logical reasoning, or the fact that the quiz could be completed with unlimited attempts until the correct answer was selected (Mueller, 2005).

In addition to specifying the lack of opportunities to practice Twitter skills in the course activities, two xMOOC participants commented on how the use and difficulty of the MCQ quizzes could be improved. One participant noted the difficulty of some of the true-or-false MCQs, noting “some of the questions in the quizzes with the answer FALSE were difficult to complete.” This brings forth the discussion of how multiple-choice question quality in xMOOCs may impact student learning and behaviour by introducing possible irrelevant difficulty. Multiple evidence-based principles and guidelines exist for writing MCQ items in various contexts, including Haladyna and Downing (1989)’s widely-cited taxonomy of multiple-choice item-writing rules. Previously, Costello et al. (2018) reviewed the frequency of item writing flaws within MOOC MCQ assessments. The authors found that of all 204 MCQ items analysed from 18 MOOCs, over 50% had at least one flawed item and violated item-writing guidelines, demonstrating that this is a prevalent issue amongst MOOCs today. Case & Swanson (2002) note that true-or-false question formats may be problematic when not used simply for explicit, factual recall, that is, to examine contextual knowledge application. This may have introduced irrelevant difficulty for the quiz-taker in our course.

Since prior literature has provided ample evidence on how poorly constructed MCQs can impact assessment psychometrics and disadvantage student performance, this issue underlines the importance of quality assurance and peer-review of MCQ items, as well as sufficient training for faculty and question-writers (Costello et al., 2018; Downing, 2005; Tarrant & Ware, 2008). For this study, the student investigator generated a majority of the MCQ items with reference to Haladyna et al.'s (2002) review of multiple-choice item-writing guidelines for assessment. The MCQ items were then reviewed and edited by the supervising investigator, who holds an extensive background in digital teaching, learning, and assessment. If MCQ items are to be used in future Fac.Dev courses, question-writing should involve a rigorous peer review process involving properly trained faculty and statistical analysis of the MCQs (Costello et al., 2018). Due to the time and cost constraints of conducting this study, this rigorous peer review process was unable to be sufficiently implemented.

### Recommendations for future courses on Fac.Dev

This pilot study demonstrated that creating, implementing, and evaluating a Twitter curriculum for healthcare professionals on Fac.Dev is feasible. The quantitative findings of this study reveal that regardless of the QUEST versus xMOOC format of modules, participants perceive an increase in their Twitter proficiency skill sets from pre-course enrolment and are similarly likely to recommend the course to a peer. Since neither format is superior to the other in achieving higher completion rates or increasing self-perceived Twitter proficiency, Fac.Dev course developers may benefit from utilizing the qualitative data from this study to focus on improving the learning experience on this

platform instead. The qualitative findings of this study corroborate literature in emphasizing the importance of interactivity for e-learning and self-directing learning for continuing professional development and the use of video multimedia to support the delivery of course content to improve the learning experience for participants and increase engagement. To increase interactivity, course developers may consider using the LMS's forum activities feature to provide asynchronous discussion, peer feedback and review, and networking opportunities. Blended learning may also be an option to explore by implementing a synchronous tutorial workshop on one of the Twitter practical skills module units like engagement tactics.

In future studies involving the evaluation of student experience of courses on Fac.Dev, a longer time period should be allocated for participants to complete their courses to alleviate the barrier of time. That way, participants would be given ample time to complete the course truly at their own pace. Then, when they are asked what barriers they encountered, it may give rise to more specific insights into non-environmental, course-design barriers to completion that educational developers for Fac.Dev can address to improve the delivery of modules and encourage engagement.

## Limitations

A limitation of this study was the small sample size of 27 participants, which did not reach the targeted sample size of 34 participants. It is unknown whether a larger sample size may have produced statistically significant differences in the primary outcome of completion rates between both groups, but nonetheless it would have increased the reliability of the results. The small sample size also presents a threat to the



external validity of the results, which is extremely limited. In the future, a longer recruitment period involving regular advertising and boosting of awareness on social media channels and formal communication pathways within institutions may result in a higher sample size.

