JMIR Medical Education

Impact Factor (2024): 3.2
Volume 4 (2018), Issue 2 ISSN 2369-3762 Editor-in-Chief: Blake J. Lesselroth, MD, MBI, FACP, FAMIA

Contents

Original Papers

Tutorial

Viewpoints

Review

Original Paper

Improving Shared Decision Making Between Patients and Clinicians: Design and Development of a Virtual Patient Simulation Tool

Simon Jacklin[1*], MPharm; Neal Maskrey[1*], MBBCh, MSc; Stephen Chapman[1*], BPharm, PhD

School of Pharmacy, Keele University, Keele, United Kingdom

[*]all authors contributed equally

Corresponding Author:
Simon Jacklin, MPharm
School of Pharmacy
Keele University
Hornbeam Building
School of Pharmacy
Keele, ST55BG
United Kingdom
Phone: 44 07597935501
Email: s.jacklin@keele.ac.uk

Abstract

Background: Shared decision making (SDM) involves the formation of a collaborative partnership between the patient and clinician combining both of their expertise in order to benefit decision making. In order for clinicians to be able to carry out this skilled task, they require practice. Virtual reality, in the form of a virtual patient, could offer a potential method of facilitating this.

Objective: The objective of this study was to create a virtual patient that simulated a primary care consultation, affording the opportunity to practice SDM. A second aim was to involve patients in the design of a virtual patient simulation and report the process of the design.

Methods: We employed a multistep design process drawing on patient and expert involvement.

Results: A virtual patient, following a narrative style, was built, which allows a user to practice and receive feedback; both clinical and communication skills are required for the simulation. The patient group provided multiple insights, which the academic team had overlooked. They pertained mostly to issues concerning the patient experience.

Conclusions: It is possible to design a virtual patient that allows a learner to practice their ability to conduct SDM. Patient input into the design of virtual patient simulations can be a worthwhile activity.

(JMIR Med Educ 2018;4(2):e10088) doi:10.2196/10088

KEYWORDS

clinical decision making; education; medical education; mobile phone; pharmacy education; virtual patient; virtual reality

Introduction

Shared decision making (SDM) involves the formation of a collaborative partnership between a patient and clinician [1]. Clinicians know about clinical guidelines, basic science, their previous experiences, and case histories, while patients understand their experience of the disease, their lifestyle, what they prefer and expect as well as the risks they will tolerate [2]. Through communication, these 2 worlds can be combined to benefit the decision-making process [3]. This partnership is not necessarily equal at all times, that is, it does not have to be an exact 50%-50% contribution. Patients sit on a continuum, all holding disparate preferences for involvement in their care [4], but all these variants can be considered as shared if the dynamics between patients and clinicians are congruent. A patient may not want to make any final decision, but they should still be involved in the process, eliciting their concerns and views [5].

The push to encourage clinicians to practice SDM has ethical, legal, and clinical dimensions with respect to patients' autonomy and their right to choose [6]. SDM with patients initiating treatment for inflammatory bowel disease was shown to increase

patient satisfaction and likelihood of adherence to therapy and decrease costs [7]. Reduction in prescribing [8] and increase in patient satisfaction [9] and confidence in decisions made [10,11] have all been reported.

There are numerous barriers and difficulties inherent in influencing clinicians to utilize SDM more often and to the highest standard [12]. SDM is a skill and a potentially overlooked element is the fact that it requires training and development [13]. It could be easy for health care professionals to assume that by carrying out consultations in clinical practice, they are honing their abilities. This may not be the case as a key factor in the acquisition and development of skills is not just practice but feedback [14,15]. Routine clinical practice does not often allow the time for self-reflection or feedback from a senior or peer and so by itself is insufficient. This is compounded by the fact that clinicians themselves are not adept at identifying their own weaknesses [16].

So how can a clinician practice and receive this vital feedback? Current approaches have limitations; simulated patients are not standardized or accessible at all times; neither videotapes nor lectures and seminars are greatly interactive as the learner cannot make active choices to dictate the outcome of a case [17,18]. Ideally, what is required is a standardized, readily accessible, low-risk, and interactive method for practice and feedback. Advancements in technology mean that virtual reality can meet all of these criteria and offer a potential solution, specifically virtual patients (VPs).

VPs have been defined as a "specific type of computer program that simulates real-life clinical scenarios; learners emulate the roles of health care providers to obtain a history, conduct a physical examination, and make diagnostic and therapeutic decisions" [19]. They are standardized, safe, and tailorable; they permit repeated practice; and they offer new economies of scale.

The examples of VPs in the literature are a heterogeneous collection of technologies, perhaps due to different pedagogical aims. A significant differentiating factor is the type of skill they attempt to develop: technical or emotional. Technical skills include managing acute medical emergencies [20] and triaging patients [21]. More recently, there have been attempts to combine technical skills with emotional ones [22]; the cited example is somewhat different from others as it involves both patients and practitioners using the simulation. While the simulation touches on SDM, it focuses on other issues too, such as health education; the scenario is concerned with a patient requesting antibiotics when they are not required.

Many virtual cases reduce emotional skills to a technical exercise; the selection of a single question (eg, do you have any medical conditions?) liberates complete, sterilized answers from the patient. Conversation is not like this; there are interjections, misunderstandings, and clarifications. In addition to simplification of emotional skills, many VPs encourage the application of a treatment plan to a patient but not a discussion about the patient's values and preferences to arrive at a decision that the patient and clinician are content with. Rote use of guidelines has previously been raised as a misapprehension of evidence-based medicine [23], and there are concerns that health care is becoming more data-driven, neglecting individual patient's wishes [24]. Developments in virtual training for consultation skills need to address these concerns.

Patient and public involvement (PPI) is the activity of including patients and public in research as collaborators rather than as participants [25]. PPI is fast becoming a key feature of health care research [26]. Efforts have also been made to engage patients and laypeople in medical education as simulated patients, tutors, or advisors on curricula [27].

The aims of this study were to design and build a novel VP simulation for developing the dual skills of technical competence and interpersonal skills to make evidence-informed, shared decisions as well as to involve patient input in the design of the VP simulator.

Methods

Design

A multistep approach was taken with the design.

Literature

The VP simulator was based on existing literature about what broad features make for a good consultation. The most common consultation model in the United Kingdom—Calgary-Cambridge [28,29]—was used as a loose structure for the script. Its 70 items provided the skeleton and flow for the simulation. The technical and clinical elements are based on National Institute for Health and Care Excellence (NICE) guidance.

Initial Script Drafting

The initial script writing was completed by a pharmacist, medical doctor, and medicines optimization expert (SJ, NM, and SC, respectively). The script was branched, multiple-choice style; at each point, the user had 3 options to choose from to select what they wanted to say or do. There was then a corresponding patient response, and 3 more options were presented, and so on. The script was designed to allow the users to take circuitous routes through the consultation; for example, if early on, a key step is missed, the user could redirect the conversation back to pick up that key point. The VP is not based on a real patient. Any resemblance to persons living or dead is coincidental.

Patient Involvement

Local patient advocacy groups were contacted to identify interested patients. Each of the 3 patients who agreed to participate was met individually and their initial ideas about the simulation discussed. Following initial script drafting, sections of the script were shown to each person and comments on realism and quality as well as any aspect of the script or simulation were elicited. Comments were collated, and the script was amended in the light of suggestions. A cycle of feedback from each patient was incorporated.

Experts

The final phase in the development of the design, before the animation element, was an expert review. We asked 3 experienced primary care clinicians to interact with a prototype version of the tool and provide written feedback on their

thoughts; the prototype was devoid of animation. Comments were invited on the clinical aspects as well as those relating to pedagogy, such as feedback. After the written reviews had been received, these were collated and the necessary amendments to the script were made.

Technical Details

The script developed through these 4 stages was then built into a Web-based VP simulator; comments from patients and experts were focused on the script and nonanimated prototype. They did not review the animations and voice-over elements due to these being predetermined but did have an opportunity to review the image of the VP. Textbox 1 lists the particular specifications and products used to create the finished product.

Textbox 1. Development software used.

- Script writing: Google Sheets and Docs, draw.io
- Audio editing: Adobe Audition and Adobe Premiere Pro
- Character and environment modeling, rigging, animation, and rendering: Maya 2014
- Character and environment texturing: Adobe Photoshop
- Compositing: Adobe After Effects CC
- Server-side scripting language: PHP

Results

The setting was a primary care consultation room with the patient sitting in front of you (see Figure 1). Users play the role of either a general practitioner or a prescribing pharmacist, whichever is relevant to them. By selecting from the multiple-choice options, usually 3 each time, the user can navigate the scenario. After each option selection, the patient will respond with a reaction using both prerecorded speech and body language shown by high-quality animation. Sometimes the patient will not answer a question completely or will respond with a question of their own; this is to mimic a more natural style of communication. At the end of the simulation, the user will receive feedback. The simulation can be used on a computer, tablet, or smartphone.

The scenario is based on the decision as to whether to initiate a statin and a "hidden" patient agenda, such as an issue with the patient's "waterworks." The hidden agenda is to add realism to the simulation and to encourage the user of the simulator to conduct an open consultation and not one confined to their own agenda. If handled appropriately, the user should engage in two-way information exchange, discuss both risks and benefits, highlight the option to do nothing, and come to a decision based on the patient's preferences. These are hallmark features of SDM [30]. The comments on the design from both the laypeople and expert clinicians are tabulated below in Tables 1 and 2.

Figure 1. Screenshot of the virtual patient.

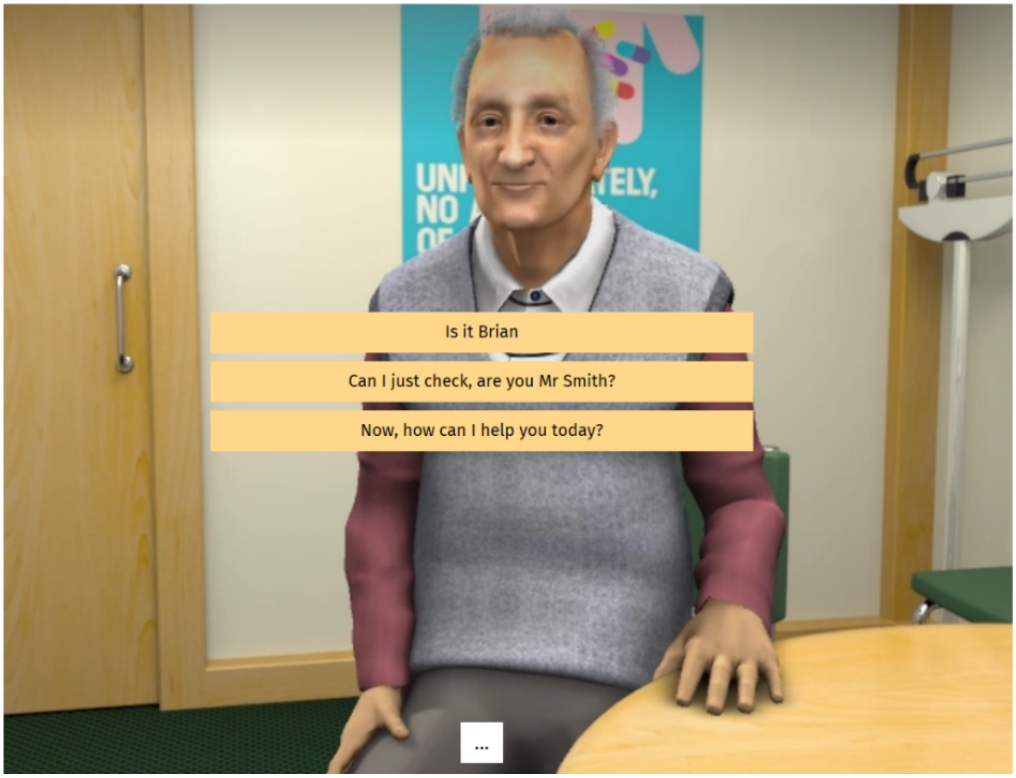


Table 1. Patient feedback.

Laypeople comments	Resultant actions
Referring to the patient's age is not relevant; polypharmacy is most likely the reason for the patient not wanting to take more medicines, which is irrespective of age.	Referring to age at this stage led to a negative feedback point.
An 84-year-old may well have hearing impairment so getting him to repeat back what changes he will make could be a way to check he has both heard and understood the discussion.	An extra chain of options was included that allowed a user to choose to do this.
There is no information on whether the clinician had met the patient before. Perhaps this information should be included at the start as it can affect the language used.	This information was included and feedback amended.
Patient background important as different cultures and ages affect communication.	Background was made more comprehensive, but this was balanced with reality; medical notes with full details of a patient's social history were felt to be unrealistic.
In the sections where risk or benefit of treatment was discussed, it was felt that the softer approach with less numbers was good and should occur more within the script. Flexibility was also felt important as if the user delved straight into statistics; they should be able to "rescue" their attempt by providing a simpler follow-up explanation.	The possible route through the simulation was made more circuitous to allow users to make imperfect choices but then recover the situation later and vice versa.

Table 2. Expert feedback.

Expert comments	Resultant actions
No option to use a PDA[a].	The option to use a PDA was included.
Very specific language used at certain stages, eg, different between "something versus anything."	There is evidence to suggest subtle adjustments in language can have profound effects [31,32].
There could be the option of a middle ground when presenting risk; current options are too distinct.	A middle ground option was included so the choice of risk explanation language was not so dichotomous.
If the case is handled very poorly, there is little feedback.	More feedback was added in the event that a user handles the simulation very poorly.
Feedback at the end is given too quickly.	A pause was added between points and a written summary provided at the end.
Whether the statin is for primary or secondary prevention is not clear.	The patient's medical history was amended to make it clearer.
The supposed red flag symptom is not clear enough.	A further bit of dialogue was added, making the urinary symptoms more explicitly a red flag.
Needs to be clear to the patient that we cannot predict whether they will or will not have a cardiac event.	A line was added to stress that we cannot predict in advance whether a person will experience an event.
No feedback for missing a potential red flag.	Additional feedback was added.
Wording of feedback could be more constructive.	Rather than stating a negative piece of feedback outright phrases such as "It was good you tried to...but..." were added to make them more constructive.
Medical notes not available from the start.	Amended such that the notes can be viewed at any given time.
Might be useful to have a print out of the feedback for use in development portfolios.	This function was added; a PDF of feedback can be downloaded each time the simulation is used.

[a]PDA: patient decision aid.

While not an explicit comment, many of the patients used the same words as those the VP used when replying to dialogue from the clinician; an encouraging sign that the language being used was lifelike.

In addition to the comments above (Table 2), additional suggestions were made about the technical elements of the simulation. These were not enacted but are listed as follows for future work: (1) feature a clock to show how long the consultation has been running, increasing the realism; (2) the ability to go backward in the consultation and retrace steps; and (3) have feedback given instantaneously, as the user goes along.

The feedback approach was based on the Kolb theory of reflection [33]; the theory is a common approach to simulation-based learning [34]. The simulation was designed to provide a concrete experience, which is the first step in the cycle. There was a short break between finishing the scenario and receiving feedback to allow some time for reflection. The feedback, given first by the VP and then in a text form, provided

some points for reflection based on the user's performance. To complete the cycle, the learning could be put into practice by repeating the simulation.

Due to this simulation trying to combine both technical and interpersonal competencies, as is the case in a real consultation, the feedback was broken down into two sections: emotional and technical. The patient animation gave the emotional, gentle feedback, for example, "you made me feel comfortable." The technical feedback was provided in a written form, for example, feedback on initiating statin and specific wording choices. This results from some of the comments in Table 2. The feedback is exportable as a PDF to enable users to store a copy for use in portfolios.

To highlight the quality of the animation used, potentially important for the fidelity of the simulation, Figure 1 shows a screenshot of the case.

To experience the VP simulator, we have created a short YouTube video to provide a brief demonstration: "Virtual Patient Demonstration" [35].

Discussion

Principal Findings

By incorporating patient opinion and SDM principles, the resulting Web-based VP simulator simulated a clinical consultation congruent with a "real-life" situation. The entirety of the patient contact is simulated, from calling the patient into the room to the final remarks as they leave. Where a significant proportion of VP simulations have sought to develop a single skill or a set of skills, the user of this software must draw on the whole array of abilities required for a competent, patient-centered consultation.

A key difficulty in the initial phase of scripting, and indeed throughout, was the balance between the different multiple-choice options; one is good, one is bad and one is somewhere in-between. What constitutes wrong at a point in the consultation may be correct at another, and as stated, users can make a wrong decision but still bring the consultation back to a good conclusion. The difficult task was to make all 3 options plausible. This meant that all of the options were close enough together such that the choice was not obvious but not so close so as to be a "spot the difference" exercise. The patient involvement was very useful here.

Unpredictability emerged as a key theme during the patient involvement phase. It was a deliberate choice not to direct patients at the outset of their inclusion in the design process, allowing them to introduce elements that may not have occurred to the health care professionals in the design team. The authors, like all health educators and researchers, have a certain education, background, and set of experiences, which affect their perspective. Laypersons, though, have a different set of experiences, which means they can provide a different outlook or view on an issue. We cannot know what this perspective will be; hence, this is where the value of PPI or lay involvement is derived.

Early concern was that the patients involved would be overawed by the technology or the process and that they would not feel able to contribute anything. The opposite was also feared, a situation where the patient did not understand the aim of the design and continually suggested inappropriate modifications. What resulted was neither of these situations; all the patients clearly understood the aim and how they could assert their opinions and views.

Conclusions

Involving patients in the design of VP simulations, particularly those involving any degree of communication, has been shown to be useful for creating realistic scenarios. The outputs from the involvement of patients cannot often be predicted, so it may well be a case of "try it and see." While virtual reality simulations can be complicated and tricky to design, laypeople have the capacity to comprehend this and also contribute valuable ideas. We would recommend future VP designers to at least consider patient or laypeople involvement in their designs.

It is also possible to design a VP that encompasses both the technical and interpersonal elements of care. Many of the previous architects of these technologies seem to have stuck to one or the other, but to model reality more closely, both have been combined in this design. What has been created is a Web-based VP to allow repetitive practice and feedback for evidence-informed SDM. The next steps will be to evaluate and investigate the views of target users, namely under- and postgraduate health care professionals.

Acknowledgments

Our thanks go to the laypeople and clinical experts involved in the design; their input was indispensable. We also thank the Digital Development Team at the Keele University School of Pharmacy for their work programming and animating the design. If you wish to use the tool in your own teaching, please get in touch with the corresponding author via email.

Conflicts of Interest

The VP described in this paper is not licensed for commercial sale; none of the authors will, therefore, receive any monetary gain from the tool. SC is 1 of the 2 patent holders for the technology. Keele University School of Pharmacy makes VP products similar to the one described in this paper for a range of external commercial clients. NM is the former Program Director of the Medicines and Prescribing Centre at the NICE and current member of the NICE Shared Decision Making Collaborative. SJ's PhD is funded

by a joint collaboration between NICE and Keele University. NICE had no input or control over the design of the VP or the writing of this paper.

References

1. Charles C, Gafni A, Whelan T. Shared decision-making in the medical encounter: what does it mean? (or it takes at least two to tango). Soc Sci Med 1997 Mar;44(5):681-692. [Medline: 9032835]
2. Coulter A, Collins A. Making shared decision-making a reality. London: King's Fund; 2011. URL: https://www.kingsfund.org.uk/publications/making-shared-decision-making-reality [accessed 2018-10-05] [WebCite Cache ID 72wLqeIUZ]
3. Bensing J. Bridging the gap. The separate worlds of evidence-based medicine and patient-centered medicine. Patient Educ Couns 2000 Jan;39(1):17-25. [Medline: 11013544]
4. Kon AA. The shared decision-making continuum. JAMA 2010 Aug 25;304(8):903-904. [doi: 10.1001/jama.2010.1208] [Medline: 20736477]
5. Légaré F, Thompson-Leduc P. Twelve myths about shared decision making. Patient Educ Couns 2014 Sep;96(3):281-286 [FREE Full text] [doi: 10.1016/j.pec.2014.06.014] [Medline: 25034637]
6. Coulter A, Hopkins A, Moulton B. Montgomery v Lanarkshire Health Board: transforming informed consent. Bulletin 2017 Jan;99(1):36-38 [FREE Full text] [doi: 10.1308/rcsbull.2017.36]
7. Lofland JH, Johnson PT, Ingham MP, Rosemas SC, White JC, Ellis L. Shared decision-making for biologic treatment of autoimmune disease: influence on adherence, persistence, satisfaction, and health care costs. Patient Prefer Adherence 2017;11:947-958 [FREE Full text] [doi: 10.2147/PPA.S133222] [Medline: 28572722]
8. Coxeter P, Del Mar CB, McGregor L, Beller EM, Hoffmann TC. Interventions to facilitate shared decision making to address antibiotic use for acute respiratory infections in primary care. Cochrane Database Syst Rev 2015 Nov 12(11):CD010907. [doi: 10.1002/14651858.CD010907.pub2] [Medline: 26560888]
9. Wiley J, Westbrook M, Greenfield JR, Day RO, Braithwaite J. Shared decision-making: the perspectives of young adults with type 1 diabetes mellitus. Patient Prefer Adherence 2014;8:423-435 [FREE Full text] [doi: 10.2147/PPA.S57707] [Medline: 24729690]
10. Hong P, Gorodzinsky AY, Taylor BA, Chorney JM. Parental decision making in pediatric otoplasty: The role of shared decision making in parental decisional conflict and decisional regret. Laryngoscope 2016 Jul;126 Suppl 5:S5-S13. [doi: 10.1002/lary.26071] [Medline: 27233057]
11. Lam WWT, Kwok M, Chan M, Hung WK, Ying M, Or A, et al. Does the use of shared decision-making consultation behaviors increase treatment decision-making satisfaction among Chinese women facing decision for breast cancer surgery? Patient Educ Couns 2014 Feb;94(2):243-249. [doi: 10.1016/j.pec.2013.11.006] [Medline: 24316055]
12. Joseph-Williams N, Lloyd A, Edwards A, Stobbart L, Tomson D, Macphail S, et al. Implementing shared decision making in the NHS: lessons from the MAGIC programme. BMJ 2017 Dec 18;357:j1744 [FREE Full text] [Medline: 28420639]
13. Maskrey N, Gordon A. Shared Understanding With Patients. JAMA Intern Med 2017 Sep 01;177(9):1247-1248. [doi: 10.1001/jamainternmed.2017.1932] [Medline: 28783822]
14. Ericsson K, Krampe R, Tesch-Römer C. The role of deliberate practice in the acquisition of expert performance. Psychological Review 1993;100(3):363-406. [doi: 10.1037/0033-295X.100.3.363]
15. Flower J. In the mush. Physician Exec 1999;25(1):64-66. [Medline: 10387273]
16. Davis DA, Mazmanian PE, Fordis M, Van Harrison R, Thorpe KE, Perrier L. Accuracy of physician self-assessment compared with observed measures of competence: a systematic review. JAMA 2006 Sep 06;296(9):1094-1102. [doi: 10.1001/jama.296.9.1094] [Medline: 16954489]
17. Davis D, O'Brien MA, Freemantle N, Wolf FM, Mazmanian P, Taylor-Vaisey A. Impact of formal continuing medical education: do conferences, workshops, rounds, and other traditional continuing education activities change physician behavior or health care outcomes? JAMA 1999 Sep 1;282(9):867-874. [Medline: 10478694]
18. Davis D, Davis N. Selecting educational interventions for knowledge translation. CMAJ 2010 Feb 09;182(2):E89-E93 [FREE Full text] [doi: 10.1503/cmaj.081241] [Medline: 20048013]
19. AAMC Institute for Improving Medical Education. Effective Use of Educational Technology in Medical Education. Summary Report of the 2006 AAMC Colloquium on Educational Technology 2006:6-7 [FREE Full text]
20. Creutzfeldt J, Hedman L, Felländer-Tsai L. Cardiopulmonary Resuscitation Training by Avatars: A Qualitative Study of Medical Students' Experiences Using a Multiplayer Virtual World. JMIR Serious Games 2016 Dec 16;4(2):e22 [FREE Full text] [doi: 10.2196/games.6448] [Medline: 27986645]
21. Ingrassia P, Ragazzoni L, Carenzo L, Barra F, Colombo D, Gugliotta G, et al. Virtual reality and live scenario simulation: options for training medical students in mass casualty incident triage. Crit Care 2012;16(Suppl 1):P479. [doi: 10.1186/cc11086]
22. Schoenthaler A, Albright G, Hibbard J, Goldman R. Simulated Conversations With Virtual Humans to Improve Patient-Provider Communication and Reduce Unnecessary Prescriptions for Antibiotics: A Repeated Measure Pilot Study. JMIR Med Educ 2017 Apr 19;3(1):e7 [FREE Full text] [doi: 10.2196/mededu.6305] [Medline: 28428160]

23. Greenhalgh T, Howick J, Maskrey N, Evidence BMRG. Evidence based medicine: a movement in crisis? BMJ 2014;348:g3725 [FREE Full text] [Medline: 24927763]
24. Heath I. The missing person: The outcome of the rule-based totalitarianism of too much contemporary healthcare. Patient Educ Couns 2017 Nov;100(11):1969-1974. [doi: 10.1016/j.pec.2017.03.030] [Medline: 28408135]
25. INVOLVE. Briefing notes for researchers: involving the public in NHS. public health and social care research 2012 [FREE Full text]
26. Brett J, Staniszewska S, Mockford C, Herron-Marx S, Hughes J, Tysall C, et al. Mapping the impact of patient and public involvement on health and social care research: a systematic review. Health Expect 2014 Oct;17(5):637-650. [doi: 10.1111/j.1369-7625.2012.00795.x] [Medline: 22809132]
27. Towle A, Bainbridge L, Godolphin W, Katz A, Kline C, Lown B, et al. Active patient involvement in the education of health professionals. Med Educ 2010 Jan;44(1):64-74. [doi: 10.1111/j.1365-2923.2009.03530.x] [Medline: 20078757]
28. Gillard S, Benson J, Silverman J. Teaching and assessment of explanation and planning in medical schools in the United Kingdom: cross sectional questionnaire survey. Med Teach 2009 Apr;31(4):328-331. [doi: 10.1080/01421590801953018] [Medline: 19142799]
29. O'Neill B. Enriching clinical communication teaching: A qualitative study of a curriculum field in UK medical schools. London: King's College London; 2015.
30. Charles C, Gafni A, Whelan T. Decision-making in the physician-patient encounter: revisiting the shared treatment decision-making model. Soc Sci Med 1999 Sep;49(5):651-661. [Medline: 10452420]
31. Heritage J, Robinson JD, Elliott MN, Beckett M, Wilkes M. Reducing patients' unmet concerns in primary care: the difference one word can make. J Gen Intern Med 2007 Oct;22(10):1429-1433 [FREE Full text] [doi: 10.1007/s11606-007-0279-0] [Medline: 17674111]
32. Schoenborn NL, Lee K, Pollack CE, Armacost K, Dy SM, Bridges JFP, et al. Older Adults' Views and Communication Preferences About Cancer Screening Cessation. JAMA Intern Med 2017 Aug 01;177(8):1121-1128 [FREE Full text] [doi: 10.1001/jamainternmed.2017.1778] [Medline: 28604917]
33. Kolb AY, Kolb DA. Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. AMLE 2005 Jun;4(2):193-212. [doi: 10.5465/amle.2005.17268566]
34. Zigmont JJ, Kappus LJ, Sudikoff SN. Theoretical foundations of learning through simulation. Semin Perinatol 2011 Apr;35(2):47-51. [doi: 10.1053/j.semperi.2011.01.002] [Medline: 21440810]
35. Jacklin S. YouTube. 2018. Virtual Patient Demonstration URL: https://www.youtube.com/watch?v=NMa6HwGCyP0 [accessed 2018-10-05] [WebCite Cache ID 6wsh7uCxU]

Abbreviations

NICE: National Institute for Health and Care Excellence
PPI: patient and public involvement
SDM: shared decision making
VP: virtual patient

Edited by G Eysenbach; submitted 12.02.18; peer-reviewed by A Schoenthaler, B Taylor, R Day; comments to author 13.07.18; revised version received 17.08.18; accepted 17.08.18; published 06.11.18.

Please cite as:
Jacklin S, Maskrey N, Chapman S
Improving Shared Decision Making Between Patients and Clinicians: Design and Development of a Virtual Patient Simulation Tool
JMIR Med Educ 2018;4(2):e10088
URL: http://mededu.jmir.org/2018/2/e10088/
doi:10.2196/10088
PMID:30401667

Tutorial

Blending Gagne's Instructional Model with Peyton's Approach to Design an Introductory Bioinformatics Lesson Plan for Medical Students: Proof-of-Concept Study

Richa Tambi[1], PhD; Riad Bayoumi[1], MD and PhD; Peter Lansberg[2], MD and PhD; Yajnavalka Banerjee[1,3], PhD

[1]Department of Basic Medical Sciences, Mohammed Bin Rashid University of Medicine and Health Sciences, Dubai, United Arab Emirates

[2]Department of Pediatrics, University Medical Center Groningen, Groningen, Netherlands

[3]University of Dundee, Department of Medical Education, University of Dundee, Dundee, United Kingdom

Corresponding Author:
Yajnavalka Banerjee, PhD
Department of Basic Medical Sciences
Mohammed Bin Rashid University of Medicine and Health Sciences
Academic Medical Center Building - 14
Dubai Healthcare City
Dubai, 505055
United Arab Emirates
Phone: 971 043 000 8710
Email: yaj.banerjee@gmail.com

Abstract

Background: With the rapid integration of genetics into medicine, it has become evident that practicing physicians as well as medical students and clinical researchers need to be updated on the fundamentals of bioinformatics. To achieve this, the following gaps need to be addressed: a lack of defined learning objectives for "Bioinformatics for Medical Practitioner" courses, an absence of a structured lesson plan to disseminate the learning objectives, and no defined step-by-step strategy to teach the essentials of bioinformatics in the medical curriculum.

Objective: The objective of this study was to address these gaps to design a streamlined pedagogical strategy for teaching basics of bioinformatics in the undergraduate medical curriculum.

Methods: The established instructional design strategies employed in medical education—Gagne's 9 events of instruction—were followed with further contributions from Peyton's four-step approach to design a structured lesson plan in bioinformatics.

Results: First, we defined the specifics of bioinformatics that a medical student or health care professional should be introduced to use this knowledge in a clinical context. Second, we designed a structured lesson plan using a blended approach from both Gagne's and Peyton's instructional models. Lastly, we delineated a step-by-step strategy employing free Web-based bioinformatics module, combining it with a clinical scenario of familial hypercholesterolemia to disseminate the defined specifics of bioinformatics. Implementation of Schon's reflective practice model indicated that the activity was stimulating for the students with favorable outcomes regarding their basic training in bioinformatics.

Conclusions: To the best of our knowledge, the present lesson plan is the first that outlines an effective dissemination strategy for integrating introductory bioinformatics into a medical curriculum. Further, the lesson plan blueprint can be used to develop similar skills in workshops, continuing professional development, or continuing medical education events to introduce bioinformatics to practicing physicians.

(JMIR Med Educ 2018;4(2):e11122) doi:10.2196/11122

KEYWORDS

bioinformatics; Gagne's instructional model; genetics; lesson plan; medical education; Peyton's approach; undergraduate medical education

Introduction

Background

The advent of high-throughput sequencing strategies and next-generation sequencing techniques has exponentially increased the output of genetic information. Although this information has contributed significantly in augmenting personalized medicine, the need for interpreting vast patient genomic datasets have made it essential for clinicians and medicine practitioners to familiarize themselves with the so called “Nuts & Bolts” of bioinformatics. Hence, one can argue that in today’s times, the inculcation of basic bioinformatics concepts and strategies in a typical medical curriculum is pivotal, which is also supported by the fact that courses have been designed to introduce bioinformatics in life sciences. [1] However, it is essential to remember that although the need for bioinformatics education and training in a medical curriculum is colossal, it has to be tailored accordingly. As recently indicated by Mulder et al, although there is an extensive range of addressees who are likely recipients of bioinformatics training, each has different needs in terms of what skills or knowledge they require and at what complexity [2]. For example, someone aiming to be a bioinformatics engineer needs exhaustive knowledge of prevailing algorithms, how they work, how to critically evaluate them, and how to translate the results. In comparison, a clinician as a bioinformatics user would need a basic level of understanding of the methods with emphasis on the interpretation of the outputs, specifically in relation to the discipline of genetics.

In medical education, although emphasis is on dissemination of knowledge pertaining to various concepts associated with genetics, rarely any curriculum addresses the pertinent question “How this knowledge can be translated to diagnosis of genetic maladies?” for which a basic outline of a typical bioinformatics analysis in line with the central dogma of molecular biology (DNA→RNA→Protein) is required. However, first, one needs to identify how “bioinformatics’ knowledge” can be translated to facilitate diagnosis specifically from the perspective of a clinician. Specifically, genetics and bioinformatics can be useful for the following 3 separate disease categories: monogenic or chromosomal disorders, such as phenylketonuria, sickle cell anemia, neurofibromatosis, or downs syndrome; more common disorders such as breast cancer, hemochromatosis (as a cause of liver disease) and cardiomyopathy for which a substantial subset of individuals have a monogenic cause or where single gene mutations can, in some families, cause the disorder; and wide spread disorders such as diabetes, hypertension, hypercholesterolemia, cancer and cardiovascular disease, which are multifactorial disorders in which multiple genes interact with one another and the environment to contribute to the cause or condition severity.

For all 3 categories, the strategy will essentially involve identifying aberrant gene sequence compared with the normal variant(s). The next step would involve assessing the severity of the aberration by translating its effect at the functional level or protein expression. Therefore, introductory bioinformatics in a typical medical curriculum needs to focus on the following 2 specifics: comparison of nucleotide sequences and prediction of how a mutation affects the structure-function of the protein it translates.

It is possible to impart knowledge of these in bioinformatics workshops. Continuing education workshops in bioinformatics has been shown to positively impact research and careers [3,4]. However, as the popularity of medical spiral curricula [5] has gained momentum, bioinformatics needs to be integrated into medical curricula, a requisite that was also highlighted by the Global Organization for Bioinformatics Learning, Education and Training [6,7]. Further, because many medical schools admit students with a high school degree (especially medical schools in the Middle East and North Africa region) who have little conceptual knowledge about sequence databases and *in silico* analysis of gene or protein sequences, education policies to examine strategies to promote the design of integrated courses, particularly bioinformatics, specifically designed to capture the expectations of medical education in the millennial era by smoothening the learning process keeping in mind the transition of students from high school to university [8] is required.

This study addresses this need, wherein a 4-hour introductory bioinformatics lesson plan was designed and implemented in an undergraduate medical curriculum. Further, because bioinformatics is not currently integrated in typical medical curricula (even those that follow the spiral model), it is imperative that such lesson plans consider the conditions under which learning occurs and the learning goals are attained. With this in mind, the established instructional design strategies employed in medical education—Gagne’s 9 events of instruction—were followed with further contributions from Peyton’s four-step approach, (Figure 1). The figure depicts both Gagne’s 9 events of instruction and Peyton’s 4-step approach, including the steps in Gagne’s 9 events of instruction that blend inputs from the principles of Peyton’s 4-step approach (indicated by the red arrows) [9-13].

Over the last decade, medical teaching approaches have undergone significant transformation. Instead of conformist programs with traditional teaching approaches, most medical schools today have developed a “reformed” medical program that includes alternative and new instructional methods, such as small group problem-based learning (PBL) [14], e-learning, or case-based work for small working groups, the use of which has been found to stimulate peer-assisted [15] and self-directed learning [16]. Therefore, the best-strategy for the dissemination of the bioinformatics learning objectives for an undergraduate medical student cohort in this lesson plan was a problem-based learning approach that promoted bioinformatics self-learning [17]. Further, rather than adopting models from other contexts that might not be relevant, because the lesson plan was designed for local effectiveness [18], a familial hypercholesterolemia clinical scenario was used because this is a common genetic disorder in the Middle East [19]. However, the lesson plan outline (Figure 2) can be tailored to any clinical scenario based on the clinical needs in specific regions. The flowchart depicts the individual lesson plan steps including the Web-based software modules implemented in the bioinformatics lesson in the first year Molecular Biology and Principles of Genetics

course (all software modules used in the lesson are accessible free of cost through different Web-based servers). The skills gained in each lesson plan step are indicated in the shaded boxes. The blended approach was implemented using sequential steps.

Lesson Plan Implementation Setting

The lesson plan was successfully implemented in an undergraduate medical education (UME) first year Molecular Biology and Principles of Genetics course at Mohammed Bin Rashid University of Medicine and Health Sciences (MBRU) Dubai, UAE (a nonprofit organization managed in collaboration with Queens University of Belfast, UK), for which the entire cohort of 54 students was registered.

The designed lesson plan employed open-source Web-based bioinformatics modules [20-22]. Use of such modules will promote the implementation of this lesson-plan in any UME course in any medical school that has access to basic computer and internet resources. The plan was founded on Gagne's model of instructional design [9], which is focused on the "information processing model" of psychological events that occur when adults are presented with various stimuli as well as learning outcomes and how to arrange specific instructional events to achieve those outcomes. Further, specific steps from Gagne's model of instructional design were blended with Peyton's 4-step instructional design approach, which, in recent times, has gained recognition as a suitable strategy for the augmentation of clinical or technical skills in UME [10].

Figure 1. Description of the blended lesson plan.

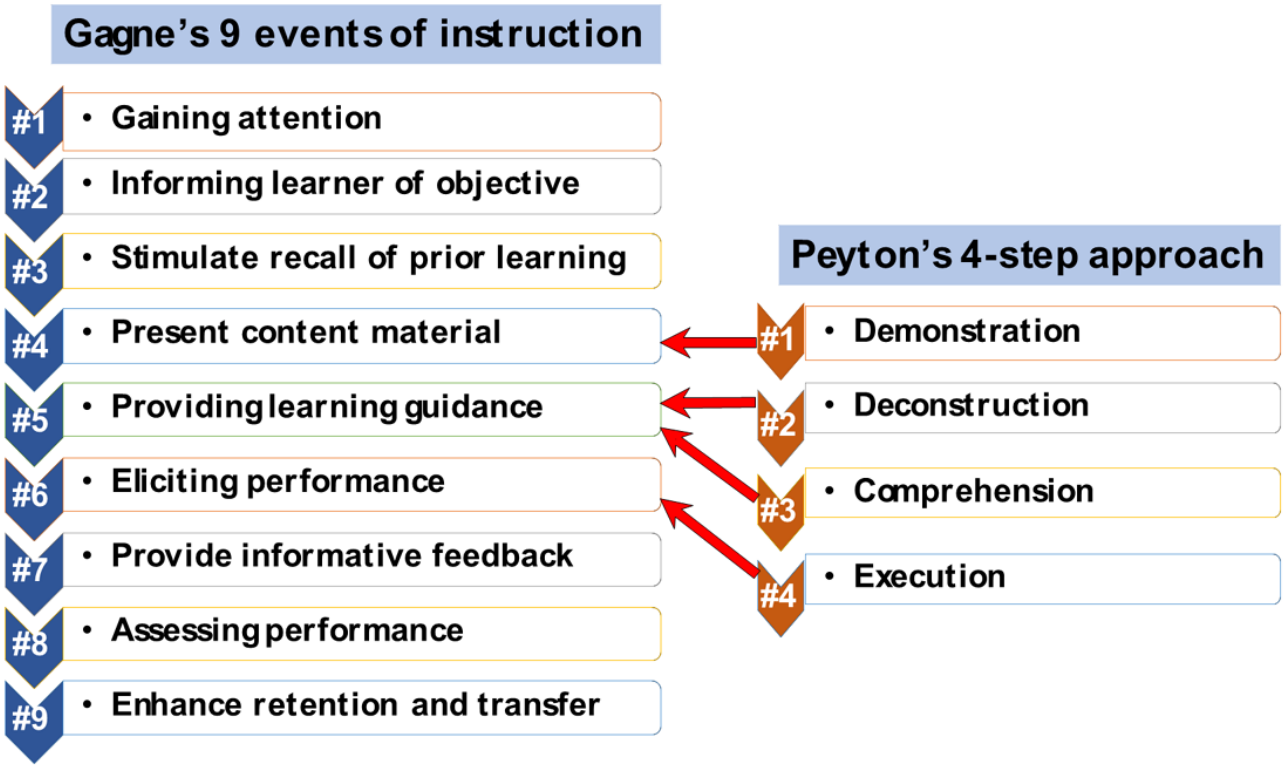
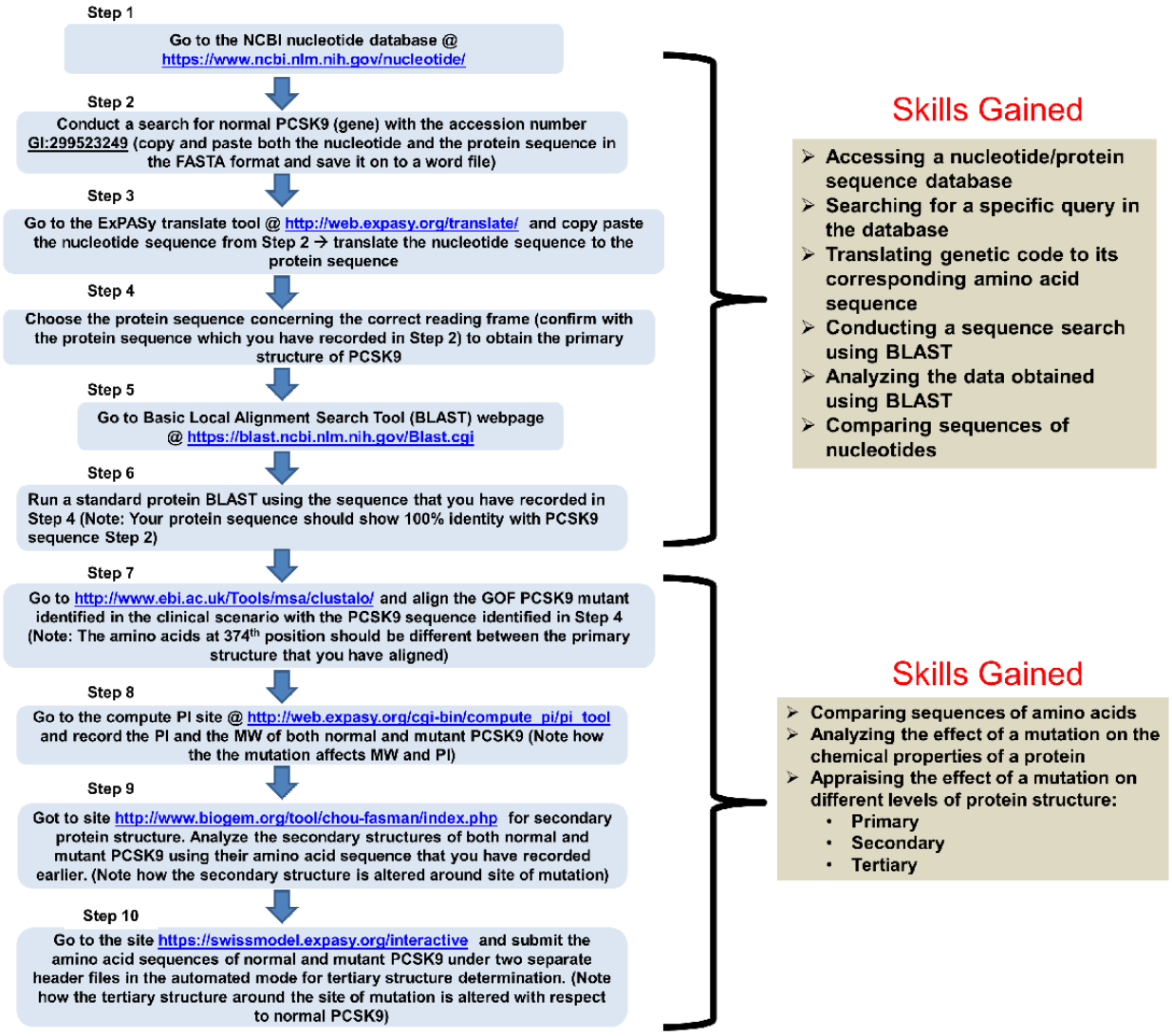


Figure 2. The sequential lesson plan steps. NCBI: National Center for Biotechnology Information; BLAST: Basic Local Alignment Search Tool; GOF: gain of function mutation; PI: isoelectric point, MW: molecular weight.



Methods

Prerequisites

All medical students attending the lesson plan implementation session were able to use a desktop computer and had successfully completed a basic biochemistry course in their previous semester; therefore, they were all familiar with the specific concepts needed to successfully follow the lesson plan. As groundwork for the session, prior to the bioinformatics session, the students were also asked to review the following concepts: genetic codes and mutations and different protein structure levels. With these prerequisites, the students were able to perform the basic bioinformatics analyses in the lesson plan. The individual lesson plan steps were as follows and the allocated times for each step are shown in Table 1.

Step 1: Gaining Attention

To engage the students prior to the lesson, the instructor attracted their attention using an unexpected auditory stimulus; for example, striking the microphone to generate a crackling sound and a Maieutic technique to stimulate cooperative argumentative dialogue using a thought-provoking question "How would you explain bioinformatics to your grandmother?" A short motivational YouTube video by Spencer Hall on bioinformatics was shown (Bioinformatics: A way to decipher DNA and cure life's deadliest diseases) [23]. This technique concurrently addressed visual, auditory, and kinesthetic learning styles [24].

Step 2: Informing Learners of the Objectives

Immediately following the video, the lesson objectives and the achievable lesson expectations were given to prepare the students for the learning process; for example, the predetermined objectives for this session are as follows:

> *Upon completion of this session, you should be able to compare gene sequences; design a strategy to translate a nucleotide sequence into its corresponding amino acid sequence; translate the effect of a genetic mutation to different protein structure levels.*

These objectives were reviewed with the students to ensure they were aware of the rationale behind the lesson plan organization and the sequence of the objectives.