Furthermore, there was a loss of follow-up at multiple stages of the study period, including seven participants who failed to enrol in their assigned course after the consent form and another seven participants who did not complete the exit survey following the one-month course period. This was anticipated, as the study population consisted of busy healthcare professionals. The timing of the study during the COVID-19 pandemic leading to increased demand and workload for health care workers may have contributed to this. Loss to follow-up was mitigated through daily reminder emails that prompted participants to enrol in their assigned course if they had not done so, weekly reminders during the course period to remind participants of the course end date, and bi-daily emails in the week following the course period to remind participants to complete the exit survey. Despite this, only 20 of the 27 enrolled participants completed the exit survey. The seven participants who enrolled in the course but did not complete the exit survey were those who did not complete their assigned course. Thus, there is overrepresentation in the data of participants who did complete the course and may have a higher opinion of the modules than those who did not complete it. These seven participants could have provided valuable input on their barriers to completion of the course and suggestions for improving the modules to encourage their completion.

Lastly, another important limitation of the study was the non-blinding of participants to the educational intervention they received at enrolment. Due to the nature of the intervention, blinding the participants and researchers to the course design was not possible. Interaction with the course material and activities makes it clear to them whether they are assigned to the QUEST modules or the xMOOC modules depending on whether their assessments were QUEST task-based or traditional MCQ-based. In addition, the QUESTION study's purpose to compare and evaluate the efficacy of the novel Fac.Dev course design to traditional xMOOC design was also outlined in the consent form, read by, and signed upon by the participants during recruitment. A few participants who were assigned to the xMOOC arm noted their awareness of being assigned to the control group in the exit survey and how that impacted their motivation to engage with the course. One participant had explicitly stated, "*being in the control group was not fun*". Another had mentioned, "*perhaps it was the branch I was in, but again, not engaging*". On the other hand, awareness of being assigned to the experimental, QUEST-based module arm may have produced the opposite effect of increased motivation and/or engagement with the course. The participant feedback highlights that it is a limitation that cannot be ignored.

## Chapter 6. Conclusion

There is growing potential for social media, particularly Twitter, to help healthcare providers advance their educational and research practices. With continuing professional development, inclusive of faculty development, being an important component of every healthcare professional's career responsibilities, academic institutions must be able to support this learning through evidence-based, self-paced, online courses for nonclinical professional skills such as social media professionalism. Two online courses teaching beginner Twitter skills for the healthcare professional were piloted on Fac.Dev, an online e-learning platform for faculty development. This study aimed to determine how the delivery of QUEST-based modules for a social media skills course for healthcare professionals affects learner experience compared to conventional e-learning through xMOOC format and understand the learning experience as reported by participants. This was addressed by measuring outcomes such as completion rates, barriers to completion, self-rated Twitter proficiency, perceived achievement of learning outcomes, likelihood of recommending to a peer, and course feedback.

A literature review was conducted to provide context to the role of continuing professional development in academic medicine and healthcare. The use of online learning interventions in the delivery of CPD programs is prevalent due to their openness, accessibility, and flexibility regarding time and space. For these reasons, massive online open courses have been reported in the literature to be particularly promising for faculty development but have abysmal engagement and completion rates. To date, no research has been done to evaluate participant engagement outcomes in an online course utilizing

authentic assessment tasks compared to a course modelled after the MOOC format, whose traditional pedagogical practices in assessment lag behind in an era of competency-based medical education.

The study revealed no significant difference was found in any of the quantitative outcomes in the comparison between both instructional module designs. Although the QUEST-based modules used authentic assessments, providing opportunities for contextualization and application of social media skills in practice, this did not significantly impact the subsequent completion rates compared to xMOOC modules with traditional MCQ activities. Participants in both arms felt they had improved in their Twitter proficiency skills as healthcare professionals in comparison to pre-course enrolment, and the self-perceived achievement of learning outcomes was similar in both arms. These results suggest that both QUEST- and xMOOC-formatted courses for social media skill sets achieve similar engagement and learning outcomes.