Table 1. Lesson Plan Steps based on Gagnes's Instructional Model Blended with Peyton's Approach

Step	Key event (allocated time)	Major happenings
1	Gaining attention (10 min)	• Instructor attracts the attention of the students using suitable audio and visual stimuli • Instructor encourages cooperative argumentative dialogue using thought-provoking questions

2	Informing learner of the objective (15 min)	• Instructor presents the learning objectives for the session on Bioinformatics analysis
		• Upon completion of this session you should be able to:
		  • Compare gene sequences
		  • Design a strategy to translate a nucleotide sequence into its corresponding amino acid sequence
		  • Translate the effect of a genetic mutation for different protein structure levels

3	Stimulate recall of prior learning (20 min)	• Students participate in an *in silico* session in which they review different bioinformatics strategies and tools to identifying aberrant genes and single nucleotide polymorphisms
4	Present content material (40 min)	• Instructor presents a scenario (refer to text) at the conclusion of which questions are asked as to which bioinformatics technique needed to be applied. Students attempt to individually answer the questions • The instructor then demonstrates the individual steps in a bioinformatics analysis (using the presented scenario)
5	Providing learning guidance (10 min)	• Instructor elaborates on the rationale of the steps • Specific dos and don'ts are also addressed • Queries stemming from the discussion of the steps with the students are also addressed by the instructor
6	Eliciting performance (40 min)	• Students perform a self-assessment exercise (refer to text)
7	Provide informative feedback (25 min)	• Pendleton's feedback model is used to provide feedback for which both instructors and students appraise the activity
8	Assessing performance (50 min)	• Students compare the obtained bioinformatics analysis results with the model answer uploaded on the learning management system • Any ensuing questions and queries are addressed by the instructor
9	Enhance retention and transfer (30 min)	• The individual lesson plan steps and the model answer are discussed side by side using both the instructor presented scenario and the self-assessment exercise • Any ensuing question either from the activity or in relation to the concepts disseminated are addressed and the session is concluded

Step 3: Stimulate Recall of Prior Learning

Medical students are adult learners. The constructivist theory claims that adults construct their knowledge founded on connections with previous learning and experiences [25]. Therefore, the students participated in group discussion sessions in which different bioinformatics strategies for identifying diseased genes and single nucleotide polymorphism candidates were reviewed to facilitate the recall of the gene structure-function concepts. Students also referred to different Web-based bioinformatics tools such as those available on the OMIC tools website [26]. This discussion session allowed the students to revisit the genetics concepts and recognize their clinical importance with the aim of inducing knowledge creation from the pre-existing foundations. This step also informed both peer-assisted learning and multi-intelligence theories [27,28].

Step 4 (Blended): Present Content Material

The detailed stages involved in bioinformatics analyses were addressed using a clinical case (Textbox 1) and presented as a PowerPoint presentation with a flowchart summarizing the steps provided as a hand-out (Figure 2). To teach the actual bioinformatics procedural skills, Peyton's 4-Step principles were integrated in this step.

Peyton's Step 1 involved a demonstration of each of the essentials needed for a bioinformatics analysis (at a standard pace without elaborating on the steps) starting from the identification of a specific gene sequence to comparing a mutant sequence (of the identified gene) with a normal or wild-type sequence, followed by an appraisal of the effect of the mutation on the different protein structure levels. In line with Fleming's Visual-Audio-Kinesthetic learning model [29], this step was aimed at encouraging visual-audio, philological, and relational acumens.

Textbox 1. Clinical Scenario used in the Lesson: Familial Hypercholesterolemia.

Case study

A 29-year-old Emirati male with a body mass index of 19.5 kg m^{-2} presented with advanced tuberous xanthomata on both auricles, elbows, gluteal regions, and legs since birth.

His father and paternal and maternal grandfather had xanthelasma; however, the siblings did not. Laboratory investigations were performed on several occasions. These revealed extreme dyslipidemia with very high total cholesterol, low density lipoprotein cholesterol, triglycerides, apolipoprotein B and lipoprotein(a), and low apolipoprotein-A levels.

Repeated combinations of lipid lowering agents with cholestyramine, atorvastatin, and ezetimibe had been virtually ineffective in improving the lipid profiles, and lipid-apheresis had to be pursued.

Genetic analyses showed that the patient was homozygous for a gain of function mutation; D374Y in the PCSK9 gene; which explained the severe observed dyslipidemia. Hence, according to the Dutch diagnostic criteria familial hypercholesterolemia was confirmed in the patient.

Deliverable or Task

Using the provided flowchart:

Compare the sequences for the mutant and normal PCSK9 genes to identify the exon in which the aberration is located.

Identify how the mutation affects the different levels of the PCSK9 protein structure.

Identify which domain of the tertiary structure of the PCSK9 is affected by the mutation.

Compare your observations with the colleagues seated next to you. You should record the relevant observations in the figure or graphs because you will require them when you prepare your report, which should be submitted as a ".docx" file using the learning management system.

Step 5 (Blended): Providing Learning Guidance

This level focused on interactive learning. First, the instructor elaborated on the individual steps for the activity and clarified the rationale. Subsequently, the instructor analyzed the steps and comprehensively reiterated the individual bioinformatics analysis steps, outlined the necessary dos and don'ts, and gave some practical tips (Peyton's Step 2). The students were encouraged to ask questions to clarify any uncertainties. This was followed by a conceptual phase in which the students clarified each of the bioinformatics analysis steps with the instructor following the directions (Peyton's Step 3). This step stimulated philological and kinesthetic learning styles. Because students had to articulate the step-by-step analysis sequence, it allowed the instructor to assess their understanding.

Step 6 (Blended): Eliciting Performance

A greater proportion of the time was allocated to this step because this step gave students the opportunity to reinforce their learning through performance. Therefore, this step was equivalent to Peyton's Step 4 in which the students (as part of a small team) attempted to complete the bioinformatics analysis using the designed scenario along the lines of Al-Waili et al [30], wherein a mutation in the PCSK9 gene leads to autosomal dominant familial hypercholesterolemia (Textbox 1). Small teams of 2-3 students collaboratively conducted the analysis with the instructor encouraging team members to follow each of the designated analysis steps and discuss the results to ensure accuracy. This step aided peer-assisted learning and created a nonthreatening positive environment for collaborative learning and the development of collective intelligence [28].

Step 7: Provide Informative Feedback

Pendleton's feedback model was implemented in this step to provide informative feedback [31]. Although students were conducting their group analysis, the instructor provided individual assistance and instant feedback by visiting the individual groups. The student groups were also encouraged to clarify questions as they arose by discussing them with the entire cohort. The students provided feedback and indicated what they appreciated about the activity as well as the aspects that could be improved.

Step 8: Assessing Performance

This activity gave the students guided hands-on practice in using bioinformatics to investigate the effects of genetic mutations on different protein structure levels. The students also prepared a report discussing their observations (to reflect their understanding).

The instructor assessed the report based on a rubric (which was also shared with the students). The report contributed 5% to the total course assessment. Report writing can augment student "reflection" on a specific subject or scenario, which stimulates self-regulated and lifelong learning as "Reflection is a metacognitive process that creates a greater understanding of both the self and the situation so that future actions can be informed by this understanding" [32].

Step 9: Enhance Retention and Transfer

Following the report submission, the students assessed similar clinical scenarios as familial hypercholesterolemia (FH) using bioinformatics, such as a clinical scenario involving sickle cell disease [33], which allowed the students to make sense of the learning event.

The activity was concluded by revisiting the learning objectives and addressing any outstanding queries. Afterwards, the students were able to use bioinformatics in any research project involving genetics. These activities informed student learning through Kolb's experiential learning cycle [34].

Results

The formal lesson plan evaluation is still pending. However, the course coordinator and instructors followed Schon's reflective practice model and [35] "reflected on the session" from which it was discovered that the students had enjoyed the activity and had been engaged in all lesson plan steps (Figure 2). When "reflecting on the session," the instructors discovered that as some of the work-stations had slowed down during the session, some student groups took longer to complete the activity. Therefore, in the future, a work-station certification step has been included; in this, in liaison with the university information technology department, a designated work-station is to be certified (for carrying out the designated bioinformatics analysis) prior to the lesson.

Next, we asked the question "Was the lesson-plan effective in disseminating the desired objectives?" To address this, we reflected on the laboratory report evaluation scores. The laboratory report assessments (which were double marked) had an average score above 90% and there were no failures (standard setting was pursued using Angoff's method [36]). Overall, 85% (46/54) of the student cohort expressed confidence in being able to apply bioinformatics in their research projects.

Discussion

Limitations

The aim of this lesson plan was to provide first year undergraduate medical students, who had come directly from high school and had had different curricula mixes, a preliminary understanding of the bioinformatics. Further, we suggest that this type of lesson plan be implemented in the initial years to provide students with the tools to understand the advanced bioinformatics concepts they may come across after their final year. Therefore, we identify the specific limitations of our study below, which not only highlight the importance of this lesson plan but also identify the specific domains that need to be further investigated.

1. An in-depth evaluation of the current lesson plan is needed. Therefore, a lesson plan evaluation form needs to be developed and implemented. As part of a separate study, based on Kamran et al [37], we plan to develop and validate [38] an lesson plan evaluation form and then implement it with several cohorts to ensure statistical validity.
2. Our molecular biology based lesson plan introduced bioinformatics to undergraduate medical students in the early years of the medical curriculum. This lesson plan does not develop student knowledge on next-generation sequencing data analysis because this requires extensive e-infrastructure [39], which is currently unavailable at MBRU. Also, this type of analysis is generally conducted by dedicated big data analysts (bioinformaticians) and therefore adds little to the clinical competencies needed for a safe, competent clinician.
3. Because our lesson plan is grounded in well-established instructional design models, instructors may feel that it interferes with their independence or flexibility. However, it is essential to base teaching plans on well-established instructional models to assist teachers and facilitators to stay on track [40]. Additionally, the lesson plan offers considerable flexibility to instructors on the choice of clinical scenario.

Conclusions

Several training modules have been developed to integrate introductory bioinformatics into pharmaceutical and biomedical science curricula [41,42,43]. However, most of these have been in a modular format that requires faculty members to have a strong understanding of bioinformatics algorithmic design, data analysis strategies, and *in silico* resources and facilities that may not be available in medical schools with limited budgets and capabilities. Although there have been papers focused on pharmaceutical bioinformatics [41,42,43], the learning objectives are not the ones required for undergraduate medical students. To the best of our knowledge, the present lesson plan is the first that outlines an effective dissemination strategy for integrating introductory bioinformatics into a medical curriculum. This lesson plan employed a "blended" methodology in which Gagne's instructional model was "blended" with Peyton's four-step approach. In this paper, we used the lesson plan to introduce bioinformatics skills into an undergraduate medical curriculum. However, the lesson plan blueprint can be used to develop similar skills in workshops, Continuing Professional Development, or Continuing Medical Education events to introduce bioinformatics to practicing physicians. Also, the lesson plan has considerable flexibility for the teaching of introductory bioinformatics analysis with only basic computing facilities, which could be beneficial for medical schools that have small operational budgets.

Acknowledgments

YB is the recipient of grant awards from the Al Jalila Foundation, Pfizer, and MBRU. Emoluments from these awards will be used to defray the publication charges associated with the publication of this paper. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Authors' Contributions

RT contributed to the penning of the manuscript and appraising the overall logistics for the implementation of the lesson plan. RB contributed to the implementation of the lesson plan and grading of student reports alluded in the study. PL designed the FH scenario used in this study as well as in manuscript preparation. YB designed the study, implemented it, evaluated the students and drafted the manuscript.

Conflicts of Interest

None declared.

References

1. Hack C, Kendall G. Bioinformatics: Current practice and future challenges for life science education. Biochem Mol Biol Educ 2005 Mar;33(2):82-85 [FREE Full text] [doi: 10.1002/bmb.2005.494033022424] [Medline: 21638550]
2. Mulder N, Schwartz R, Brazas MD, Brooksbank C, Gaeta B, Morgan SL, et al. The development and application of bioinformatics core competencies to improve bioinformatics training and education. PLoS Comput Biol 2018 Feb;14(2):e1005772 [FREE Full text] [doi: 10.1371/journal.pcbi.1005772] [Medline: 29390004]
3. Brazas MD, Ouellette BFF. Navigating the changing learning landscape: perspective from bioinformatics.ca. Brief Bioinform 2013 Sep;14(5):556-562. [doi: 10.1093/bib/bbt016] [Medline: 23515468]
4. Reisdorph N, Stearman R, Kechris K, Phang TL, Reisdorph R, Prenni J, et al. Hands-on workshops as an effective means of learning advanced technologies including genomics, proteomics and bioinformatics. Genomics Proteomics Bioinformatics 2013 Dec;11(6):368-377 [FREE Full text] [doi: 10.1016/j.gpb.2013.10.002] [Medline: 24316330]
5. Harden RM. What is a spiral curriculum? Med Teach 1999;21(2):141-143. [doi: 10.1080/01421599979752] [Medline: 21275727]
6. Attwood TK, Atwood TK, Bongcam-Rudloff E, Brazas ME, Corpas M, Gaudet P, GOBLET Consortium. GOBLET: the Global Organisation for Bioinformatics Learning, Education and Training. PLoS Comput Biol 2015 Apr;11(4):e1004143 [FREE Full text] [doi: 10.1371/journal.pcbi.1004143] [Medline: 25856076]
7. Attwood TK, Bongcam-Rudloff E, Brazas ME, Corpas M, Gaudet P, Lewitter F, GOBLET Consortium. Correction: GOBLET: The Global Organisation for Bioinformatics Learning, Education and Training. PLoS Comput Biol 2015 May;11(5):e1004281 [FREE Full text] [doi: 10.1371/journal.pcbi.1004281] [Medline: 25974841]
8. Siri A, Bragazzi NL, Khabbache H, Spandonari MM, Cáceres LA. Mind the gap between high school and university! A field qualitative survey at the National University of Caaguazú (Paraguay). Adv Med Educ Pract 2016;7:301-308 [FREE Full text] [doi: 10.2147/AMEP.S103811] [Medline: 27307777]
9. Al-Eraky MM. AM last page. Robert Gagné's nine events of instruction, revisited. Acad Med 2012 May;87(5):677. [doi: 10.1097/ACM.0b013e318250e01d] [Medline: 22531595]
10. Nikendei C, Huber J, Stiepak J, Huhn D, Lauter J, Herzog W, et al. Modification of Peyton's four-step approach for small group teaching - a descriptive study. BMC Med Educ 2014 Apr 02;14:68 [FREE Full text] [doi: 10.1186/1472-6920-14-68] [Medline: 24690457]
11. Khadjooi K, Rostami K, Ishaq S. How to use Gagne's model of instructional design in teaching psychomotor skills. Gastroenterol Hepatol Bed Bench 2011;4(3):116-119 [FREE Full text] [Medline: 24834168]
12. Münster T, Stosch C, Hindrichs N, Franklin J, Matthes J. Peyton's 4-Steps-Approach in comparison: Medium-term effects on learning external chest compression - a pilot study. GMS J Med Educ 2016;33(4):Doc60 [FREE Full text] [doi: 10.3205/zma001059] [Medline: 27579360]
13. Woo WH. Using Gagne's instructional model in phlebotomy education. Adv Med Educ Pract 2016;7:511-516 [FREE Full text] [doi: 10.2147/AMEP.S110357] [Medline: 27621681]
14. Jin J, Bridges SM. Educational technologies in problem-based learning in health sciences education: a systematic review. J Med Internet Res 2014;16(12):e251 [FREE Full text] [doi: 10.2196/jmir.3240] [Medline: 25498126]
15. Field M, Burke J, Lloyd D, McAllister D. Peer-assisted learning in clinical examination. Lancet 2004 Feb 07;363(9407):490-491. [doi: 10.1016/S0140-6736(04)15501-3] [Medline: 14962535]
16. Lee L, Chao Y, Huang C, Fang J, Wang S, Chuang C, et al. Cognitive Style and Mobile E-Learning in Emergent Otorhinolaryngology-Head and Neck Surgery Disorders for Millennial Undergraduate Medical Students: Randomized Controlled Trial. J Med Internet Res 2018 Feb 13;20(2):e56 [FREE Full text] [doi: 10.2196/jmir.8987] [Medline: 29439943]
17. Ranganathan S. Bioinformatics education--perspectives and challenges. PLoS Comput Biol 2005 Nov;1(6):e52 [FREE Full text] [doi: 10.1371/journal.pcbi.0010052] [Medline: 16322761]
18. Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet 2010 Dec 04;376(9756):1923-1958. [doi: 10.1016/S0140-6736(10)61854-5] [Medline: 21112623]
19. Bamimore MA, Zaid A, Banerjee Y, Al-Sarraf A, Abifadel M, Seidah NG, et al. Familial hypercholesterolemia mutations in the Middle Eastern and North African region: a need for a national registry. J Clin Lipidol 2015;9(2):187-194. [doi: 10.1016/j.jacl.2014.11.008] [Medline: 25911074]
20. Perrin BS, Miller BT, Schalk V, Woodcock HL, Brooks BR, Ichiye T. Web-based computational chemistry education with CHARMMing III: Reduction potentials of electron transfer proteins. PLoS Comput Biol 2014 Jul;10(7):e1003739 [FREE Full text] [doi: 10.1371/journal.pcbi.1003739] [Medline: 25058418]
21. Pickard FC, Miller BT, Schalk V, Lerner MG, Woodcock HL, Brooks BR. Web-based computational chemistry education with CHARMMing II: Coarse-grained protein folding. PLoS Comput Biol 2014 Jul;10(7):e1003738 [FREE Full text] [doi: 10.1371/journal.pcbi.1003738] [Medline: 25058338]

22. Miller BT, Singh RP, Schalk V, Pevzner Y, Sun J, Miller CS, et al. Web-based computational chemistry education with CHARMMing I: Lessons and tutorial. PLoS Comput Biol 2014 Jul;10(7):e1003719 [FREE Full text] [doi: 10.1371/journal.pcbi.1003719] [Medline: 25057988]
23. Hall S. Bioinformatics: A way to deciphere DNA and cure life's deadliest diseases | Spencer Hall | TEDxUGA URL: https://www.youtube.com/watch?v=_eHz6qzTCfc [accessed 2018-05-23] [WebCite Cache ID 6zdXF0NNq]
24. Samarakoon L, Fernando T, Rodrigo C. Learning styles and approaches to learning among medical undergraduates and postgraduates. BMC Med Educ 2013 Mar 25;13:42 [FREE Full text] [doi: 10.1186/1472-6920-13-42] [Medline: 23521845]
25. Kaufman DM. Applying educational theory in practice. BMJ 2003 Jan 25;326(7382):213-216 [FREE Full text] [Medline: 12543841]
26. Perrin H, Denorme M, Grosjean J, Dynomant E, Henry V, Pichon F. OMICtools: a community-driven search engine for biological data analysis. arXiv preprint arXiv 2017:a.
27. Podgurski MJ. Theorists and Techniques: Connecting Education Theories to Lamaze Teaching Techniques. J Perinat Educ 2016;25(1):9-17 [FREE Full text] [doi: 10.1891/1058-1243.25.1.9] [Medline: 26848246]
28. Ross MT, Cameron HS. Peer assisted learning: a planning and implementation framework: AMEE Guide no. 30. Med Teach 2007 Sep;29(6):527-545. [doi: 10.1080/01421590701665886] [Medline: 17978966]
29. Buşan A. Learning styles of medical students - implications in education. Curr Health Sci J 2014;40(2):104-110 [FREE Full text] [doi: 10.12865/CHSJ.40.02.04] [Medline: 25729590]
30. Al-Waili K, Al-Zidi WA, Al-Abri AR, Al-Rasadi K, Al-Sabti HA, Shah K, et al. Mutation in the PCSK9 Gene in Omani Arab Subjects with Autosomal Dominant Hypercholesterolemia and its Effect on PCSK9 Protein Structure. Oman Med J 2013 Jan;28(1):48-52 [FREE Full text] [doi: 10.5001/omj.2013.11] [Medline: 23386946]
31. Anderson PAM. Giving feedback on clinical skills: are we starving our young? J Grad Med Educ 2012 Jun;4(2):154-158 [FREE Full text] [doi: 10.4300/JGME-D-11-000295.1] [Medline: 23730434]
32. Sandars J. The use of reflection in medical education: AMEE Guide No. 44. Med Teach 2009 Aug;31(8):685-695. [Medline: 19811204]
33. Xu M, Papageorgiou DP, Abidi SZ, Dao M, Zhao H, Karniadakis GE. A deep convolutional neural network for classification of red blood cells in sickle cell anemia. PLoS Comput Biol 2017 Oct;13(10):e1005746 [FREE Full text] [doi: 10.1371/journal.pcbi.1005746] [Medline: 29049291]
34. Burger PH, Scholz M. The learning type makes the difference - the interrelation of Kolb's learning styles and psychological status of preclinical medical students at the University of Erlangen. GMS Z Med Ausbild 2014;31(4):Doc42 [FREE Full text] [doi: 10.3205/zma000934] [Medline: 25489342]
35. Mickleborough T. Intuition in medical practice: A reflection on Donald Schön's reflective practitioner. Med Teach 2015;37(10):889-891. [doi: 10.3109/0142159X.2015.1078893] [Medline: 26427516]
36. Shulruf B, Wilkinson T, Weller J, Jones P, Poole P. Insights into the Angoff method: results from a simulation study. BMC Med Educ 2016 May 04;16:134 [FREE Full text] [doi: 10.1186/s12909-016-0656-7] [Medline: 27142788]
37. Kamran A, Zibaei M, Mirkaimi K, Shahnazi H. Designing and evaluation of the teaching quality assessment form from the point of view of the Lorestan University of Medical Sciences students - 2010. J Educ Health Promot 2012;1:43 [FREE Full text] [doi: 10.4103/2277-9531.104813] [Medline: 23555146]
38. Tsang S, Royse CF, Terkawi AS. Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. Saudi J Anaesth 2017 May;11(Suppl 1):S80-S89 [FREE Full text] [doi: 10.4103/sja.SJA_203_17] [Medline: 28616007]
39. Spjuth O, Bongcam-Rudloff E, Dahlberg J, Dahlö M, Kallio A, Pireddu L, et al. Recommendations on e-infrastructures for next-generation sequencing. Gigascience 2016 Jun 07;5:26 [FREE Full text] [doi: 10.1186/s13742-016-0132-7] [Medline: 27267963]
40. Mason WTM, Strike PW. See one, do one, teach one--is this still how it works? A comparison of the medical and nursing professions in the teaching of practical procedures. Med Teach 2003 Nov;25(6):664-666. [doi: 10.1080/01421590310001605705] [Medline: 15369918]
41. Madlung A. Assessing an effective undergraduate module teaching applied bioinformatics to biology students. PLoS Comput Biol 2018 Dec;14(1):e1005872 [FREE Full text] [doi: 10.1371/journal.pcbi.1005872] [Medline: 29324777]
42. Luo J. Teaching the ABCs of bioinformatics: a brief introduction to the Applied Bioinformatics Course. Brief Bioinform 2014 Nov;15(6):1004-1013 [FREE Full text] [doi: 10.1093/bib/bbt065] [Medline: 24008274]
43. Lyall A. Bioinformatics in the pharmaceutical industry. Trends Biotechnol 1996 Aug;14(8):308-312. [doi: 10.1016/0167-7799(96)10042-1] [Medline: 8987464]

Abbreviations

FH: familial hypercholesterolemia
MBRU: Mohammed Bin Rashid University of Medicine and Health Sciences
UME: undergraduate medical education

Edited by G Eysenbach; submitted 24.05.18; peer-reviewed by W Hong Woo, A Benis, M Puttaroo; comments to author 21.06.18; revised version received 30.06.18; accepted 03.07.18; published 25.10.18.

Please cite as:
Tambi R, Bayoumi R, Lansberg P, Banerjee Y
Blending Gagne's Instructional Model with Peyton's Approach to Design an Introductory Bioinformatics Lesson Plan for Medical Students: Proof-of-Concept Study
JMIR Med Educ 2018;4(2):e11122
URL: http://mededu.jmir.org/2018/2/e11122/
doi:10.2196/11122
PMID:30361192

Viewpoint

Electronic Health Records as an Educational Tool: Viewpoint

Yacob Habboush[1], MD; Robert Hoyt[2], MD; Sary Beidas[1], MD

[1]Department of Internal Medicine, Orange Park Medical Center, HCA South Atlantic Division, Orange Park, FL, United States
[2]College of Allied Health Professions, University of Nebraska Medical Center, Omaha, NE, United States

Corresponding Author:
Sary Beidas, MD
Department of Internal Medicine
Orange Park Medical Center
HCA South Atlantic Division
2001 Kingsley Avenue
Orange Park, FL, 32073
United States
Phone: 1 904 639 850
Email: sary.beidas@hcahealthcare.com

Abstract

Background: Electronic health records (EHRs) have been adopted by most hospitals and medical offices in the United States. Because of the rapidity of implementation, health care providers have not been able to leverage the full potential of the EHR for enhancing clinical care, learning, and teaching. Physicians are spending an average of 49% of their working hours on EHR documentation, chart review, and other indirect tasks related to patient care, which translates into less face time with patients.

Objective: The purpose of this article is to provide a preliminary framework to guide the use of EHRs in teaching and evaluation of residents.

Methods: First we discuss EHR educational capabilities that have not been reviewed in sufficient detail in the literature and expand our discussion for each educational activity with examples. We emphasize quality improvement of clinical notes as a basic foundational skill using a spreadsheet-based application as an assessment tool. Next, we integrate the six Accreditation Council for Graduate Medical Education (ACGME) Core Competencies and Milestones (CCMs) framework with the Reporter-Interpreter-Manager-Educator (RIME) model to expand our assessments of other areas of resident performance related to EHR use. Finally, we discuss how clinical utility, clinical outcome, and clinical reasoning skills can be assessed in the EHR.

Results: We describe a pilot conceptual framework—CCM framework—to guide and demonstrate the use of the EHR for education in a clinical setting.

Conclusions: As EHRs and other supporting technologies evolve, medical educators should continue to look for new opportunities within the EHR for education. Our framework is flexible to allow adaptation and use in most training programs. Future research should assess the validity of such methods on trainees' education.

(JMIR Med Educ 2018;4(2):e10306) doi:10.2196/10306

KEYWORDS

electronic health records; education; teaching; learning

Introduction

By July 2016, 95% [1] of hospitals and 60% [2] of office-based physicians had adopted electronic health records (EHRs). Because of the rapid adoption of EHRs, physicians may not have fully leveraged the potential benefits of using the EHR as a teaching tool to enhance medical education, clinical care, and efficiency [3].

Typically, physicians spend an average of 49% of their working hours using the EHR to document, review charts, and perform other indirect tasks related to patient care [4]. This translates into less face time with patients [4]. Given the significant amount of time physicians spend on EHR-related tasks, educators have an opportunity to help learners leverage the capabilities inherent to the EHR and thus improve the quality of patient care.

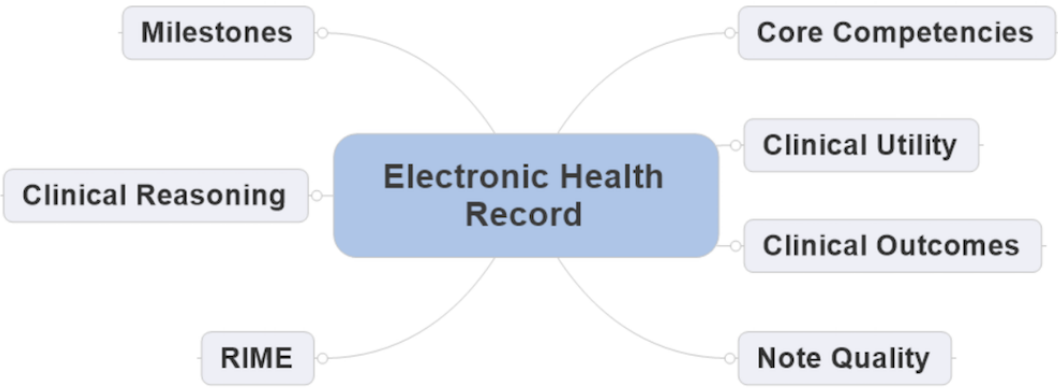
To achieve our aim, we incorporated the six Core Competencies and Milestones (CCMs) of the Accreditation Council for

Graduate Medical Education (ACGME) into a framework to inform our teaching using the EHR. Our efforts expand on the Tierney et al [5] report, which focused on the ACGME's Core Competencies and EHR tasks. Under this framework, we emphasize high-quality clinical notes as a foundational means to assess trainees' activities in the EHR and correlate these activities to their level of training. We recognize that our framework may have limitations and it will evolve over time as EHR functionality and use benefit from technological improvements (eg, improved usability, input from data related to genomics, population health, and mobile phones).

In this article, we elaborate on using the EHR as a tool to enhance educational activities by mapping the tools in relation to the EHR as illustrated in Figure 1. We also discuss how different components, such as the ACGME's CCMs, QNOTE, the Reporter-Interpreter-Manager-Educator (RIME) framework, clinical utility, clinical outcome, and clinical reasoning, are facilitated through the use of the EHR for the purpose of education.

We are not aware of other studies that have linked tasks and activities in the EHR to CCMs for the purpose of assessing education.

Figure 1. Electronic health record educational tools flowchart. RIME: Reporter-Interpreter-Manager-Educator.



Methods

In this article, we attempt to combine multiple educational concepts and tools to enhance the teaching and learning experience of medical students and residents. The following are the components used to focus on the assessment of trainees' progression.

Competencies and Milestones Integration

Overview

ACGME's CCMs are a set of guidelines that allow a graduate medical education program to assess the progression of residents during clinical training. Monitoring trainees' progression through EHR use can help in identifying gaps in knowledge, problem solving, and skills which can be targeted and remediated. For example, identifying a resident's case-mix to ensure sufficient exposure during training in their specialty [6,7].

For integration of the CCMs, we used an internal medicine residency program to map the progression of an internal medicine resident through a longitudinal time frame. We have incorporated practicable links between the ACGME's CCMs.

Next, we describe the ACGME's Core Competencies with examples of activities a learner performs in the EHR that educators can use as an opportunity to enhance learning and evaluation.

Patient Care

Clinical notes have multiple stakeholders. To achieve a patient-centered stance in the EHR, patients should be able to read physician notes. Hence, we should insist that our trainees limit the use of abbreviations and avoid scientific jargon. This is especially relevant in the assessment and plan section of the note. Also, instructions should be succinct and clear and the use of complete sentences is encouraged to facilitate the understanding of the physician's advice and recommendations. Patient-centered notes should also reflect a patient's involvement in decision making through highlighting patient preferences in conjunction with evidence-based medicine (EBM) guidelines and protocols [8]. Avoiding altogether the use of the copy-and-paste function or relying on automated text to complete medical notes with standardized templates and auto-populated notes further degrades the quality of an EHR note [9,10]. A direct result from using these tools is "note bloat" [11]. There may be a place for automation in documentation when properly planned and executed; however, as it is fashionably used, automation adds insult to injury [5].

Medical Knowledge

Continuous learning and reinforcement learning within the EHR environment is a desirable behavior. This can be achieved by adding short EBM notes in the assessment and plan section of the clinical note. EBM tools embedded in the EHR or through clinical decision-support tools displayed at a well-planned strategic interface facilitate an EBM-centric documentation process (eg, using the 2017 American Heart Association guidelines to document the optimal blood pressure target of 130/80 mmHg in a patient whose blood pressure was 160/87 mmHg recorded during a follow-up clinic visit). Furthermore, the EHR can also be used during the morning preclinic brief where a multidisciplinary approach is implemented to promote preclinical resident preparation and encourage teamwork. Once

the documentation of clinical notes is optimized—residents demonstrate high-quality notes, consistently—other EHR-related tools, such as alerts, drug interactions, and preventive guides, can further contribute to strengthening continuous learning habits [10,12].

Practice-Based Learning and Improvement

Data from the EHR can be extracted to a population health spreadsheet for use as an example of practice-based learning and improvement to expose trainees to a population-based approach. Thus, desired clinical measures can be tracked to support patient management. Population health is a core principle of measurement-based care where reimbursement is tied to value-based care. Practice-based learning and improvement activities achieved through the use of an EHR can support a continuous lifelong learning experience [13,14]. For instance, trainees could use the point-of-care EBM tools, such as UpToDate or DynaMed, to quickly read, access, and apply recommendations for clinical management of patients.

Interpersonal and Communication Skills

The "huddle" or "morning brief" requires that trainees prepare for the day and anticipate patients' needs by reviewing scheduled patient charts. Other uses that facilitate interpersonal and communication skills include presenting cases during academic sessions, communicating with patients via a patient portal, and communicating with other staff members through an internal messaging system [15]. Setting up the exam rooms in a patient-centered stance supports interpersonal and communication skills. This can be achieved by installing a large monitor to access the EHR and display EHR content, which helps with patient education [16,17]. The use of computers during patient consultations is perceived positively by most patients if the physician takes into account the presence of a "third person" in the exam room and favorably adjusts their verbal and nonverbal communication behaviors [18,19].

From an educational perspective, the EHR can be used to identify the interactions taking place between team members. To illustrate, attending physicians can and do review the charts prior to interaction with trainees. This may eliminate the benefit of presenting findings, sparking rational discussions, and formulating an informative decision. Therefore, attending previsit charts may unintentionally compromise some aspects in the process of learning. One way to remedy this is to establish a daily morning brief where the whole team comes together to identify and review complex cases before clinic begins. Other interpersonal and communication skills benefits from the huddle include promoting team dynamics and interdisciplinary work [20].

Professionalism

The widespread adoption of EHRs has caused physicians to change how they interact with patients and staff [16]. Assessment of professionalism-related issues in the EHR may relate to incomplete notes, spelling and grammatical errors, note bloat, unsigned notes, organization, and structure. Appropriate balance between using the EHR and interacting with patients during clinical visits has been shown to increase interpersonal interaction with patients; hence, excessive time spent looking at displays rather than talking with patients is unfavorably perceived by patients [16,21]. Physicians' professionalism also applies to communications with others for consultations and referrals, review of labs in timely manner, and communication of results to patients without the use of jargon, abbreviations, slang, or derogatory terms [2,17].

Systems-Based Practice

System-based practice refers to the process of providing cost-effective health care through integrating a team approach to patient care [22]. Examples of system-based practice in relation to the EHR include being able to identify safety errors or identifying quality-improvement gaps in the EHR. In addition, the EHR can provide outcome-based knowledge by analysis of specific population cohorts, such as frequent admissions, frail elderly, congestive heart failure, and diabetic mellitus [5] (ie, automated identification through the EHR of patients who need influenza and pneumococcal immunization to lessen comorbidities in eligible populations). Educators can assess notes for team members' interactions, such as notes that demonstrate cohesion in assessment and plans.

Next, we discuss the remaining educational tools and concepts.

Note Quality

QNOTE is a validated evaluation tool—Microsoft Excel spreadsheet format—used to assess medical documentation notes for quality, completeness, and efficiency [5,23]. Clinical notes can be assessed for clarity, conciseness, prevalence, organization, priority, and sufficiency of information documented [23]. The ability of QNOTE to generate a quantitative score for clinical notes assists with identifying the gaps in documentation so users learn how to properly document and provides users a sense of what they need to do to remediate their documentation skills. We have used QNOTE to assist residents in identifying gaps in clinical note documentation through a peer-to-peer EHR chart review. Although a structured note is desirable from a data-centric perspective, free text in clinical notes is necessary for context and storytelling [24]. For example, a *subjective*, *objective*, *assessment*, and *plan* note might be well structured with all components fully documented; however, the note may lack critical analysis and clinical reasoning where trainees fail to document their thinking process behind the assessment and plan section and patients' preferences.

Reporter-Interpreter-Manager-Educator Framework

RIME is an assessment framework used to evaluate trainees' professional progression through four stages: Reporter, Interpreter, Manager, and Educator [25]. An EHR can provide educators with a feedback tool to monitor a trainee's progression. For example, as trainees progress through the stages of RIME, they also progress in the stages of relationship to the team (ie, dependent, independent, and collaborative), level of performance (ie, reporter, interpreter, manager, and educator), and level of diligence. Here, diligence is defined as being comprehensive, paying careful attention, and consistently looking for information [26]. Within each stage of RIME, there are levels of expertise identified by an integration of knowledge, skills, diligence, team relationship, and performance level as illustrated by Cadieux and Goldszmidt [26]. Table 1 expands

on RIME and provides examples for tracking trainees' progression in the EHR [25,26].

Clinical Utility

Trainees' documentation needs to be assessed to ensure that the information collected from the patient is not only complete but also addresses identified patient problem (eg, a patient presents with a chief complaint of headache). In the system review, the resident finds out that the patient also has unintentional weight loss. Did the trainee make the connection between headache and weight loss? Was the differential diagnosis discussed in the note and was a plan of action clearly articulated and discussed with the patient [12,27,28]?

Clinical Outcomes

The EHR could be used to assess clinical outcomes of patients managed by a particular resident after reviewing a longitudinal selected set of notes and labs to determine disease control versus progression. Furthermore, the EHR can be used to compare the disease progression of different patients diagnosed with similar diseases managed by different residents to assess the variation in care and if they meet the standards of care. Temporal data in the EHR can also uncover or forecast clinical outcomes [29]. For example, a diabetic patient's complications trajectory could be tracked in the EHR by a resident to predict onset of end-stage renal disease. The EHR can also be used when presenting a clinical-case conference or a Morbidity and Mortality session—observing the Health Insurance Portability and Accountability Act and privacy rules by ensuring that individuals present are properly credentialed and patient consent for teaching purposes is documented—to assess outcomes by reviewing clinical notes directly from the EHR.

Clinical Reasoning

During the first and second year of training, residents are developing their clinical reasoning documentation skills. Identifying the extent and depth for clinical reasoning skills is achieved by reading the assessment and plan section of the note. Residents can further enhance their clinical reasoning through learning how to synthesize and document a differential diagnosis and analyze the clinical information by identifying the key components in the patient's history [30]. In addition, educators can look for instances when trainees are using heuristics (ie, intuitive thinking versus analytical thinking) in their clinical reasoning [31].

Table 1. Reporter-Interpreter-Manager-Educator model framework with examples.

Level of performance	Electronic health record feature	Examples from clinical notes
Reporter	• Gather and document clinical facts • Proficiency in history taking, physical examination, and basic medical knowledge • Recognize normal from abnormal • Answers "what" questions	"Patient with past medical history of diabetes presented to the emergency room complaining of chest pain. Pain started an hour ago while watching TV. It is crushing in character and located substernal. Pain does not radiate. There are no alleviating or exacerbating factors..."
Interpreter	• Clinical reasoning • Problem-solving skills • Prioritize among problems identified and yield a differential diagnosis • Follow up on diagnostic tests and analyze the data • Minimal signs of collaborative team work • Diligence • Answer "why" questions	"...According to the CIDI[a] 3 screening scale for bipolar disorder, the patient is at a very low risk with only one positive endorsement. Therefore, patient is unlikely to have bipolar disorder and more likely has depression. SSRI[b] is initiated to manage his depression. Risk and benefits are explained to the patient; patient understands. Follow up in two weeks."
Manager	• Anticipate outcomes • Independent decision-making process • Provide alternative options • Personalize assessment and plan • Balance between team-dependent and team-independent relationship • Patient centered • Diligence • Answers "how" questions	"...A1c is 11.4, insulin was recommended for the patient; however, after a collaborative decision, patient refused to start on insulin and preferred to initiate metformin and lifestyle adjustments."
Educator	• Self-directed learning • Document teaching point • Seek answers based on evidence-based medicine • Share experiences and educational points • Diligence	"According to the new ACC/AHA[c] guidelines, patient's blood pressure is at an optimal level of 124/78 mmHg. New guidelines have changed the target BP[d] to lower than 130/80 rather than 140/90."

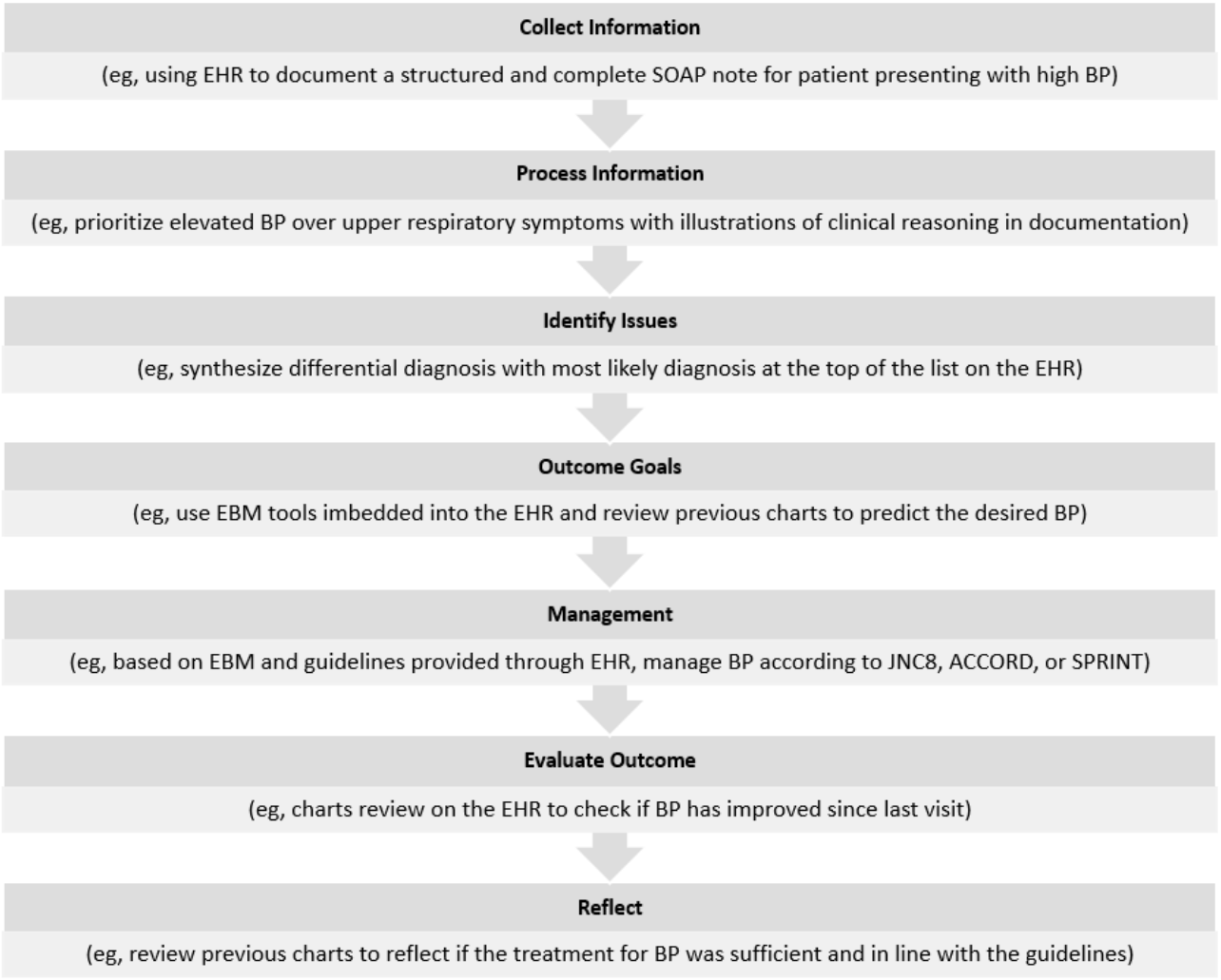
[a]CIDI: Composite International Diagnostic Interview.

[b]SSRI: Selective serotonin reuptake inhibitor.

[c]ACC/AHA: American College of Cardiology/American Heart Association.

[d]BP: blood pressure.

Figure 2. Clinical reasoning process with examples. EHR: electronic health record; SOAP: subjective, objective, assessment, and plan; BP: blood pressure; EBM: evidence-based medicine; JNC8: Eighth Joint National Committee; ACCORD: Action to Control Cardiovascular Risk in Diabetes; SPRINT: Systolic Blood Pressure Intervention Trial.



Clinicians can propose a diagnostic plan and desired outcome state of the patient; this will identify the necessary investigational tests and management plan to transit the patient from the present state to the outcome state after implementing the management plan through the decision-making process. Providing feedback to residents and giving them space to reflect on and narrow their differential diagnosis will help in improving the decision-making process and clinical thinking [30,32]. Figure 2 provides more examples for each of the stages in the clinical reasoning process.

Results

We created a pilot conceptual framework (see Figure 3) to serve as a visual guide for accessing resident progression during training from an EHR perspective. Preliminary results from using our framework are supportive in continuing our course; however, our data are limited and incomplete.

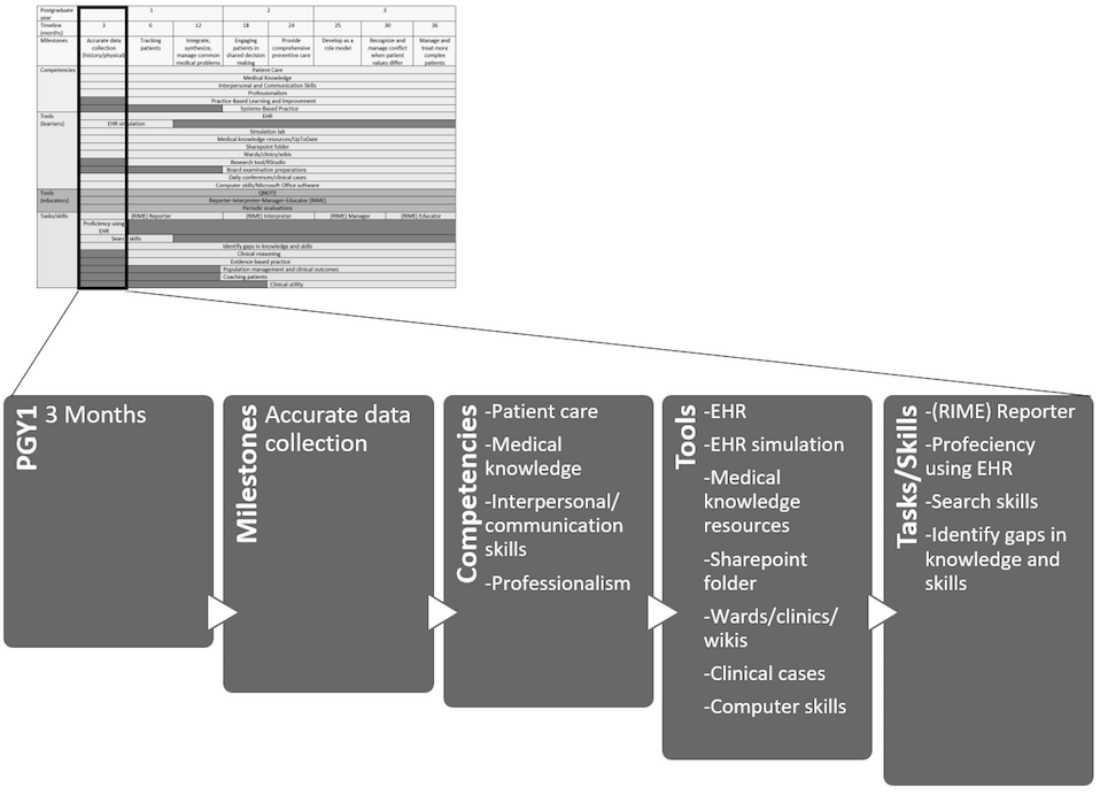
The following is a demonstration of how to use the conceptual framework. We expect an intern to achieve proficiency by the end of the initial 3 months in the following tasks and skills: review documentations in the EHR, present a case to the attending physician, and use point-of-care knowledge applications like UpToDate or DynaMed Plus. For assessment purposes, we recommend using QNOTE for assessing note quality. QNOTE uses a spreadsheet form to assess 12 elements in the quality of clinical notes and quantitatively measures clinical documentation in the EHR [23]. Thus, connecting the intern's proficiency in use of the EHR can be mapped to a Reporter performing level using the RIME model [25]. In addition, a Reporter is expected to be proficient in placing orders, retrieving labs and diagnostic images, documenting notes, and search skills. Reporters can sometimes reflect on their own performance and identify gaps in their clinical knowledge. Some may consider these activities as evidence of proficiency in using an EHR.