The study findings present valuable insight on optimizing the user-centered learning experience on Fac.Dev for healthcare professionals. Interpretation of participant feedback constructed multiple themes regarding how to improve course delivery that are consistent with best practices in literature and adult learning theories. Recommendations for the development of future online courses of nonclinical professional skill development on Fac.Dev includes the use of more visual, multimedia elements and interactivity throughout the modules, and more time and flexibility for completion. By translating these recommendations into practice, we can provide healthcare professional learners with an engaging and enriching self-directed learning experience.

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[Farhana/ba83587b09ee1b1b56626702322de32632c9e62d](https://www.semanticscholar.org/paper/Achievement-of-the-Program-Outcomes-in-Outcomes-A-Yusoff-Farhana/ba83587b09ee1b1b56626702322de32632c9e62d)

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## Appendix

### Appendix A. HIREB Ethics Approval Letter



Feb-04-2022

**Project Number:** 14426

**Project Title:** Evaluating Learner Outcomes of a Twitter Course for Health Professionals: QUEST-based vs Instructional ONLINE module (QUESTION)

**Student Principal Investigator:**

**Local Principal Investigator:** Dr Teresa Chan

We have completed our review of your study and are please to issue our final approval. You may now begin your study.

The following documents have been approved on both ethical and scientific grounds:

Document Name	Document Date	Document Version
QUESTION Study Info Poster Version 2	Jan-25-2022	2
QUESTION Study Recruitment Email - 20220125 CLEAN	Jan-25-2022	2 - clean
QUESTION STUDY - End-of-Time Period Survey - 20220125 CLEAN	Jan-25-2022	2 - clean
QUESTION Study Protocol - 20220125 CLEAN	Jan-26-2022	2 - clean
QUESTION Study Consent Form & Demographics Survey - 20220125 CLEAN	Jan-26-2022	2 - clean

The following documents have been acknowledged:

Document Name	Document Date	Document Version
CITI GCP Training 2020; Certificate #39851317	Dec-29-2020	1
QUESTION Study Provisional Approval Cover Letter	Jan-26-2022	1

**In light of the current COVID-19 pandemic, while HIREB has reviewed and approved this application, the research must be conducted in accordance with institutional and/or public health requirements.**

Any changes to this study must be submitted with an Amendment Request Form before they can be implemented.

This approval is effective for 12 months from the date of this letter. Upon completion of your study please submit a **Study Completion Form**.

If you require more time to complete your study, you must request an extension in writing before this approval expires. Please submit an **Annual Review Form** with your request.

**PLEASE QUOTE THE ABOVE REFERENCED PROJECT NUMBER ON ALL FUTURE CORRESPONDENCE**

Good luck with your research,

A handwritten signature in black ink, appearing to read "Kristina Trim".

Kristina Trim, PhD, RSW  
Chair, HIREB Student Research Committee  
McMaster University

The Hamilton Integrated Research Ethics Board (HIREB) represents the institutions of Hamilton Health Sciences, St. Joseph's Healthcare Hamilton, Research St. Joseph's-Hamilton, the Faculty of Health Sciences at McMaster University, and Niagara Health and operates in compliance with and is constituted in accordance with the requirements of: The Tri-Council Policy Statement on Ethical Conduct of Research Involving Humans; The International Conference on Harmonization of Good Clinical Practice Guideline (ICH GCP); Part C Division 5 of the Food and Drug Regulations of Health Canada, Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations and the provisions of the Ontario Personal Health Information Protection Act 2004 and its applicable Regulations. For studies conducted at St. Joseph's Healthcare Hamilton, HIREB complies with the Health Ethics Guide of the Catholic Alliance of Canada.