In Figure 4, we illustrate by example how to use the CCMs conceptual framework by specifically focusing on the first 3 months of residency and linking the necessary milestones and competencies to the available technology to achieve the set tasks and skills.

Figure 3. Pilot conceptual framework. EHR: electronic health record; RIME: Reporter-Interpreter-Manager-Educator.

Postgraduate year	1			2		3		
Timeline (months)	3	6	12	18	24	25	30	36
Milestones	Accurate data collection (history/physical)	Tracking patients	Integrate, synthesize, manage common medical problems	Engaging patients in shared decision making	Provide comprehensive preventive care	Develop as a role model	Recognize and manage conflict when patient values differ	Manage and treat more complex patients
Competencies	Patient Care							
	Medical Knowledge							
	Interpersonal and Communication Skills							
	Professionalism							
	Practice-Based Learning and Improvement							
	Systems-Based Practice							
Tools (learners)	EHR							
	EHR simulation							
	Simulation lab							
	Medical knowledge resources/UpToDate							
	Sharepoint folder							
	Wards/clinics/wikis							
	Research tool/RStudio							
	Board examination preparations							
	Daily conferences/clinical cases							
	Computer skills/Microsoft Office software							
Tools (educators)	QNOTE							
	Reporter-Interpreter-Manager-Educator (RIME)							
	Periodic evaluations							
Tasks/skills	(RIME) Reporter			(RIME) Interpreter		(RIME) Manager		(RIME) Educator
	Proficiency using EHR							
	Search skills							
	Identify gaps in knowledge and skills							
	Clinical reasoning							
	Evidence-based practice							
	Population management and clinical outcomes							
	Coaching patients							
	Clinical utility							

Figure 4. Example of how the conceptual framework in Figure 3 is utilized. PGY1: postgraduate year 1; EHR: electronic health record; RIME: Reporter-Interpreter-Manager-Educator.



Discussion

During our search to uncover new ways to leverage the use of the EHR for teaching and learning, we found it advantageous to associate ACGME's CCMs to EHR tasks and activities. Consequently, we developed the CCMs conceptual model (see Figure 4) as a guide to help in assessing residents as they progress through the residency program. The tools, tasks, and skills used in the CCMs framework are flexible and can be customized to address specific gaps in learning or assessment.

We emphasize the quality of clinical notes as a critical aspect of the CCMs framework. At least two retrospective studies examined physicians' quality of notes and concluded that the EHR can improve the overall quality of notes [33,34]. Clinical notes can be assessed by an educator, or using peer-to-peer assessment, to provide direct feedback to trainees. Other studies have also shown benefits in utilizing EHR simulations, where trainees could learn how to accurately document clinical notes with constructive feedback to improve health care delivery while also identifying gaps in trainees' knowledge and skills [35,36]. We believe EHR simulations are important tools in teaching sound EHR practices; however, they are beyond the scope of this article. Similar to educators in other fields, clinicians interested in teaching need to develop their teaching skills. Typically, faculty development programs have been the main venue for learning these skills. Other venues include university-degree granting programs in clinical education for those who are interested or have the time and resources to pursue a higher degree in medical education.

In the pre-EHR era, clinical hypo-competence was described as the lack of accurate information, failure to generate relevant differential diagnosis, and incomplete analysis and processing of information with a lack of a collaborative patient-centered approach. In this technology-driven era of health care we find that clinical hypo-competence remains as a persistent problem promoted by note bloat, use of macros, and automated sentence and phrase generation in EHRs [7]. Recognizing the importance of the EHR in today's clinical environment, coupled with the rapid advances in technology, trainees, including medical students, should be exposed to clinical information systems (eg, EHRs, patient portals, devices, wearables, and other clinical technologies) as early as possible in their education to prepare them for the lifelong learning experience required for a successful career in medicine. We believe that clinical educators can assist trainees to develop a solid foundation in clinical documentation using the EHR and enhance proper use of applications for documentation, such as natural language processing tools and macro generators, to lessen trainees' cognitive load and improve time-on-task processes when using clinical information systems.

The use of the EHR as an educational tool can facilitate clinic workflow, monitor trainees' learning experience, improve clinical reasoning, and identify the gaps in trainees' knowledge by mapping trainees' progression through the ACGME's CCMs [5,37]. Determining what cases trainees have experienced during a rotation could also be monitored through the EHR. A recent study reported that only 3% of postgraduate-year-1 residents are exposed to the 10 most common diagnoses, while 31% had experienced fewer than five of the diagnoses [34]. An EHR could be used to enhance research and quality-improvement projects through identifying certain populations to study. An EHR could also help us understand diseases and management plans and support better population health [38].

The limitations of this study include the experience of one institution. There is a paucity of published articles pertaining to using the EHR as a teaching tool. Major strengths of the study include the use of the standardized ACGME's CCMs and validated tools such as QNOTE and the RIME framework. Also, the conceptual framework could be generalized and customized (see Figure 4) to most graduate medical education programs as it could be adopted by any program to assess trainees' progression from a technology perspective.

In summary, physicians spend a significant portion of their working hours in the EHR. Clinical educators should continue to look for opportunities to uncover new approaches for education and use of the EHR in educational activities that benefit patient care, efficiency, and proper safe use. Our center is currently in the process of validating this conceptual framework through a prospective, institutional review board-approved study.

Acknowledgments

This research was supported by HCA and/or an HCA-affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA or any of its affiliated entities.

Conflicts of Interest

None declared.

References

1. Office of the National Coordinator for Health Information Technology. HealthIT.gov. 2017 Aug. Hospitals participating in the CMS EHR incentive programs: Health IT Quick-Stat #45 URL: https://dashboard.healthit.gov/quickstats/pages/FIG-Hospitals-EHR-Incentive-Programs.php [accessed 2018-10-02] [WebCite Cache ID 72sXE9kcg]
2. Office of the National Coordinator for Health Information Technology. HealthIT.gov. 2017 Aug. Office-based health care professionals participating in the CMS EHR incentive programs: Health IT Quick-Stat #44 URL: https://dashboard.

healthit.gov/quickstats/pages/FIG-Health-Care-Professionals-EHR-Incentive-Programs.php [accessed 2018-09-25] [WebCite Cache ID 72hbV0ERP]
3. Struik MHL, Koster F, Schuit AJ, Nugteren R, Veldwijk J, Lambooij MS. The preferences of users of electronic medical records in hospitals: Quantifying the relative importance of barriers and facilitators of an innovation. Implement Sci 2014 Jun 05;9:69 [FREE Full text] [doi: 10.1186/1748-5908-9-69] [Medline: 24898277]
4. Sinsky C, Colligan L, Li L, Prgomet M, Reynolds S, Goeders L, et al. Allocation of physician time in ambulatory practice: A time and motion study in 4 specialties. Ann Intern Med 2016 Dec 06;165(11):753-760. [doi: 10.7326/M16-0961] [Medline: 27595430]
5. Tierney MJ, Pageler NM, Kahana M, Pantaleoni JL, Longhurst CA. Medical education in the electronic medical record (EMR) era: Benefits, challenges, and future directions. Acad Med 2013 Jun;88(6):748-752. [doi: 10.1097/ACM.0b013e3182905ceb] [Medline: 23619078]
6. Sequist TD, Singh S, Pereira AG, Rusinak D, Pearson SD. Use of an electronic medical record to profile the continuity clinic experiences of primary care residents. Acad Med 2005 Apr;80(4):390-394. [Medline: 15793025]
7. Platt FW, McMath JC. Clinical hypocompetence: The interview. Ann Intern Med 1979 Dec;91(6):898-902. [Medline: 517891]
8. Nusbaum N. The electronic medical record and patient-centered care. Online J Public Health Inform 2011;3(2):5780 [FREE Full text] [doi: 10.5210/ojphi.v3i2.3721] [Medline: 23569603]
9. Hirschtick RE. A piece of my mind. Copy-and-paste. JAMA 2006 May 24;295(20):2335-2336. [doi: 10.1001/jama.295.20.2335] [Medline: 16720812]
10. Borycki EM, Griffith J, Reid P, Kuo M, Kushniruk AW. Do electronic health records help undergraduate students develop health informatics competencies? Stud Health Technol Inform 2014;205:838-842. [Medline: 25160305]
11. Versel N. HealthcareITNews. 2013 Oct 10. 'Note bloat' putting patients at risk URL: https://www.healthcareitnews.com/news/note-bloat-putting-patients-risk [accessed 2018-09-25] [WebCite Cache ID 72hdJB1XI]
12. Beiter PA, Sorscher J, Henderson CJ, Talen M. Do electronic medical record (EMR) demonstrations change attitudes, knowledge, skills or needs? Inform Prim Care 2008;16(3):221-227 [FREE Full text] [Medline: 19094409]
13. Buetow S, Kenealy T. Evidence-based medicine: The need for a new definition. J Eval Clin Pract 2000 May;6(2):85-92. [Medline: 10970002]
14. Chatterji M, Graham M, Wyer P. Mapping cognitive overlaps between practice-based learning and improvement and evidence-based medicine: An operational definition for assessing resident physician competence. J Grad Med Educ 2009 Dec;1(2):287-298 [FREE Full text] [doi: 10.4300/JGME-D-09-00029.1] [Medline: 21975994]
15. Delbanco T, Walker J, Darer JD, Elmore JG, Feldman HJ, Leveille SG, et al. Open notes: Doctors and patients signing on. Ann Intern Med 2010 Jul 20;153(2):121-125. [doi: 10.7326/0003-4819-153-2-201007200-00008] [Medline: 20643992]
16. O'Malley A, Cohen G, Grossman J. Electronic medical records and communication with patients and other clinicians: Are we talking less? Issue Brief Cent Stud Health Syst Change 2010 Apr(131):1. [Medline: 20499485]
17. Bardach S, Real K, Bardach D. Perspectives of healthcare practitioners: An exploration of interprofessional communication using electronic medical records. J Interprof Care 2017 May;31(3):300-306. [Medline: 28151026]
18. Rouf E, Whittle J, Lu N, Schwartz MD. Computers in the exam room: Differences in physician-patient interaction may be due to physician experience. J Gen Intern Med 2007 Jan;22(1):43-48 [FREE Full text] [doi: 10.1007/s11606-007-0112-9] [Medline: 17351838]
19. Strayer SM, Semler MW, Kington ML, Tanabe KO. Patient attitudes toward physician use of tablet computers in the exam room. Fam Med 2010 Oct;42(9):643-647 [FREE Full text] [Medline: 20927673]
20. Meeks DW, Smith MW, Taylor L, Sittig DF, Scott JM, Singh H. An analysis of electronic health record-related patient safety concerns. J Am Med Inform Assoc 2014;21(6):1053-1059 [FREE Full text] [doi: 10.1136/amiajnl-2013-002578] [Medline: 24951796]
21. Arar NH, Wang C, Pugh JA. Self-care communication during medical encounters: Implications for future electronic medical records. Perspect Health Inf Manag 2006 Apr 24;3:3 [FREE Full text] [Medline: 18066361]
22. Bae J. Value-based medicine: Concepts and application. Epidemiol Health 2015;37:e2015014 [FREE Full text] [doi: 10.4178/epih/e2015014] [Medline: 25773441]
23. Burke H, Hoang A, Becher D, Fontelo P, Liu F, Stephens M, et al. QNOTE: An instrument for measuring the quality of EHR clinical notes. J Am Med Inform Assoc 2014;21(5):910-916 [FREE Full text] [doi: 10.1136/amiajnl-2013-002321] [Medline: 24384231]
24. Rosenbloom S, Denny J, Xu H, Lorenzi N, Stead W, Johnson K. Data from clinical notes: A perspective on the tension between structure and flexible documentation. J Am Med Inform Assoc 2011;18(2):181-186 [FREE Full text] [doi: 10.1136/jamia.2010.007237] [Medline: 21233086]
25. Stephens M, Gimbel R, Pangaro L. The RIME/EMR scheme: An educational approach to clinical documentation in electronic medical records. Acad Med 2011 Jan;86(1):11-14. [doi: 10.1097/ACM.0b013e3181ff7271] [Medline: 21191202]
26. Cadieux DC, Goldszmidt M. It's not just what you know: Junior trainees' approach to follow-up and documentation. Med Educ 2017 Aug;51(8):812-825 [FREE Full text] [doi: 10.1111/medu.13286] [Medline: 28418205]

27. Smart A. A multi-dimensional model of clinical utility. Int J Qual Health Care 2006 Oct;18(5):377-382. [doi: 10.1093/intqhc/mzl034] [Medline: 16951425]
28. Grosse SD, Khoury MJ. What is the clinical utility of genetic testing? Genet Med 2006 Jul;8(7):448-450. [doi: 10.1097/01.gim.0000227935.26763.c6] [Medline: 16845278]
29. Capuzzo M, Moreno R. Patient-Centred Acute Care Training: An ESICM Multidisciplinary Distance Learning Programme for Intensive Care Training. Brussels, Belgium: European Society of Intensive Care Medicine (ESICM); 2010 Oct. Clinical outcome: Professionalism URL: http://pact.esicm.org/media/Clinical outcome 31Oct10final.pdf [accessed 2018-10-02] [WebCite Cache ID 72sZQlmNF]
30. Bartlett R, Bland A, Rossen E, Kautz D, Benfield S, Carnevale T. Evaluation of the Outcome-Present State Test Model as a way to teach clinical reasoning. J Nurs Educ 2008 Aug;47(8):337-344. [Medline: 18751647]
31. Tay SW, Ryan P, Ryan CA. Systems 1 and 2 thinking processes and cognitive reflection testing in medical students. Can Med Educ J 2016 Oct;7(2):e97-e103 [FREE Full text] [Medline: 28344696]
32. Guerrasio J, Aagaard EM. Methods and outcomes for the remediation of clinical reasoning. J Gen Intern Med 2014 Dec;29(12):1607-1614 [FREE Full text] [doi: 10.1007/s11606-014-2955-1] [Medline: 25092006]
33. Burke HB, Sessums LL, Hoang A, Becher DA, Fontelo P, Liu F, et al. Electronic health records improve clinical note quality. J Am Med Inform Assoc 2015 Jan;22(1):199-205 [FREE Full text] [doi: 10.1136/amiajnl-2014-002726] [Medline: 25342178]
34. Rajkomar A, Ranji S, Sharpe B. Using the electronic health record to identify educational gaps for internal medicine interns. J Grad Med Educ 2017 Feb;9(1):109-112 [FREE Full text] [doi: 10.4300/JGME-D-16-00272.1] [Medline: 28261404]
35. Mountain C, Redd R, O'Leary-Kelly C, Giles K. Electronic medical record in the simulation hospital: Does it improve accuracy in charting vital signs, intake, and output? Comput Inform Nurs 2015 Apr;33(4):166-171. [doi: 10.1097/CIN.0000000000000144] [Medline: 25887108]
36. March CA, Scholl G, Dversdal RK, Richards M, Wilson LM, Mohan V, et al. Use of electronic health record simulation to understand the accuracy of intern progress notes. J Grad Med Educ 2016 May;8(2):237-240 [FREE Full text] [doi: 10.4300/JGME-D-15-00201.1] [Medline: 27168894]
37. Martin SK, Farnan JM. "Real-time" clinical reasoning via the EHR? The EHR and its role in clinical supervision. J Grad Med Educ 2017 Feb;9(1):137 [FREE Full text] [doi: 10.4300/JGME-D-16-00530.1] [Medline: 28261415]
38. Botsis T, Hartvigsen G, Chen F, Weng C. Secondary use of EHR: Data quality issues and informatics opportunities. AMIA Jt Summits Transl Sci Proc 2010 Mar 01;2010:1-5 [FREE Full text] [Medline: 21347133]

Abbreviations

ACC/AHA: American College of Cardiology/American Heart Association
ACCORD: Action to Control Cardiovascular Risk in Diabetes
ACGME: Accreditation Council for Graduate Medical Education
BP: blood pressure
CCMs: Core Competencies and Milestones
CIDI: Composite International Diagnostic Interview
EBM: evidence-based medicine
EHR: electronic health record
JNC8: Eighth Joint National Committee
PGY1: postgraduate year 1
RIME: Reporter-Interpreter-Manager-Educator
SOAP: subjective, objective, assessment, and plan
SPRINT: Systolic Blood Pressure Intervention Trial
SSRI: Selective serotonin reuptake inhibitor

Edited by G Eysenbach; submitted 05.03.18; peer-reviewed by J Gold, S Buttigieg; comments to author 03.08.18; revised version received 08.08.18; accepted 10.08.18; published 12.11.18.

Please cite as:
Habboush Y, Hoyt R, Beidas S
Electronic Health Records as an Educational Tool: Viewpoint
JMIR Med Educ 2018;4(2):e10306
URL: http://mededu.jmir.org/2018/2/e10306/
doi:10.2196/10306
PMID:30425025

Original Paper

Development of a Web-Based Formative Self-Assessment Tool for Physicians to Practice Breaking Bad News (BRADNET)

Anne-Christine Rat[1,2,3*], MD, PhD; Laetitia Ricci[3,4*], PhD (Psych); Francis Guillemin[1,3], MD, PhD; Camille Ricatte[4], MPsych; Manon Pongy[4], MPsych; Rachel Vieux[1,5], MD, PhD; Elisabeth Spitz[4], PhD (Psych); Laurent Muller[4], PhD (Psych)

[1]EA 4360 APEMAC, Université de Lorraine, Nancy, France

[2]Rheumatology, Nancy University Hospital, Nancy, France

[3]CIC 1433 Clinical Epidemiology, INSERM, Nancy University Hospital, Nancy, France

[4]Equipe de psychologie de la santé de Metz, EA 4360 APEMAC, Université de Lorraine, Metz, France

[5]Department of Pediatrics, Besançon University, Besançon, France

[*]these authors contributed equally

Corresponding Author:
Anne-Christine Rat, MD, PhD
EA 4360 APEMAC
Université de Lorraine
Rue du Morvan
Nancy,
France
Phone: 33 383153203
Email: ac.rat@chru-nancy.fr

Abstract

Background: Although most physicians in medical settings have to deliver bad news, the skills of delivering bad news to patients have been given insufficient attention. Delivering bad news is a complex communication task that includes verbal and nonverbal skills, the ability to recognize and respond to patients' emotions and the importance of considering the patient's environment such as culture and social status. How bad news is delivered can have consequences that may affect patients, sometimes over the long term.

Objective: This project aimed to develop a Web-based formative self-assessment tool for physicians to practice delivering bad news to minimize the deleterious effects of poor way of breaking bad news about a disease, whatever the disease.

Methods: BReaking bAD NEws Tool (BRADNET) items were developed by reviewing existing protocols and recommendations for delivering bad news. We also examined instruments for assessing patient-physician communications and conducted semistructured interviews with patients and physicians. From this step, we selected specific themes and then pooled these themes before consensus was achieved on a good practices communication framework list. Items were then created from this list. To ensure that physicians found BRADNET acceptable, understandable, and relevant to their patients' condition, the tool was refined by a working group of clinicians familiar with delivering bad news. The think-aloud approach was used to explore the impact of the items and messages and why and how these messages could change physicians' relations with patients or how to deliver bad news. Finally, formative self-assessment sessions were constructed according to a double perspective of progression: a chronological progression of the disclosure of the bad news and the growing difficulty of items (difficulty concerning the expected level of self-reflection).

Results: The good practices communication framework list comprised 70 specific issues related to breaking bad news pooled into 8 main domains: opening, preparing for the delivery of bad news, communication techniques, consultation content, attention, physician emotional management, shared decision making, and the relationship between the physician and the medical team. After constructing the items from this list, the items were extensively refined to make them more useful to the target audience, and one item was added. BRADNET contains 71 items, each including a question, response options, and a corresponding message, which were divided into 8 domains and assessed with 12 self-assessment sessions. The BRADNET Web-based platform was developed according to the cognitive load theory and the cognitive theory of multimedia learning.

Conclusions: The objective of this Web-based assessment tool was to create a "space" for reflection. It contained items leading to self-reflection and messages that introduced recommended communication behaviors. Our approach was innovative as it provided an inexpensive distance-learning self-assessment tool that was manageable and less time-consuming for physicians with often overwhelming schedules.

(JMIR Med Educ 2018;4(2):e17) doi:10.2196/mededu.9551

KEYWORDS

bad news disclosure; health communication; physician-patient relationship; distance e-learning

Introduction

Bad news is defined as any information that adversely and seriously affects an individual's view of their future [1]. Any physician will have to deliver bad news during the course of their practice, but they are not always prepared to face these difficult situations. Learning how to deliver bad news is a real need for healthcare professionals because how bad news is relayed can have consequences that will affect the patient for a long time [2]. Patients interviewed regarding the delivery of bad news highlighted the importance of the relational dimension and wished for more time during the consultation and a multidisciplinary approach [3]. Appropriate communication behaviors during medical consultations have been shown to improve physician-patient relationships and alleviate patient anxiety [4-6].

Recommendations for delivering bad news have mainly been developed to deliver a diagnosis of cancer [7-11]. The protocol Setting-up, Perception, Invitation, Knowledge, Emotion, Strategy (SPIKES), in 6 steps, is the most well-known tool for delivering bad news to patients with cancer [11][11]. Guidelines in these models are straightforward and practical (ie, do not speak with medical jargon, manage time constraints and interruptions, determine the patient's knowledge and expectations, deliver information in a progressive manner, check the patient's understanding, try to maintain the patient's hope, etc).

Although these guidelines were mainly developed in the context of cancer, every chronic disease, irreversible condition, or striking event can have a major effect on a patient's life. For example, the bad news may relate to neurological, musculoskeletal, cardiac, renal, or respiratory disease or a serious congenital condition in a child.

Furthermore, publishing recommendations are not sufficient to implement and change behavior, if needed. Healthcare providers also need to develop adaptive abilities to manage the complexity of clinical situations in which each patient is unique. Therefore, training on how to deliver bad news helps physicians (1) to analyze their practice and difficulties; (2) to grasp the specific elements of the situation, including the context and individual characteristics of the patient; (3) to perceive the factors that influence physician-patient interactions (verbal and nonverbal attitudes); (4) to facilitate the development of a repertoire of communication strategies for delivering bad news that the patient finds difficult to accept (both cognitively and emotionally); and (5) to decipher and understand the patient's emotional, cognitive, and behavioral responses in order to respond appropriately. Such training sessions should be provided both as initial and in-service training to build on the practice and experience of the physician.

In France, training sessions on how to deliver bad news, either as initial training or lifelong training, are not widespread [12]. To date, only motivated physicians have participated in training sessions on delivering bad news, even though student training is progressively increasing. Web-based technologies for delivering training could reach a greater number of physicians who cite high workloads, time pressures, and weak motivation, preventing them from engaging in intensive face-to-face training. Moreover, face-to-face training requires trained instructors, recognized for their experience in the field of delivering bad news, with mastery of medical, as well as psychological, social, and educational questions. A sound basis of evidence exists to support the use of computer-based techniques to improve general communication skills [13].

Over the past two decades, evidence from the literature indicates that formative self-assessment is an interesting way to improve learning (even "a *sine qua non* for effective learning" according to Black and William [14]) and is a necessary step for self-related learning. Indeed, with self-assessment, people reflect on their practice and their assessment of these practices and use their ratings to improve their skills [15]. Moreover, self-assessment plays a key role in the development of metacognitive skills. According to the research on self-assessment, learners who are skilled in metacognitive self-assessment and therefore aware of their abilities are more strategic and perform better than those who are unaware [16]. In terms of metacognitive knowledge, the accuracy of self-knowledge (ie, having accurate perceptions and making accurate judgments about one's knowledge and skills) is relevant to learning [17]. However, the effectiveness of self-assessment depends to a large extent on the quality of the feedback provided to the learner [18]. Generally, feedback is an inherent catalyst for all self-regulated activities and contributes to guiding cognitive activities during which knowledge is acquired, fine-tuned, and restructured. External feedback should be used to reinforce internal feedback and be oriented toward formative assessment rather than summative assessment. In fact, the objective of feedback is to help the learner identify their strengths and weakness and to target areas that need work and improvement. Feedback should be provided using the principles of comprehensive and benevolent communication and should support an individual's autonomy.

This strategy of learning also seems relevant for lifelong education because the learner can then directly integrate the self-assessment reflective process into their practice and thus

proceed through an iterative process (but led by personal reflection).

The goal of our research project was to build a Web-based formative self-assessment tool for physicians to practice delivering bad news: the BReaking bAD NEws Tool (BRADNET). BRADNET was envisioned as a way to create a space for self-reflection and for self-practice analysis to minimize the deleterious effects of a poor way of breaking bad news about a disease, whatever the disease.

Methods

Development of and evidence-based health interventions are increasingly based on intervention mapping (IM), a protocol that consists of an iterative process integrating theoretical aspects, expert input and several data from the target population [19,20]. We followed the methodological line adopted by IM protocol, which consisted of a review of the literature, interviewing stakeholders, building a framework, and refining (Figure 1).

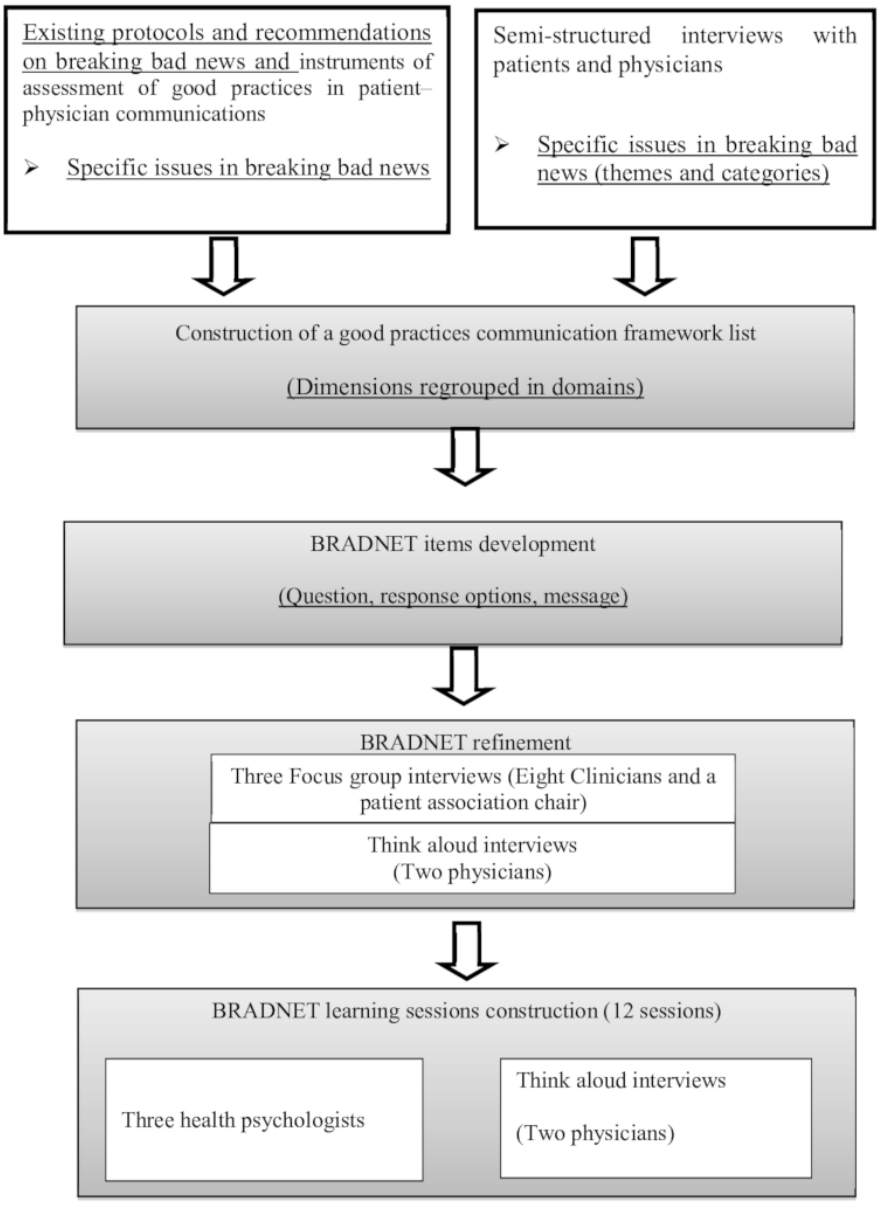
Existing Protocols and Recommendations

We reviewed the existing protocols and recommendations for delivering bad news and instruments to assess patient-physician communication.

Semistructured Interviews With Patients and Physicians

Interview guides (one targeting patients and the second physicians) were the product of brainstorming with 3 health psychologists (LM, CR, ES) and 3 physicians (1 pediatrician, RV and 2 rheumatologists, FG and ACR) who were experienced in delivering bad news. Individual interviews were conducted by 6 trained psychologist interviewers, with 25 patients (11 with rheumatoid arthritis, 11 with heart failure, and 3 with cancer) and 22 physicians (10 nephrologists, 4 cardiologists, 4 oncologists, 3 neurologists, and 1 rheumatologist).

Figure 1. BRADNET development.



We used a referral sampling strategy in which clinicians from the research team recruited other physicians in private practice or hospitals. The sampling strategy was based on the maximum variation strategy to achieve maximum diversity on relevant aspects of breaking bad news [21,22]. Clinicians from the research team (rheumatology, cardiology, and oncology service) identified the patients in their clinical practice according to maximized variability criteria, as specified by the project team. Interviews took place in private practice or in hospitals, depending on the place of recruitment. The resultant 47 interviews were recorded and transcribed to fully capture the contents of each interview.

Thematic Analysis

Data analysis proceeded in an iterative manner using the grounded theory methods approach [23]. Two researchers (LM, ES) created codebooks and categories from inductive data, not preconceived hypotheses on which data might be overlaid [23,24]. Ten sessions with 2 health psychologists (LM, ES) were organized for constructing the 2 thematic codebooks, 1 for patients and 1 for physicians. Transcripts were double-coded by 2 analysts to ensure consistency [25]. The 2 coders (MMo, CR) were a psychologist and a PhD student. Data analyses were performed using NVivo v10 (QSR International, Melbourne, Australia). Coding discrepancies were resolved between the 2 coders by discussion on meaning.

Construction of the Good Practices Communication Framework List by Experts

Specific issues related to breaking bad news were retrieved from existing protocols. We also used recommendations for delivering bad news and instruments that assess patient-physician communication, and specific issues related to breaking bad news were retrieved from physician and patient interviews. Issues were then selected, and close issues were merged by 4 independent groups composed of 3 health psychologists (LM, CR, ES), 2 sociologists, 2 epidemiologists, and 3 clinicians (FG, ACR, RV). Finally, the 4 lists were pooled and restructured to achieve a consensus on a common list (good practices communication framework list) of dimensions to serve as a basis for item development. The dimensions were also grouped into domains.

BRADNET Item Development

Items were then created from the good practices communication framework list (Figure 2). Their content was developed by a working group of 2 clinicians (ACR, RV) and 4 health psychologists (LM, CR, LR, ES). A BRADNET item was presented in the shape of a question that called for a reflection on one's medical communication approach, response options, and a message that opened up perspectives.

Each item targeted a specific aspect of bad news delivery (such as the physician's reaction to a patient's anger). For each item, the question required the users to actively recall their past experience and beliefs and how they coped with that situation. The answering modalities ask respondents to position themselves according to various behaviors or attitudes of their practice (multiple responses were possible and no answer modality was considered a *good* or *bad* answer). Then, the message recognized the difficulty of the situation and the need for a personalized response in each situation. The system questioned the physician about the patient's needs and cognitive and emotional states, modified by a potentially stressful situation, and offered some clues to better account for the needs of the patient in this situation. The messages were designed to be benevolent (to identify possible difficulties and open to improvements), short (to avoid wasting any time), practical (practical applications, nontheoretical), and easy to apply.

Because BRADNET did not assess knowledge, the message was not personalized. Instead, it aimed to develop the understanding and awareness of cognitive-behavioral processes and the abilities and motivation necessary to improve skills related to breaking bad news. Even if the message was the same for everybody, how users received and processed the messages was different and could have different impacts. This may increase physician awareness of the importance of select behavioral or communication issues, validate some practices and thoughts, or introduce a reflection on the benefits of change. There was no score because BRADNET did not assess the level of knowledge or desirability. Questions were not intended for self-testing, but rather for reflection.

BRADNET Refinement: Focus Group Interviews

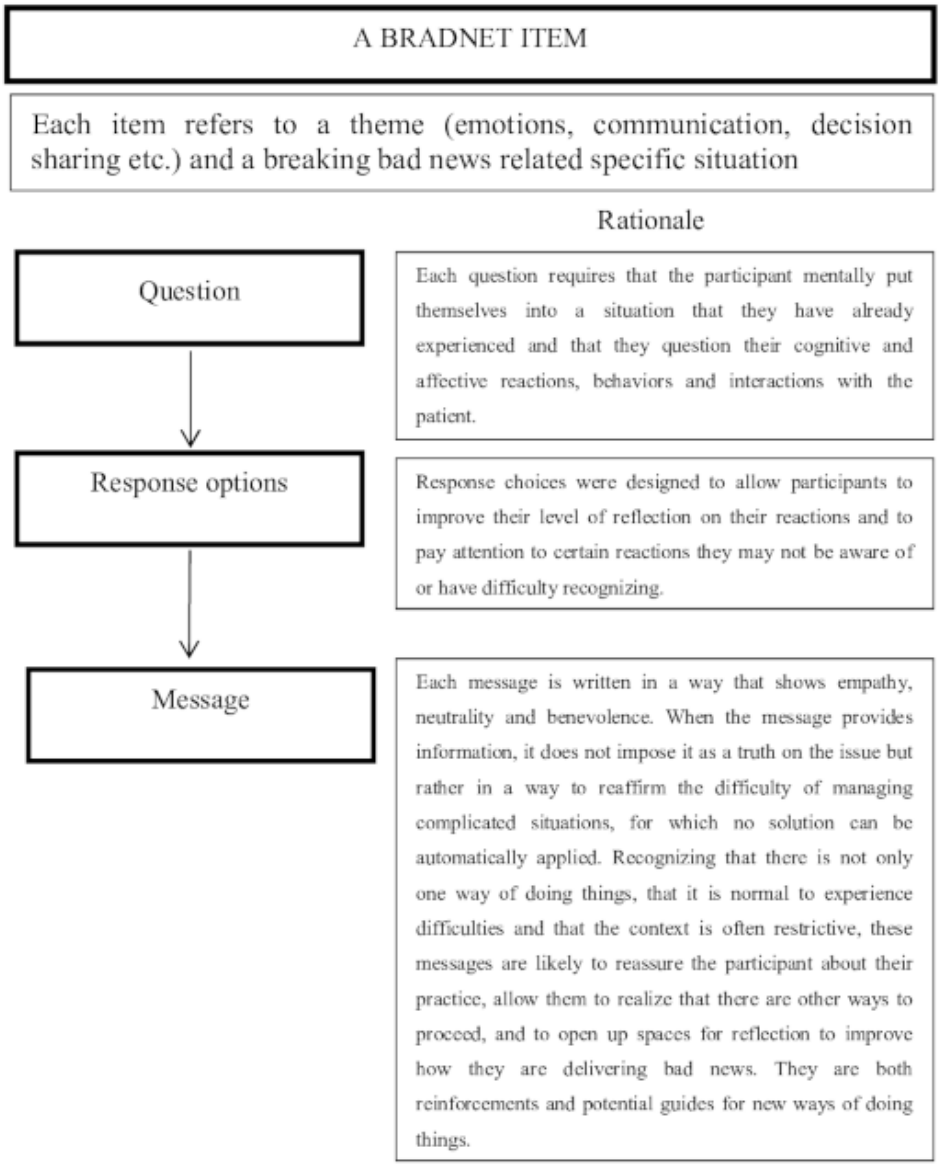
To ensure that physicians found BRADNET acceptable, understandable, and relevant to their patients' condition, the tool was refined by a working group of the "Patient Therapeutic Education in Rheumatology Section" consisting of 8 clinicians familiar with delivering bad news, as well as experts in therapeutic education, and the chair of a patient association. Items and messages were reworded and completed to improve acceptability and content during 3 sessions of 2-3 hours each and during reviews and email exchanges. Items were also refined by 4 health psychologists (LM, CR, LR, and ES).

Think-Aloud Interviews

"Think aloud" is a method for modeling cognitive processes. Different studies involving the think-aloud method agree that "this is a very direct method to gain insight into the knowledge and methods of problem solving in humans" [26]. The purpose of this method is to have easier access to thought processes and paths during the execution of a task and thus to collect qualitative data at the moment when tasks arise.

As part of the BRADNET development, the think-aloud approach was used to explore the impact of the items and messages and why and how these messages could change physicians' relations with patients or how to deliver bad news. The objective was to determine whether the items could be useful to physicians, including initiating participant reflection on the meaning of the item, in terms of their own practices. The interviews were conducted with 2 physicians (neonatology and palliative care). Each physician spoke aloud during 3 sessions of 2 hours each.

Figure 2. Format of a BRADNET item.



BRADNET Learning Sessions Construction

Acquisition of knowledge increases when learning sessions are separated [27-29]. This separation is even more important when learning includes self-reflection and behavior modification. LM, CR, and ES organized the BRADNET items into formative self-assessment sessions according to the double perspective of progression: a chronological progression of the disclosure of the bad news and the growing difficulty of items (difficulty concerning the expected level of self-reflection). The aim was to include items relating to several domains in each self-training session. This format, including the short sessions, met two objectives: (1) reducing physicians' time and (2) preventing cognitive overload and optimizing learning retention [30].

BRADNET Web-Based Platform Development: Theoretical Learning Principles

BRADNET was developed according to the cognitive load theory [28,30] and the cognitive theory of multimedia learning, which are based on 3 assumptions: the dual channel assumption (people possess separate processing systems for visual and verbal representations), the limited capacity assumption (the amount of processing is limited), and the active learning assumption (cognitive processing includes studying relevant incoming data, organizing this data into verbal and pictorial representations, and integrating these representations with each other and with prior knowledge [31]).

We envisioned BRADNET as a tool comprising static illustrations and printed text. Indeed, as compared with dynamic animation and narration learning formats, static illustrations and printed text have the advantage of reducing extraneous processing (cognitive processing that confounds training objectives), helping to manage intrinsic processing (cognitive processing of the key material) because students can control the pace of presentation and promoting learning retention. A static format allows people to control the pace and order of presentation and to engage in deeper processing such as making connections between words and pictures. It also encourages them to focus on the most relevant information. Finally, it allows for engaging people in active processing through activities such as generating explanations or answering questions during

learning. A static format is also more appropriate than a dynamic one because BRADNET is a formative self-assessment tool, with items that lead to self-reflection. Static media can lead to better learning than dynamic media (such as animation and narration) [31]. Several multimedia instruction messages, consistent with how people learn will be used to enhance learning outcomes [32].

Multimedia Principle

The presentation of words and pictures, rather than words alone, causes learners to use both visual and verbal channels.

Reduce Extraneous Processing

- Coherence principle: exclusion of words or images that are not relevant
- Spatial contiguity principle: corresponding words and pictures are presented near to, rather than far from, each other on the screen to help build connections
- Temporal contiguity principle: learners must have corresponding words and images in working memory at the same time in order to make connections between them
- Signaling principle: cues highlighting the organization of the essential material designed to call attention to the important material

Manage Essential Processing

- Segmenting principle: message is segmented into meaningful units rather than a continuous unit
- Spaced education principle: educational encounters that are spaced (space distribution) result in more efficient learning and improved learning retention compared with mass distribution of the educational encounters (bolus education) [29,33-35]
- Pretraining principle: people learn better when they know the names and characteristics of the main concepts
- Progressive difficulty: intrinsic cognitive load depends on the expertise of the learner in the domain (knowledge available in long-term memory), so to reduce it, the difficulties related to breaking bad news points to issues that are improved as the sessions progress (as the learner becomes more of an expert). Moreover, in our training design, we further enhanced the level of difficulty by proposing two last items (session 12) without any response options (for full space for reflection) to extend acquired skills [28]

Foster Generative Processing

Personalization principle: the words are presented in a conversational style, changed into first and second person with some conversational sentences

- Embodiment principle: onscreen agents display human-like gestures, movements, eye contact, and facial expressions
- Control of the pace and order of presentation principle
- The essential ideas of each training session will be reiterated at the end of the session and at the beginning of the next session to increase learning retention
- Stressing the same content repeatedly over time results in more efficient learning and improved learning retention

Results

Existing Protocols and Recommendations

The protocol SPIKES and recommendations from the World Health Organization and the Haute Autorité de Santé in France were some examples examined as recommendations on delivering bad news [1,8-11,36,37]. The Medical Communication Competence Scale, the Communication Assessment Tool, and the Frankfurt Observer Communication Checklist [38-40] were examined as patient-physician communication assessment instruments.

Semistructured Interviews With Patients and Physicians

Semistructured interviews were designed to allow patients and physicians to describe their own experiences with breaking bad news, while addressing their understanding and emotions in these situations and how they manage interpersonal relationships. The main topics of the open-ended interview guides are presented in Textbox 1.

Textbox 1. Main topics included in the open-ended interview guides for patients and physicians

Patients

1. Factual description of delivering bad news about disease
2. Cognition (eg, *questioning, anticipation, projection into the future)*
3. Emotion, behavior around the delivery of bad news
4. Interpersonal relationships (eg, *with families and work colleagues)*
5. Feelings and potential for improvement

Physicians

1. Factual description of delivering bad news about disease
2. Cognition (eg, *difficulties, examples of experiences, self-assessment*)
3. Emotion, behavior around the delivery of bad news
4. Interpersonal relationships (eg, *with patients and colleagues*)

Thematic Analysis Grids

For patient interviews, 3 categories were retrieved from the thematic analysis (Multimedia Appendix 1):

- The time of delivering bad news: reaction to the diagnosis (awareness of the disease, uncertainties surrounding the disease, psychological reactions), illness representation, and evolution of interpersonal relationships (with work colleagues, the healthcare team, family, and relatives)
- Care pathway and medical care: period after the breaking of bad news, with medical care after the diagnosis (description, questions and doubts of the patient, psychological reactions, interpersonal relation)
- Life with the disease (how care is delivered, physical and psychological impacts of the disease, adjustment to the illness)

For physician interviews, 8 categories were retrieved from the thematic analysis (Multimedia Appendix 2):

- Elements that might be taken into account for breaking the bad news
- Difficulties experienced by the physician at the time of delivering bad news
- Physician's training in delivering bad news
- Information provided by the physician about medical treatments and overall disease management
- Specific characteristics of the disease
- Physician-patient relationship
- Physician's perception of their role
- Physician's emotional experience

Construction of the Good Practices Communication Framework List by Experts

In total, 70 dimensions or specific issues related to breaking bad news were selected and structured. The good practices communication framework list consisted of 8 main domains, each domain consisting of dimensions constituting items to be developed in BRADNET (the number in brackets refers to the number of dimensions for each domain):

1. Opening (3): general questioning about the experience of breaking bad news, such as the kind of bad news delivered by the physician
2. Preparing for the consultation wherein bad news will be delivered (3): physicians are asked to consider how they prepare for a consultation in which they have to deliver bad news (eg, ensuring an enabling environment, asking patients to be accompanied by relatives)
3. Communication techniques (22): devoted to attitudes and behavior that can improve the quality of the physician-patient relationship (eg, introduce oneself, take time, respect silence, and ask open-ended questions)
4. Consultation content (19): the physician is asked to question the kind of the information that should be sought (eg, the patient's concerns) and transmitted (depending on the patient's beliefs or health skills) and how the patient can be supported (eg, by mentioning the future and life with the disease)
5. Attention (5): the patient's verbal and nonverbal attitudes, emotional difficulties, and cognitive limitations, to which the physician should pay attention
6. Physician emotional management (3): physicians are asked to question their emotions during a consultation wherein bad news is delivered, their behaviors and attitudes that betray their emotions, and how they cope with these emotions
7. Shared decision making (12): how physicians can develop a relationship with the patient, during which the patient has a role of care partner with whom decisions are made
8. Relationship between the physician and the medical team (3): questions of transmitting information regarding the patient or care of the patient to other healthcare professionals

With the good practices communication framework list thus defined, the final intervention could be developed.

BRADNET Items Development

Experts constructed 70 items based on the good practices communication framework list. Questions were built to foster reflection on how each physician delivered bad news in the past to anchor messages introducing recommended communication behaviors related to the physician's practice. The answering modalities of an item were a particular communication behavior in a specific situation (see items from domains 2, 4, 6, 7, 8 in Multimedia Appendix 3) or questions assessing the frequency of a specific behavior (see items from domains 3 and 5 in Multimedia Appendix 3).

BRADNET Refinement

As a result of the first refinement phase, besides extensive rewording, adaptation of the content and message adjustments, an additional dimension "the severity of the diagnosis also depends on the patient and their needs" was added to the domain "Consultation content." The item generated highlights that the severity of the diagnosis depends on individual perceptions and that the impact of delivering bad news on individual perceptions should not be underestimated, even if it may seem unimportant. Finally, the Web-based self-assessment tool to practice delivering bad news, BRADNET, was composed of 71 items (ES, LR, ACR).