## Appendix B. Consent Form and Demographics Survey

# QUESTION Study: Evaluating Learning Outcomes of a QUEST-based Twitter Curriculum for Healthcare Professionals

You are invited to participate in our study that compares outcomes between the Query-based Ubiquitous Education & Scholars Training (QUEST) format and an extended Massive Open Online Course (xMOOC). This study is being conducted by Victoria Tran (McMaster University), Dr. Teresa Chan (McMaster University), Dr. Yusuf Yilmaz (McMaster University), Dr. Ilana Bayer (McMaster University), and Dr. Sandra Monteiro (McMaster University)

By clicking to continue, you are implying that you would like to participate in this study. Please read the following consent form thoroughly to ensure that you are in agreement with the terms

\*\*\*

### **Study Information & Consent form**

#### **Purpose and Objectives**

The main purpose of this study is to determine the effectiveness of the QUEST vs. xMOOC format.

#### *Importance of this Research*

This research will help us evaluate the new outcomes-based QUEST format compared to that of a more traditional xMOOC learning environment. This list will serve to improve the program and to generate scholarship regarding the program itself.

#### *Participants Selection*

You are being invited to participate in this project because you have been identified as a trainee or professional in a healthcare field including, but not limited to: medicine, dentistry, midwifery, nursing, paramedics, physiotherapy, physicians assistants, occupational therapy, and speech language pathology, and may be interested in optimizing your professional social media presence.

#### *What is involved?*

If you agree to voluntarily participate in this study, your participation will include enrolling in a 1 month Twitter curriculum for health professionals. This research study is a randomized controlled trial; you will be randomized into learning through one of two formats: the outcomes-based QUEST format, or an extended Massive-Open Online Course format (xMOOC). Following the 1 month course period, you will be asked to complete a survey involving both open ended and closed

questions about your learning experience and skill development. You will only have two weeks to complete this survey, and you will be reminded that you need to complete this survey several times once initiated.

You will complete the surveys online through LimeSurvey (like this form).

### ***Risks & Inconvenience***

There are no known or anticipated risks to you by participating in this research. Participation in this study may cause some inconvenience to you, including the loss of the time spent completing module activities and the surveys. The potential for privacy breach is minimized through data access restricted to only immediate members of the research team, as well as secure storage of data on password-protected files, the University computing network, and encrypted USB keys.

### ***Benefits***

The potential benefits of your participation in this study include benefits from the resource generated from this study's results, as well as benefits to yourself and your future colleagues within the field of Health Professions Education.

### ***Compensation***

So long as you enrol within the module, upon completion of the 1 month period, you will be automatically entered into a draw for a \$500 gift certificate from Amazon. You do not need to complete the modules to be eligible for the draw.

### **Voluntary Participation**

Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. You will be given an opportunity to derive a code that is your unique participant code on the next page, **please write this code down**. If you withdraw from the study part-way through, any previously contributed data will remain as part of the survey, since it will already have been integrated into the subsequent rounds of the survey. If you complete the survey, you will need to provide us with your participant code for your responses to be removed.

### **Identity**

For the purpose of this study, we are hoping to link the module outcomes with Twitter usage and productivity. You will be asked to share your Twitter handle and engagement statistics for the period of the study, but nothing beyond what is openly accessible on Twitter already.

You will be optionally asked to submit further details in our study survey. However, if you wish to partition your data so that your Twitter account information is kept separate from your survey response data, that will be possible as well. You will be given the option to submit your Twitter information via both the survey and the QUEST or online module. Meanwhile, for any data you

provide us within the boundaries of the study (via surveys, etc.) your identity will be kept completely confidential during the research phase of our study, as no identifying information other than your affiliate program will be recorded. Your Twitter information will be redacted (e.g. deidentified) prior to release of the dataset for open use by replacing your Twitter handle with an alias (e.g. a made up set of letters).

### **Confidentiality**

Your confidentiality and the confidentiality of the data will be protected by data being stored securely within the McMaster University Limesurvey tool and/or the online module system. Raw data collected will only be viewed by the project analyst. We will adhere to institutional guidelines about learner and study participant privacy throughout.

### **Dissemination of Results**

It is anticipated that the results of this study will be shared with others in the following ways: conference / scholarly meeting presentations, publication of the data and generation of a resource for future learners.

### **Data Sharing**

A redacted (de-identified) copy of these data will be published alongside this paper. It is also possible that these data will be re-examined in the future for the purposes since we aim to make this data open. The data collected during this survey will be securely stored within the University computing network.

### **Contacts**

Individuals that may be contacted regarding this study by Dr. Teresa Chan, McMaster University, email: [teresa.chan@medportal.ca](mailto:teresa.chan@medportal.ca). For the purposes of ensuring the proper monitoring of the research study, it is possible that a member of the Hamilton Integrated Research Ethics Board may consult your research data. By signing this consent form, you authorize such access.

This study has been reviewed by the Hamilton Integrated Research Ethics Board (HiREB). The HiREB is responsible for ensuring that participants are informed of the risks associated with the research, and that participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair, HiREB, at 905.521.2100 x 42013.

By completing and submitting the questionnaire, YOUR FREE AND INFORMED CONSENT IS IMPLIED and indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers. By participating in this study you do not waive any rights to which you may be entitled under the law. Please print & retain a copy of this letter for your reference now. Or, email Dr. Teresa Chan for a copy for your records ([teresa.chan@medportal.ca](mailto:teresa.chan@medportal.ca))

**Next Page**

1.1 What is your age?	<i>Free Text, Must be Number, Mandatory</i>
1.2 What is your gender?	Man Woman Trans woman Trans man Non-binary/Non-conforming Two spirited Other Prefer not to answer
1.3a Are you in a health profession or training to be in a health profession?	Yes No
1.3b If “Yes” What profession do you most affiliate with?	Dentistry Medicine Midwife Nursing Paramedic Physiotherapy Physicians Assistant Occupational Therapist Speech Language Pathologist Other
1.4a Do you have a Twitter account?	Yes (show question 1.4b, 1.4c, 1.4d) No
1.4b What year did you first register for Twitter? (OPTIONAL)	<i>Free Text, Must be Number</i>
1.4c How many Twitter followers do you currently have?	<i>Free Text, Must be Number</i>

<p>1.4d What is your Twitter handle? (OPTIONAL)</p>	<p><i>Free Text</i></p>						
<p>1.5 Would you be interested in participating in our study? This would require you to start a 1 month curriculum targeted to improving your professional Twitter engagement?</p>	<p>Yes (If yes, show 1.6, 1.7) No</p>						
<p>1.6 What is your email address?</p>	<p><i>Free Text, Must be Email</i></p>						
<p>1.7 Consent: 1.7 Do you consent to being part of this study if you are eligible?</p>	<p>Yes <i>Mandatory field.</i></p>						
<p>1.8 Unique Identifier</p>	<p>For this study you will need to have a unique identifier. Please tell us the following:</p> <table border="1" data-bbox="618 1272 1398 1654"> <tr> <td data-bbox="618 1272 1295 1402">Your graduation year from first degree or diploma (e.g. 2003, if you graduated from your BHSc in 2003)</td> <td data-bbox="1295 1272 1398 1402"></td> </tr> <tr> <td data-bbox="618 1402 1295 1528">The first three letters of the Street where you grew up (e.g. Main St = MAI)</td> <td data-bbox="1295 1402 1398 1528"></td> </tr> <tr> <td data-bbox="618 1528 1295 1654">The last three digits of your cellular phone number (e.g. ***-***-*123 = 123)</td> <td data-bbox="1295 1528 1398 1654"></td> </tr> </table> <p>&lt;SUBMIT BUTTON&gt;</p>	Your graduation year from first degree or diploma (e.g. 2003, if you graduated from your BHSc in 2003)		The first three letters of the Street where you grew up (e.g. Main St = MAI)		The last three digits of your cellular phone number (e.g. ***-***-*123 = 123)	
Your graduation year from first degree or diploma (e.g. 2003, if you graduated from your BHSc in 2003)							
The first three letters of the Street where you grew up (e.g. Main St = MAI)							
The last three digits of your cellular phone number (e.g. ***-***-*123 = 123)							
<p>Post-submission message</p>	<p>Thank you very much for your interest! We will be in touch with you to let you know whether you meet the eligibility criteria, and if so, which group you will be assigned to.</p>						