The analysis of the verbal material resulting from the think-aloud approach allowed for classifying the elements of the verbatim into 8 points:

1. Reflections on the content of the items: physicians verbally indicated their degree of support with each of the items: complete support, confirming what is said in the questions, propositions or messages; partial support; or disagree with all or some of the items.
2. Items analysis: physicians show hesitations, misunderstandings, want to correct text, criticize the item, or simply make remarks.
3. Analysis of their own practice: physicians question their own practice and how to improve it in terms of the questions posed by the tool.
4. Reactions to the items: brings together all the psychological defensive processes observable in the discourse of

physicians when they are confronted with the content of the formative self-assessment tool: processes of resistance, distancing, reassurance, conflicts or opposition, identification, humor, doubt, and associations.
5. Factual description of the practice: factual aspects of the practice of medicine mentioned by the participants. These are comments without reflection and conceptualization; the participants listed what they do without associating it with any meaning or representations.
6. Associated thoughts: thoughts not directly related to the tool but derived from its analysis.
7. Global assessment and suggestions for improvement.
8. Prospects for future use: based on their own experience and perspectives from the initial training, participants reflect on proposing a relevant implementation of the tool.

Following this step, the items were again extensively refined to make them more useful to the target audience (ES, LM, MP).

Examples of BRADNET items are shown in Multimedia Appendix 3.

BRADNET Learning Sessions

In total, 12 formative self-assessment sessions were constructed (8 sessions with 6 items, 2 sessions with 7 items, 1 session with 5 items, and 1 session with 4 items). Five sessions included items from 4 main domains, 4 sessions from 4 main domains, and 3 sessions from 5 main domains. Session durations were estimated at 10 to 15 minutes. The proposed length of the total self-assessment was 45 days to maximize the retention of the messages and to start applying changes progressively during the self-assessment. Two sessions a week seemed to be manageable for physicians with high workloads and time pressures.

BRADNET Web-Based Platform Development

Description of the Web Platform

The interface will consist of a modal window of connection, allowing either the inscription on the website and the creation of a user account or a login to access the contents of the website. These identification data will be used to track the user's progress throughout the sessions and the items included in each session.

At first use, a welcome message will introduce the purpose and flow of the formative self-assessment program. During subsequent uses, this welcome message will recall where the user is in the program, focus on key elements of the previous session, and offer the ability to resume the course of the program where the user left off.

Each session will offer 4-6 items consisting of a question, predefined response modes or free input fields, and a message offering information or reinforcements on the attitudes and behaviors that may be appropriate to the situations encountered by the user in his or her practice. The sequence will be implemented as follows: the question appears first, then after 5 seconds, the response proposals or the free text field that was initially blurred appears on the screen under the question. Once the user has provided a response, a “continue” button appears and allows the user to display the message related to the question asked. This message is accompanied by a button to go to the next item but remains inoperative for 15 seconds (grayed out), allowing the user to take the time to read the message before proceeding to the next step.

At the end of a session, the user is thanked and is encouraged to return to the website in a few days to partake of the next session. The user will be offered the possibility to print the session in a pdf format.

During the use of the application, the following information is collected: the dates and times of connection, the time spent on each page or before the click to move to a next step in the program (eg, time spent displaying the message of an item), the overall time during each login session, and answers given.

The Web application was initially configured using a content management system (CMS) specifically developed for the purposes of the study and the collection of information mentioned above. CMS must allow for 1) setting up the greeting messages, the number and contents of the sessions, the expected durations between the sessions, the time of presentation of the messages, the possibility of sending a reminder by email the day before or the same day of a session, etc, and 2) accessing the data of use of the tool. All collected data will be managed by a website administrator with strict confidentiality rules.

Consistency of BRADNET features with theoretical learning principles is described in Table 1.

Table 1. Description of the BRADNET features and theoretical learning principles.

Theoretical learning principles	BRADNET features
Multimedia principle	Presentation of words and pictures
Reduction of extraneous cognitive load	
Coherence principle [1,2]	Expressing questions and messages in a neutral and simple language
Signaling principle (reduction of extraneous cognitive load)	• Highlighting key ideas of the items messages • Provide take-home messages at the end of each session
Spatial contiguity principal	Combining written text and pictures or illustrations in the items messages (eg, a physician looking at the computer screen) when appropriate
Manage essential processing	
Pretraining principle	Presentation of the formative self-assessment tool at the beginning of the training: description of the 8 domains addressed, number of sessions and items by sessions and approximate time needed to complete one session
• Segmenting principle • Spaced education principle (Allow for starting to apply changes progressively during the self-assessment and to become aware of the content of the message, implement it, and ponder the messages)	Learning sessions organization: segmentation in 12 spaced sessions
Limited capacity assumption	Short sessions
Progressive difficulty	Learning sessions organization: progression of difficulty Practical situations and examples
Foster generative processing	
Personalization principle	Use of the first and second person conversational style
Adaptation of the tool to health care professionals and daily practice	Refinement and reformulation of items and messages by healthcare professionals
Control of the pace principle	Presentation of the session item by item (one screen for the questions and answering modalities and one screen for the message and key words) with a “continue” button at the bottom right side of the screen.
Reinforcement of long-term memory	Recall of the key messages at the beginning of the next session
Active learning, engagement of the learner	
Development of understanding, abilities, motivation, and self-regulation [3]	• Formative self-assessment • Reflection on one’s practice • Open questions • Messages provide no judgment on practice or behavior • Refractory period between the screens (whatever the judgment of rate of learning [4], BRADNET encourages physicians to take the time to read the message before proceeding to the next step by means of a 15-second blurred “continue” button)
Support of the physician during implementation	Session printed in a pdf format

Discussion

Principal Findings

The formative self-assessment tool, BReaking bAD NEws Tool (BRADNET), for physicians to practice breaking bad news to patients, contains 71 items, each including a question, response options, and a corresponding message. Questions are as important as messages. These 71 items were divided into 8 domains practiced with 12 formative self-assessment sessions.

A Web-based tool has the potential to reach a large number of physicians at low cost and thus ensure maximal dissemination. Indeed, a Web-based communication skills training that can be followed at any time is more accessible than classroom training. It can also reach physicians with weak motivation to follow intensive face-to-face training. Web-based teaching has been successfully developed for a variety of medical training domains. The advantages include accommodating different learning styles, a self-paced mode, and the use of computer-adapted technology. This approach allows for multiplying different educational supports and is consistent with recent teaching approaches [43-45].

Research on clinical communication training demonstrating efficacy and sustained effects is sparse [46,47]; teaching methods involve mainly role playing, simulated patients or objectively structured clinical exams. Few interventions have

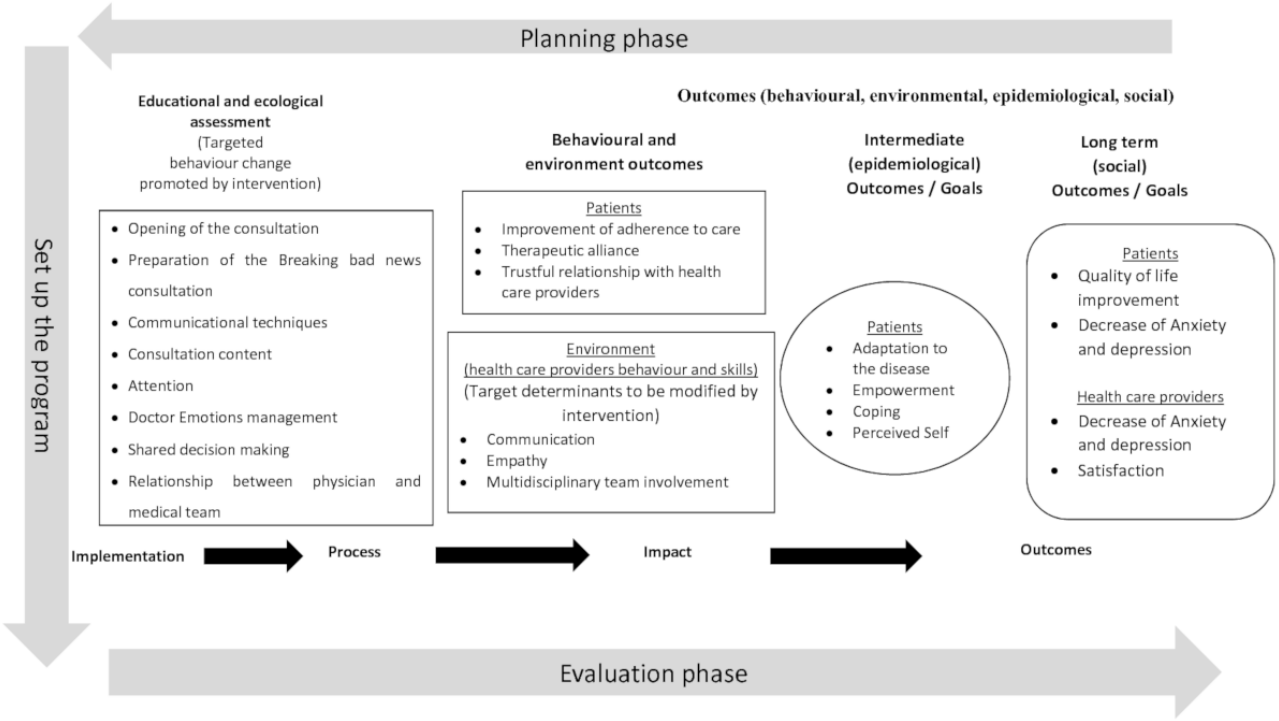
included virtual humans or computer-based interactions [13,48-50]. Kron et al studied the impact of virtual humans on the capacity for interacting using a wide range of communication behaviors to train students' communication skills. Like BRADNET, the training encourages reflection during and after their interaction with virtual humans, is interactive, and encourages active learning and practice. Trained students displayed improved communication performance on the objective structured clinical exam and attitudes and experiences. They valued the ability of the program to provide immediate feedback, teach nonverbal communication skills, and prepare them for emotion-charged patient encounters, all themes addressed in BRADNET [48]. In another Web-based intervention, students reviewed a video presenting history-taking, breaking bad news, and shared decision making. They identified and marked key events and attached written reflections. Critical self-reflection and active engagement of the students in their own learning were the main learning principles [49]. Finally, a computer-based test measuring medical students' communication skills in the field of shared decision making tested factual knowledge and applied knowledge by presenting patient vignettes. The control group scored significantly lower than the intervention one [13].

BRADNET was built to take into account physicians' time constraints and to optimize communication skills learning. It contains several principles to lessen physicians' cognitive load while attending the training sessions (segmenting principle, coherence principle, dual channel assumption, temporal contiguity principle, signaling principle, spaced education principle). Learning sessions are short, spaced, and organized to increase difficulty and reflection over the training to allow learners to construct schemas when they connect new information to the things they already know and further decrease cognitive load. Segmentation of content into spaced sessions is important to deal with time constraints, to enable the learner to become aware of the content of the message and implement it, and to return to the messages.

The originality of our project lies in the development of a generic tool suitable for different chronic diseases. So, far, guidelines about delivering bad news have been developed mainly to deliver a diagnosis of cancer, but every chronic disease, irreversible condition, or striking event can have a major effect on a patient's life. How bad news is communicated can have consequences that may affect patients, sometimes definitively. It likely affects the patient–health care provider relationship, therapeutic alliance, adhesion to care, and patients' subsequent adjustment to the disease [51]. Consequences of a chronic disease not only depend on its medical severity but also on individual perceptions, needs, personality, social environment, education, beliefs, and culture. Proposing personalized support and being aware of the unique nature of the physician-patient relationship is important, whatever the chronic disease. Even if different diseases have different consequences and representations, the impact of the quality of breaking bad news plays a critical role.

The content of BRADNET was developed by iterative processes that integrated theoretical aspects, interviews, and expert input. By collecting broad and deep information from various sources and by using a refinement step, we tried to increase the accuracy and validity of the BRADNET content [52,53]. To design the study to assess the impact of BRADNET on healthcare professional skills and behaviors and on patients, we propose a logic model (Figure 3) based on the PRECEDE-PROCEED model (PPM) to replace the intervention in a context of evaluation.

Figure 3. Theoretical framework.



In the PPM model, PRECEDE means Predisposing, Reinforcing, and Enabling Constructs in Educational/environmental Diagnosis and Evaluation and PROCEED means Policy Regulatory, and Organizational Constructs in Educational and Environmental Development. In this planning model, all aspects of a person's environment are considered potential intervention targets, as are the person's skills and behavior. The plan starts from the end goal of producing objectives and intermediate objectives, to developing a plan to achieve the objectives defined and then implement and evaluate the intervention [54]. Assessment of BRADNET will include measurements of the different patient outcomes: long-term outcomes (eg, quality of life, depression), intermediate outcomes (eg, coping, empowerment), behavioral and environmental outcomes (eg, adherence to care, relationship with health care provider), and processes (judgment or satisfaction of the physicians with the different BRADNET features, consistent with learning principles such as session durations, recall of the key messages or emphasis on key ideas).

A potential limitation of this study was the absence of specialists in the science of education involved the development of BRADNET. However, FG, LM, ACR, RV, and ES are academic professionals and are thus experienced in teaching, and ACR also teaches in a graduate diploma in therapeutic education or self-management programs. Moreover, formative self-assessment adopts principles of psychologic interviews: benevolence, understanding, and bringing knowledge without imposing it. Creating a space for reflection by giving the opportunity to initiate change is one approach to behavioral change.

Conclusion

In conclusion, most courses for training on the disclosure of a bad news use either classical classroom training sessions on communication skills training courses [11,55-58] or classical training plus standardized patient intervention [59-63]. Our approach provides a distance-learning self-training tool that is not expensive and more manageable and less time-consuming for physicians with often overwhelming schedules. BRADNET was built to take into account physicians' time constraints. The Web-based tool will further be tested in a randomized controlled trial with patients.

Practical Implications

The BRADNET intervention, a simple Web-based intervention, is expected to meet physicians' needs when breaking bad news. In France, only a few physicians have been trained and there is a need for training and personal self-reflection related to the delivery of bad news. BRADNET could be used to complete a previous training or be considered as a basic training. Improving the delivery of bad news could improve patients' adaptation to diseases and therapeutic alliances and decrease their anxiety and depression.

Acknowledgments

Funding has been provided by La région Lorraine, LR postdoctoral fellowship. The authors thank the clinician rheumatologists and experts in therapeutic education Catherine Beauvais, Serge Perrot, Violaine Foltz, Didier Poivret**,** Janine-Sophie Le Quintrec; Laurent Grange, Sophie Pouplin, and Laurence Carton (Association Française de Lutte Anti-Rhumatismale AFLAR) for their comprehensive reviews and important contributions toward refining BRADNET items; Marjorie Maugendre and Mathilde Mosson for patient interviews; the psychologists Nawell Hannachi, William Houlé, Rita Luz, and Marina Kretch, the sociologists Joëlle Kivits and Laura Saez, and the epidemiologists Nelly Agrinier and Elodie Speyer for the selection of specific issues to disclose bad news.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Supplementary table: Breaking Bad News Reading Grid for patient.

[PDF File (Adobe PDF File), 23KB - mededu_v4i2e17_app1.pdf]

Multimedia Appendix 2

Supplementary table: Breaking bad news Reading Grid for physicians.

[PDF File (Adobe PDF File), 18KB - mededu_v4i2e17_app2.pdf]

Multimedia Appendix 3

Supplementary table: Examples of 8 items, one for each of the 8 main domains of BRADNET.

[PDF File (Adobe PDF File), 31KB - mededu_v4i2e17_app3.pdf]

References

1. Buckman R. A Guide for Health Care Professionals. In: How to Break Bad News. Baltimore, Maryland, USA: JHU Press; 1992.
2. Zolnierek KBH, Dimatteo MR. Physician communication and patient adherence to treatment: a meta-analysis. Med Care 2009 Aug;47(8):826-834 [FREE Full text] [doi: 10.1097/MLR.0b013e31819a5acc] [Medline: 19584762]
3. Friedrichsen M, Strang P, Carlsson M. Breaking bad news in the transition from curative to palliative cancer care--patient's view of the doctor giving the information. Support Care Cancer 2000 Nov;8(6):472-478. [Medline: 11094992]
4. Fogarty LA, Curbow BA, Wingard JR, McDonnell K, Somerfield MR. Can 40 seconds of compassion reduce patient anxiety? J Clin Oncol 1999 Jan;17(1):371-379. [doi: 10.1200/JCO.1999.17.1.371] [Medline: 10458256]
5. Liénard A, Merckaert I, Libert Y, Delvaux N, Marchal S, Boniver J, et al. Factors that influence cancer patients' anxiety following a medical consultation: impact of a communication skills training programme for physicians. Ann Oncol 2006 Sep;17(9):1450-1458. [doi: 10.1093/annonc/mdl142] [Medline: 16801333]
6. Paul CL, Clinton-McHarg T, Sanson-Fisher RW, Douglas H, Webb G. Are we there yet? The state of the evidence base for guidelines on breaking bad news to cancer patients. Eur J Cancer 2009 Nov;45(17):2960-2966. [doi: 10.1016/j.ejca.2009.08.013] [Medline: 19762227]
7. Fallowfield L. Giving sad and bad news. Lancet 1993 Feb 20;341(8843):476-478. [Medline: 8094499]
8. Girgis A, Sanson-Fisher RW. Breaking bad news. 1: Current best advice for clinicians. Behav Med 1998;24(2):53-59. [doi: 10.1080/08964289809596381] [Medline: 9695896]
9. Walsh RA, Girgis A, Sanson-Fisher RW. Breaking bad news. 2: What evidence is available to guide clinicians? Behav Med 1998;24(2):61-72. [doi: 10.1080/08964289809596382] [Medline: 9695897]
10. Announcements and News. WHO URL: http://www.who.int/occupational_health/publications/newsletter/newsletter_17_announcements_news/en/ [accessed 2014-07-10] [WebCite Cache ID 705aSjMxh]
11. Baile WF, Buckman R, Lenzi R, Glober G, Beale EA, Kudelka AP. SPIKES-A six-step protocol for delivering bad news: application to the patient with cancer. Oncologist 2000;5(4):302-311 [FREE Full text] [Medline: 10964998]
12. Bonnaud-Antignac A, Campion L, Pottier P, Supiot S. Videotaped simulated interviews to improve medical students' skills in disclosing a diagnosis of cancer. Psychooncology 2010 Sep;19(9):975-981. [doi: 10.1002/pon.1649] [Medline: 19918865]
13. Kiessling C, Bauer J, Gartmeier M, Iblher P, Karsten G, Kiesewetter J, et al. Development and validation of a computer-based situational judgement test to assess medical students' communication skills in the field of shared decision making. Patient Educ Couns 2016 Nov;99(11):1858-1864. [doi: 10.1016/j.pec.2016.06.006] [Medline: 27345253]
14. Black P, Wiliam D. Assessment and Classroom Learning. Assessment in Education: Principles, Policy & Practice 2006 Jul 28;5(1):7-74. [doi: 10.1080/0969595980050102]
15. Brew A, Boud D. Teaching and research: Establishing the vital link with learning. High Educ 1995 Apr;29(3):261-273. [doi: 10.1007/BF01384493]
16. Imel S. Trends and Issues Alert. 2002. Metacognitive Skills for Adult Learning URL: https://eric.ed.gov/?id=ED469264 [accessed 2017-03-27] [WebCite Cache ID 705b42CJj]
17. Pintrich PR. The Role of Metacognitive Knowledge in Learning, Teaching, and Assessing. Theory Into Practice 2002 Nov;41(4):219-225. [doi: 10.1207/s15430421tip4104_3]
18. Taras M. To Feedback or Not to Feedback in Student Self-assessment. Assessment & Evaluation in Higher Education 2003 Oct;28(5):549-565. [doi: 10.1080/02602930301678]
19. Godin G, Gagnon H, Alary M, Levy JJ, Otis J. The degree of planning: an indicator of the potential success of health education programs. Promot Educ 2007;14(3):138-142. [Medline: 18154222]
20. Kok G, Schaalma H, Ruiter RAC, van EP, Brug J. Intervention mapping: protocol for applying health psychology theory to prevention programmes. J Health Psychol 2004 Jan;9(1):85-98. [doi: 10.1177/1359105304038379] [Medline: 14683571]
21. Sandelowski M. Sample size in qualitative research. Res. Nurs. Health 1995 Apr;18(2):179-183. [doi: 10.1002/nur.4770180211]
22. Coyne I. Sampling in qualitative research. Purposeful and theoretical sampling; merging or clear boundaries? J Adv Nurs 1997 Sep;26(3):623-630. [doi: 10.1046/j.1365-2648.1997.t01-25-00999.x]
23. Lasch KE, Marquis P, Vigneux M, Abetz L, Arnould B, Bayliss M, et al. PRO development: rigorous qualitative research as the crucial foundation. Qual Life Res 2010 Oct;19(8):1087-1096 [FREE Full text] [doi: 10.1007/s11136-010-9677-6] [Medline: 20512662]
24. Charmaz K. Constructing Grounded Theory. In: Constructing Grounded Theory. UK: Sage; 2014:978-971.
25. Brod M, Tesler L, Christensen T. Qualitative research and content validity: developing best practices based on science and experience. Qual Life Res 2009 Nov;18(9):1263-1278. [doi: 10.1007/s11136-009-9540-9] [Medline: 19784865]
26. Patrick DL, Burke LB, Gwaltney CJ, Leidy NK, Martin ML, Molsen E, et al. Content validity--establishing and reporting the evidence in newly developed patient-reported outcomes (PRO) instruments for medical product evaluation: ISPOR PRO Good Research Practices Task Force report: part 2--assessing respondent understanding. Value Health 2011 Dec;14(8):978-988 [FREE Full text] [doi: 10.1016/j.jval.2011.06.013] [Medline: 22152166]
27. Anderson J. Learning memory: An integrated approach (2nd ed.). In: Learning memory: An integrated approach (2nd ed.). Hoboken, NJ, USA: John Wiley & Sons Inc; 2000.