## Appendix C. Study Recruitment Infographic

**McMaster University** | **HEALTH SCIENCES**

### The QUESTION Study: Evaluating Outcomes of a QUEST-based Social Media Course for Health Professionals

With the rise of the **#FOAMed** movement, Twitter has become a powerful tool to promote scholarship and build learning communities

Our team is developing **online modules** to teach health professionals and trainees **how to use Twitter** to enhance your professional and academic life

#### About the Research Project

We are conducting a **randomized control trial** to understand how the delivery of a Twitter curriculum through different web-based module designs affects learner outcomes. The **QUESTION** Study stands for **Q**uery-based, **U**biqutous **E**ducator and **S**cholars **T**raining (QUEST) modules vs. **I**nstructional **O**Nline modules.

### We need YOU to help us evaluate the learning outcomes of our Twitter curriculum!

#### Why should you enrol in our study?

- **You'll learn** how to incorporate Twitter strategies into your educational or research practice
- **You'll help us learn** how to best teach social media competencies to future health professionals
- **It's easy!** You can complete the module at your own pace within the 1 month period.
- You will be entered in a draw to win one available \$500 Amazon gift certificate

#### Eligibility Criteria

- You are in a health profession or training to be in a health profession
- You **do not** have a Twitter account OR have **less than 250** Twitter followers

#### Participation Involves...

- Enrolment in a 1-month online, asynchronous Twitter curriculum for health professionals
- Completion of surveys on your learning experience and skill development following the 1-month course period

**TO PARTICIPATE OR FOR MORE INFORMATION:**  
Please contact **Victoria Tran** at [tranv16@mcmaster.ca](mailto:tranv16@mcmaster.ca)  
This study is supervised by **Dr. Teresa Chan** ([teresa.chan@medportal.ca](mailto:teresa.chan@medportal.ca))

This study has been reviewed by the Hamilton Integrated Research Ethics Board under Project # 14426  
Version 2 - Version Date: January 25 2022

## Appendix D. Recruitment Email

*Subject: Twitter Curriculum for Health Professionals Study Participation*

Dear HSED community,

We are reaching out to you today to invite you to participate in a research project entitled: The QUESTION Study. We aim to evaluate how the delivery of a social media curriculum through the Query-based Ubiquitous Education & Scholars Training (QUEST) format affects learning outcomes in comparison to a traditional Instructional ONline format.

To do so, we are recruiting health professionals and trainees interested in developing their Twitter proficiency skills to enhance their academic and professional life.

This study will involve enrolment in a 1-month web-based, asynchronous Twitter curriculum in which you will learn how to create a Twitter profile and brand, how to construct microcontent and increase engagement, and how to maintain professionalism on social media. After the 1 month course period, you will be asked to complete a survey about your learning experiences.

If you are interested in participating, please visit this link <http://bit.ly/questionstudy> for a full description of our study and the consent form.

For more information, please contact the principal investigator, Victoria Tran (tranv16@mcmaster.ca) or supervising investigator, Dr. Teresa Chan (teresa.chan@medportal.ca). You may also refer to the attached poster.

We appreciate your consideration for your involvement with this project, and invite you to forward this offer to your peers who may be interested.

Yours Truly,

Victoria Tran, BHSc, MSc candidate  
Teresa M. Chan, MD, FRCPC, MHPE, Associate Dean, Program for Faculty Development

## Appendix E. Course Exit Survey

We invite you to complete our end-of-study survey. We are asking all participants to complete the information regardless of the completion status of the course after the defined curriculum timeline (1 month)

1. Which arm of the study were you assigned?	Group A: QUEST modules Group B: Instructional online modules	
2. Did you complete all modules of the social media curriculum?	Yes No	
Depending on previous answers participants will have a branched set of questions from this point.	If answered “Yes” above.	If answered “No” above.
3a. Barriers	<p>Were there barriers or challenges you faced while completing the module? (Check all that apply)</p> <ul style="list-style-type: none"> <li>● Time (I did not have time)</li> <li>● Motivation (I did not feel motivated)</li> <li>● Disinterest (I am not interested in the content)</li> <li>● Difficulty (I felt it was too difficult)</li> <li>● Ease (I felt it was too easy)</li> <li>● Platform (I found it difficult to navigate the learning platform)</li> <li>● Other (Free text)</li> </ul>	<p>What barriers or challenges did you face that contributed to lack of completion? (Check all that apply)</p> <ul style="list-style-type: none"> <li>● Time (I did not have time)</li> <li>● Motivation (I did not feel motivated)</li> <li>● Disinterest (I am not interested in the content)</li> <li>● Difficulty (I felt it was too difficult)</li> <li>● Ease (I felt it was too easy)</li> <li>● Platform (I found it difficult to navigate the learning platform)</li> <li>● Other (Free text)</li> </ul>

<p>3b. Better enabling completion (MANDATORY)</p>	<p>N/A</p>	<p>What could we have changed the module to make it possible for you to complete it? <i>Free text</i></p>
<p>4a. Enjoyment</p>	<p>Were there aspects of the modules that you enjoyed? <i>Free Text</i></p>	<p>Were there aspects of the modules that you enjoyed? <i>Free Text</i></p>
<p>4b. How likely are you to recommend these modules to a peer?</p>	<p>9 (highly likely) 8 7 6 5 4 3 2 1 (very unlikely)</p>	<p>9 (highly likely) 8 7 6 5 4 3 2 1 (very unlikely)</p>
<p>5a. Twitter Proficiency Retrospective Pre</p>	<p>Think back to before starting the modules. How proficient do you think your professional Twitter skills were BEFORE starting the modules?</p> <p>9 (Proficient enough to confidently engage in Twitter for professional use) 8 7 6 5 4 3 2 1 (Not proficient at all)</p>	<p>Think back to before starting the modules. How proficient do you think your professional Twitter skills were BEFORE starting the modules?</p> <p>9 (Proficient enough to confidently engage in Twitter for professional use) 8 7 6 5 4 3 2 1 (Not proficient at all)</p>

<p>5b. Twitter Proficiency Retrospective Post</p>	<p>How proficient do you think your professional Twitter skills are AFTER completing the modules?</p> <p>9 (Proficient enough to confidently engage in Twitter for professional use) 8 7 6 5 4 3 2 1 (Not proficient at all)</p>	<p>How proficient do you think your professional Twitter skills are AFTER starting the modules?</p> <p>9 (Proficient enough to confidently engage in Twitter for professional use) 8 7 6 5 4 3 2 1 (Not proficient at all)</p>
<p>6a. What knowledge, skills, and attitudes have you learned through the modules? Check all that apply.</p>	<ul style="list-style-type: none"> <li>● I can articulate how Twitter can be used to advance my educational practices.</li> <li>● I can articulate how Twitter can be used to advance my research practices.</li> <li>● I can create Tweets relevant to my professional context.</li> <li>● I can employ engagement tactics to increase the reach of my Tweets.</li> <li>● I can engage with others professionally on Twitter.</li> <li>● I can identify when another individual is being professional on Twitter.</li> <li>● I am comfortable on Twitter and know how to respond in most situations.</li> </ul>	
<p>6b. Are there any other learning outcomes that you achieved during this module? (OPTIONAL)</p>	<p><i>Free text</i></p>	
<p>Please list any other suggestions for improving these modules (OPTIONAL)</p>	<p><i>Free text</i></p>	