28. Kalyuga S, Chandler P, Tuovinen J, Sweller J. When problem solving is superior to studying worked examples. Journal of Educational Psychology 2001;93(3):579-588. [doi: 10.1037/0022-0663.93.3.579]
29. Kerfoot BP, DeWolf WC, Masser BA, Church PA, Federman DD. Spaced education improves the retention of clinical knowledge by medical students: a randomised controlled trial. Med Educ 2007 Jan;41(1):23-31. [doi: 10.1111/j.1365-2929.2006.02644.x] [Medline: 17209889]
30. van MJJG, Sweller J. Cognitive load theory in health professional education: design principles and strategies. Med Educ 2010 Jan;44(1):85-93. [doi: 10.1111/j.1365-2923.2009.03498.x] [Medline: 20078759]
31. Mayer RE, Hegarty M, Mayer S, Campbell J. When static media promote active learning: annotated illustrations versus narrated animations in multimedia instruction. J Exp Psychol Appl 2005 Dec;11(4):256-265. [doi: 10.1037/1076-898X.11.4.256] [Medline: 16393035]
32. Mayer RE. The promise of multimedia learning: using the same instructional design methods across different media. Learning and Instruction 2003 Apr;13(2):125-139. [doi: 10.1016/S0959-4752(02)00016-6]
33. Dempster FN. The Spacing Effect: A Case Study in the Failure to Apply the Results of Psychological Research. Am Psychol 1988 Aug 1;43(8):627-634.
34. Cepeda NJ, Pashler H, Vul E, Wixted JT, Rohrer D. Distributed practice in verbal recall tasks: A review and quantitative synthesis. Psychol Bull 2006 May;132(3):354-380. [doi: 10.1037/0033-2909.132.3.354] [Medline: 16719566]
35. Kerfoot BP, Brotschi E. Online spaced education to teach urology to medical students: a multi-institutional randomized trial. Am J Surg 2009 Jan;197(1):89-95. [doi: 10.1016/j.amjsurg.2007.10.026] [Medline: 18614145]
36. Buckman R, Kazon Y. S'asseoir pour parler: l'art de communiquer de mauvaises nouvelles aux malades. In: L'art de communiquer de mauvaises nouvelles aux malades. Issy-les-Moulineaux, France: Elsevier Masson; 2007:211.
37. Haute Autorité de Santé. Annoncer une mauvaise nouvelle. 2008 Oct. Annoncer une mauvaise nouvelle URL: http://www.has-sante.fr/portail/jcms/c_698028/fr/annoncer-une-mauvaise-nouvelle [accessed 2016-05-17]
38. Cegala DJ, Coleman MT, Turner JW. The development and partial assessment of the medical communication competence scale. Health Commun 1998;10(3):261-288. [doi: 10.1207/s15327027hc1003_5] [Medline: 16370986]
39. Mercer LM, Tanabe P, Pang PS, Gisondi MA, Courtney DM, Engel KG, et al. Patient perspectives on communication with the medical team: pilot study using the Communication Assessment Tool-Team (CAT-T). Patient Educ Couns 2008 Nov;73(2):220-223. [doi: 10.1016/j.pec.2008.07.003] [Medline: 18703306]
40. Sennekamp M, Gilbert K, Gerlach FM, Guethlin C. Development and validation of the "FrOCK": Frankfurt observer communication checklist. Z Evid Fortbild Qual Gesundhwes 2012;106(8):595-601. [doi: 10.1016/j.zefq.2012.07.018] [Medline: 23084867]
41. Siegesmund A. Using self-assessment to develop metacognition and self-regulated learners. FEMS Microbiol Lett 2017 Jun 15;364(11). [doi: 10.1093/femsle/fnx096] [Medline: 28498982]
42. Kornell N, Bjork RA. The promise and perils of self-regulated study. Psychonomic Bulletin & Review 2007 Apr;14(2):219-224. [doi: 10.3758/BF03194055]
43. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM. Instructional design variations in internet-based learning for health professions education: a systematic review and meta-analysis. Acad Med 2010 May;85(5):909-922. [doi: 10.1097/ACM.0b013e3181d6c319] [Medline: 20520049]
44. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM. Internet-based learning in the health professions: a meta-analysis. JAMA 2008 Sep 10;300(10):1181-1196. [doi: 10.1001/jama.300.10.1181] [Medline: 18780847]
45. Taveira-Gomes T, Ferreira P, Taveira-Gomes I, Severo M, Ferreira MA. What Are We Looking for in Computer-Based Learning Interventions in Medical Education? A Systematic Review. J Med Internet Res 2016 Aug 01;18(8):e204 [FREE Full text] [doi: 10.2196/jmir.5461] [Medline: 27480053]
46. Alelwani S, Ahmed Y. Medical training for communication of bad news: A literature review. J Educ Health Promot 2014;3:51 [FREE Full text] [doi: 10.4103/2277-9531.134737] [Medline: 25077144]
47. Satterfield JM, Hughes E. Emotion skills training for medical students: a systematic review. Med Educ 2007 Oct;41(10):935-941. [doi: 10.1111/j.1365-2923.2007.02835.x] [Medline: 17822414]
48. Kron FW, Fetters MD, Scerbo MW, White CB, Lypson ML, Padilla MA, et al. Using a computer simulation for teaching communication skills: A blinded multisite mixed methods randomized controlled trial. Patient Educ Couns 2017 Apr;100(4):748-759. [doi: 10.1016/j.pec.2016.10.024] [Medline: 27939846]
49. Hulsman RL, Harmsen AB, Fabriek M. Reflective teaching of medical communication skills with DiViDU: assessing the level of student reflection on recorded consultations with simulated patients. Patient Educ Couns 2009 Feb;74(2):142-149. [doi: 10.1016/j.pec.2008.10.009] [Medline: 19062232]
50. Quail M, Brundage SB, Spitalnick J, Allen PJ, Beilby J. Student self-reported communication skills, knowledge and confidence across standardised patient, virtual and traditional clinical learning environments. BMC Med Educ 2016 Feb 27;16:73 [FREE Full text] [doi: 10.1186/s12909-016-0577-5] [Medline: 26919838]
51. Last BF, van VAM. Information about diagnosis and prognosis related to anxiety and depression in children with cancer aged 8-16 years. Eur J Cancer 1996 Feb;32A(2):290-294. [Medline: 8664044]
52. MacKenzie S, Podsakoff P, Podsakoff N. Construct Measurement and Validation Procedures in MIS and Behavioral Research: Integrating New and Existing Techniques. MIS Quarterly 2011 Mar;35(2):293-334 [FREE Full text]

53. Linn AJ, van WJCM, Smit EG, Perry K, van DL. 1+1=3? The systematic development of a theoretical and evidence-based tailored multimedia intervention to improve medication adherence. Patient Educ Couns 2013 Dec;93(3):381-388. [doi: 10.1016/j.pec.2013.03.009] [Medline: 23579041]
54. Crosby R, Noar SM. What is a planning model? An introduction to PRECEDE-PROCEED. J Public Health Dent 2011;71 Suppl 1:S7-15. [Medline: 21656942]
55. Pang Y, Tang L, Zhang Y, Song L, Goelz T, Fritzsche K, et al. Breaking bad news in China: implementation and comparison of two communication skills training courses in oncology. Psychooncology 2015 May;24(5):608-611. [doi: 10.1002/pon.3698] [Medline: 25257977]
56. Ungar L, Alperin M, Amiel GE, Beharier Z, Reis S. Breaking bad news: structured training for family medicine residents. Patient Educ Couns 2002 Sep;48(1):63-68. [Medline: 12220751]
57. Lienard A, Merckaert I, Libert Y, Delvaux N, Marchal S, Boniver J, et al. Factors that influence cancer patients' and relatives' anxiety following a three-person medical consultation: impact of a communication skills training program for physicians. Psychooncology 2008 May;17(5):488-496. [doi: 10.1002/pon.1262] [Medline: 17879970]
58. Baile WF, Kudelka AP, Beale EA, Glober GA, Myers EG, Greisinger AJ, et al. Communication skills training in oncology. Description and preliminary outcomes of workshops on breaking bad news and managing patient reactions to illness. Cancer 1999 Sep 01;86(5):887-897. [Medline: 10463990]
59. Szmuilowicz E, el-Jawahri A, Chiappetta L, Kamdar M, Block S. Improving residents' end-of-life communication skills with a short retreat: a randomized controlled trial. J Palliat Med 2010 Apr;13(4):439-452. [doi: 10.1089/jpm.2009.0262] [Medline: 20201666]
60. Eid A, Petty M, Hutchins L, Thompson R. "Breaking bad news": standardized patient intervention improves communication skills for hematology-oncology fellows and advanced practice nurses. J Cancer Educ 2009;24(2):154-159. [doi: 10.1080/08858190902854848] [Medline: 19431034]
61. Amiel GE, Ungar L, Alperin M, Baharier Z, Cohen R, Reis S. Ability of primary care physician's to break bad news: a performance based assessment of an educational intervention. Patient Educ Couns 2006 Jan;60(1):10-15. [doi: 10.1016/j.pec.2005.04.013] [Medline: 16122897]
62. Cushing AM, Jones A. Evaluation of a breaking bad news course for medical students. Med Educ 1995 Nov;29(6):430-435. [Medline: 8594407]
63. Schildmann J, Kupfer S, Burchardi N, Vollmann J. Teaching and evaluating breaking bad news: a pre-post evaluation study of a teaching intervention for medical students and a comparative analysis of different measurement instruments and raters. Patient Educ Couns 2012 Feb;86(2):210-219. [doi: 10.1016/j.pec.2011.04.022] [Medline: 21571487]

Abbreviations

CMS: content management system
IM: intervention mapping
PPM: PRECEDE-PROCEED model
SPIKES: Setting-up, Perception, Invitation, Knowledge, Emotion, Strategy
BRADNET: BReaking bAD NEws Tool

Edited by G Eysenbach; submitted 01.12.17; peer-reviewed by T Taveira-Gomes, J Alpert; comments to author 28.12.17; revised version received 22.03.18; accepted 22.04.18; published 19.07.18.

Please cite as:
Rat AC, Ricci L, Guillemin F, Ricatte C, Pongy M, Vieux R, Spitz E, Muller L
Development of a Web-Based Formative Self-Assessment Tool for Physicians to Practice Breaking Bad News (BRADNET)
JMIR Med Educ 2018;4(2):e17
URL: http://mededu.jmir.org/2018/2/e17/
doi:10.2196/mededu.9551
PMID:30026180

Original Paper

Development and Evaluation of a New Security and Privacy Track in a Health Informatics Graduate Program: Multidisciplinary Collaboration in Education

Leming Zhou[1], PhD, DSc; Bambang Parmanto[1], PhD; James Joshi[2], PhD

[1]Department of Health Information Management, University of Pittsburgh, Pittsburgh, PA, United States

[2]Department of Informatics and Networked Systems, School of Computing and Information, University of Pittsburgh, Pittsburgh, PA, United States

Corresponding Author:
Leming Zhou, PhD, DSc
Department of Health Information Management
University of Pittsburgh
6021 Forbes Tower
Pittsburgh, PA,
United States
Phone: 1 412 383 6653
Fax: 1 412 383 6655
Email: lmzhou@gmail.com

Abstract

Background: The widespread application of technologies such as electronic health record systems, mobile health apps, and telemedicine platforms, has made it easy for health care providers to collect relevant data and deliver health care regimens. While efficacious, these new technologies also pose serious security and privacy challenges.

Objective: The training program described here aims at preparing well-informed health information security and privacy professionals with enhanced course materials and various approaches.

Methods: A new educational track has been built within a health informatics graduate program. Several existing graduate courses have been enhanced with new security and privacy modules. New labs and seminars have been created, and students are being encouraged to participate in research projects and obtain real-world experience from industry partners. Students in this track receive both theoretical education and hands-on practice. Evaluations have been performed on this new track by conducting multiple surveys on a sample of students.

Results: We have succeeded in creating a new security track and developing a pertinent curriculum. The newly created security materials have been implemented in multiple courses. Our evaluation indicated that students (N=72) believed that receiving security and privacy training was important for health professionals, the provided security contents were interesting, and having the enhanced security and privacy training in this program was beneficial for their future career.

Conclusions: The security and privacy education for health information professionals in this new security track has been significantly enhanced.

(JMIR Med Educ 2018;4(2):e19) doi:10.2196/mededu.9081

KEYWORDS

information security; research projects; partnership and collaboration

Introduction

In most current health informatics, medical informatics, nursing informatics, and health information management (HI-MI-NI-HIM) education programs, there is either no dedicated security and privacy class or only one available course [1]. At the same time, however, it is widely accepted that security and privacy are crucial in the domain of health care. According to a study done by Staggers et al in 1999 [2], health care professionals recognized the importance of privacy and security and the need to enhance security and privacy education in this field.

Currently, the discussion on security and privacy issues continues in a variety of health care areas [3-6], especially in

fields such as the electronic health record (EHR) systems, mobile health (mHealth) apps, and telemedicine platforms. These recent developments in health information technologies have created challenges in security and privacy that are far more serious than those seen just two decades ago.

According to the Office of the National Coordinator for Health Information Technology data brief released in 2016, 96% of hospitals in the United States possess certified EHR technology. Likewise, 84% of hospitals had adopted at least a basic EHR system with clinician notes in 2015, which is a 9-fold increase since 2008 [7,8]. In large hospitals, dedicated information technology (IT) teams protect patient health data, but in many smaller clinics, there are no dedicated IT personnel to manage EHR systems. This leaves a huge number of security vulnerabilities for attackers to explore.

The widespread adoption of new technologies such as mHealth apps and telemedicine systems makes security and privacy issues in health care more challenging and urgent since patients can easily share the confidential health data they receive from health care providers without knowing the security risks.

The cloud and health social networks, an emerging new frontier for health care delivery, pose new challenges in security and privacy as well. Currently, there are many social media tools available for patients and health care professionals, such as social networking platforms (Facebook, Twitter, LinkedIn), blogs, wikis, and photo and video sharing sites (Flickr, YouTube, Instagram). Patients use Twitter to obtain knowledge and exchange ideas and use Facebook to obtain social support, while health care professionals use LinkedIn and Twitter to communicate with colleagues and identify potential jobs [9]. The social media are great tools for communication and knowledge transfer. However, since patients have to share their personal information on social media when they seek information for their own disease, they should have serious concerns about their privacy [9]. When health care professionals share their own experience with colleagues via social media or upload patient records to the cloud, there is also risk of violating their patients' information confidentiality [10].

Health care professionals are responsible for educating patients regarding the safe and ethical sharing of personal health records. Furthermore, health care professionals must properly handle all types of sensitive health records, such as personal genomic information, EHR data, and data collected with mobile apps or other various trackers and wearable sensors. In other words, the changing face of health IT and health care information management requires that we enhance the security and privacy education offered to health care professionals, especially to students in HI-MI-NI-HIM programs.

There are 3 typical approaches in enhancing security and privacy education in HI-MI-NI-HIM programs: (1) cross-listing existing security and privacy courses offered by computer science or information science departments, (2) adding a security and privacy course to the curriculum, or (3) addressing security and privacy issues in relevant courses. In the first approach, students in HI-MI-NI-HIM programs are required to have a solid background in computer science topics such as computer programming and computer networks. These prerequisites make the security and privacy courses inaccessible for many HI-MI-NI-HIM students. In the second approach, the major challenge for students is the connection between security and privacy theory and their application in health science. A single course can be used to introduce security and privacy theories but students do not have much chance to know the application of those theories in health care practice and health data management. The third approach is the opposite of the second approach. When instructors discuss specific health IT systems or health data management, they can describe the relevant security and privacy challenges; however, the instructors would not be able to go into the details of these challenges, the fundamental security and privacy theories behind those challenges, and the desired solutions.

In response to this current situation, a new information security and privacy track in a Health Information Systems (HIS) graduate program has been created in the Department of Health Information Management (HIM) in collaboration with the Department of Informatics and Networked Systems (INS) at the University of Pittsburgh (Pitt) with the goal of producing highly desired, well-trained security and privacy professionals in the domain of health care. Instead of simply modifying the curriculum by cross-listing a number of existing security and privacy courses or trying to cover every aspect of security and privacy in a single course, a number of significant curriculum changes have been made. For example, courses from INS were modified and introduced in this new track. Multiple existing courses have been enhanced with security and privacy contents. New labs, seminars, research projects, and internship activities have also been developed and offered to students. It is expected that this new track will enhance the security and privacy training to students in this graduate program.

Methods

New Track Creation

Modifying and Including Informatics and Networked Systems Graduate Courses

The courses in the HIS graduate program are classified by type as Health Informatics and Foundation, Health Management, or elective courses/thesis option. Of the 15 available Health Informatics and Foundation courses, students are required to take 10; of the 5 Health Management courses, they must take 2. For their remaining credits, students are allowed to take 2 additional electives or choose the thesis option. Students in the thesis option take 2 courses: Graduate Research Proposal and Graduate Research. Here, students obtain course credits by attending seminars and conducting research under the guide of a project mentor.

In developing the new security and privacy track, we introduced 2 required courses and 2 elective courses in the Health Informatics and Foundation category, offered in Pitt's INS department. Required are Introduction to Security and Privacy (INFSCI 2150) and Security in E-Commerce (INFSCI 2731); Security Management and Computer Forensics (INFSCI 2621) and Developing Secure Systems (INFSCI 2620) are elective. These courses were chosen because they had rich contents in

security and privacy, including both theoretical foundations (INFSCI 2150) and practical applications (INFSCI 2731, INFSCI 2621, and INFSCI 2620) in various fields. In addition, these 4 courses only required students to have general knowledge in computer systems and computer programming, which is also the prerequisite of our HIS graduate program. They did not expect students to have extensive knowledge in computer networks or cryptography. The instructors of these 4 courses have worked closely with faculty members in the HIS graduate program to create examples and case studies in these courses. The purpose was to contextualize these courses with current issues from the health care domain so that HIS students can gain an understanding of the most relevant security and privacy principles and technologies in the context of health care. For instance, INS instructors started to discuss Health Insurance Portability and Accountability Act (HIPAA) regulations and their impact to risk management, health data anonymization, health data security in the cloud, and secure health-related private data release. Table 1 shows the updated curriculum for the security and privacy track in the HIS graduate program at Pitt.

Enhancing Existing Courses

Some changes have been made to existing courses in the HIS graduate program. In Security, Privacy and Legal Issues in Health Systems (HRS 2421), we have added 2 guided discussion sessions, 2 student presentations, 2 scholarly papers, and 1 hands-on course project. In Telemedicine, Tele-rehabilitation, and e-Health (HRS 2432), security and privacy issues are described and discussed when each telemedicine platform is introduced in the class. Guest lecturers are invited to explain the details of certain systems, such as the security and privacy of patient records in web portals. In Topics in Health Care (HRS 2902), lectures regarding information security and privacy issues in health systems have been added. In Electronic Health Records (HRS 2490), a faculty member from INS delivers 2 lectures on the security and privacy of EHR records. Finally, 1 discussion session and 1 term paper on personal genomic information security have been added to Data Analytics and Its Applications in Genomics (HRS 2425).

Developing New Labs

Six new educational lab modules have been introduced into various classes throughout the new track. These lab modules include lifecycle management in cloud and health social networks, security policy and auditing issues in the health care environment, authentication and identity management, access control for EHR systems, secure mobile apps and social networks in health care, and HIPAA compliance management. All these labs are closely related to pressing security and privacy issues in the domain of health care such as the cloud, social media, mobile app, identity management, access control, and HIPAA compliance. Instructors from the INS and HIM departments met and discussed the content of these lab modules. Each instructor took the lead of 1 lab module according to his/her expertise. For instance, Valerie Watzlaf in the HIM department guided students to investigate the HIPAA compliance of existing telemedicine systems; LZ led students to evaluate the security of a new EHR system created for the FOCUS Pittsburgh Free Health Clinic (FPFHC) and BP trained students to investigate the security of mobile apps.

For students in HI-MI-NI-HIM programs, EHR is one system they should be familiar with. Lab exercises were created for them to get familiar with multiple EHR systems. In the Electronic Health Records (HRS 2490) class, the Virtual Lab system developed by the American Health Information Management Association was used to teach students how to use EHR systems such as the one made by Cerner to manage and protect patient data. We also introduce the OpenEMR (open-emr.org) to students, which is freely available to everyone. Students can make changes on the OpenEMR system to see the differences in the output, which is quite beneficial for them to identify the impact of different authentication methods.

Developing New Seminars

Four new seminars have been created. These new seminars are typically related to specific research projects led by faculty members in the HIM and INS departments, with topics in high assurance electronic health (eHealth) and health IT infrastructure, security and privacy in the cloud and health social networks, secure health care cyber-physical systems, and advanced topics in secure health care information systems. In these seminars, both instructors and students read the current literature and gave presentations that are followed by extensive discussion in the class.

Designing Small-Scale Research Projects

Small-scale research projects are created by faculty members and provided to students. Some examples include the security features of a new health IT system created for a free clinic, the security of published mobile health apps, and projects in topics such as access control, social network, and cloud security.

LZ has been working closely with FPFHC to create a health IT system for the clinic. Everything is created from scratch, which provides abundant security and privacy research opportunities for students. Students involved in this project can test different security measures and privacy policies and manipulate fake user accounts and medical records to determine the security of the implemented system. They have the opportunity to go through the whole life cycle of secure system development and testing.

JJ did extensive research in security and privacy such as role-based access control (RBAC), temporal access control, geo-social-RBAC, anonymization, identity threats, and security and privacy issues in social network systems and the cloud computing environment [11-22]. In this new security and privacy track, JJ has created research projects and test beds for graduate students to conduct research projects in access control, social network, and cloud security.

BP has led the development of multiple innovative mHealth systems and telemedicine platforms, including the iMHere system for mHealth and VISYTER (Versatile and Integrated System for Telerehabilitation) for telemedicine [23,24]. In this track, he has created research projects for graduate students to investigate the security issues in existing telehealth systems and mobile health apps.

Table 1. Curriculum of the Health Information Systems graduate program, Security and Privacy Track.

Course type and number	Course title	Credit
Prerequisites		
__[a]	Computer programming	3
—	Statistics	3
Health Informatics and Foundation courses (select 29-30 credits)		
HRS 2420	Introduction to Health Information Systems	3
HRS 2421	Security, Privacy, and Legal Issues in Health Systems	3
HRS 2422	Computer Programming for Health Informatics	3
HRS 2424	Data Base Management in Health Care	3
HRS 2428	Software Engineering Project Management	3
HRS 2439	Health Information Systems Internship	3
HRS 2490	Electronic Health Records	3
HRS 2423	Cloud Computing, HL7[b], and Analytics in Health Care	3
HRS 2425	Data Analytics and Its Applications in Genomics	3
HRS 2426	Evaluation of Classification Systems	3
HRS 2431	Evaluation Methods in Health Information Systems	3
HRS 2432	Telemedicine, Tele-Rehabilitation, and e-Health	3
HRS 2434	Business Issues/Data Analytics in Health Care	2
HRS 2901	Introduction to Research Methodology	3
HRS 2910	Statistical Applications in Health and Rehabilitation	3
INFSCI 2150	Introduction to Security and Privacy	3
INFSCI 2731	Security in E-Commerce	3
INFSCI 2621	Security Management and Computer Forensics	3
INFSCI 2620	Developing Secure Systems	3
Health Management courses (select 6 credits)		
HRS 2435	Financial Management Foundations	3
HRS 2445	Human Resource Management	3
HRS 2454	Lean Six Sigma for Healthcare Management	3
HRS 2902	Topics in Health Care	3
HRS 2905	Ethical Issues in Health Care	3
Thesis option (6 credits)		
HRS 2924	Graduate Research Proposal	2
HRS 2925	Graduate Research	4

[a]Not applicable.

[b]HL7: Health Level 7.

Providing Internship Experiences

We always encourage students to seek internship experiences in different health care organizations. For instance, many graduate students have the opportunity to work with organizations such as the University of Pittsburgh Medical Center (UPMC) hospitals and Veterans Affairs Pittsburgh Health System as interns. Currently, the HIM department at Pitt has more than 80 active industry partners including multiple UPMC hospitals and various nonprofit health organizations. Students in this new track are specifically encouraged to have security- and privacy-related internship experience with these industry partners.

Evaluation of the New Track

Since the course materials have just recently been implemented, we can offer only a preliminary evaluation report. Pitt's Collaborative for Evaluation and Assessment Capacity worked closely with the project team to perform the evaluation, which included collecting data according to the project objectives in

each course/activity as well as evaluating the impact of project activities on learning outcomes. All new items in the track will be evaluated through observation, pre/post comparisons, surveys, and/or feedback from students and faculty.

In general, evaluation activities involve the following:

- Collecting information regarding student satisfaction and perception toward the new course materials, training approach, and other activities through surveys
- Measuring student learning results through performance in courses, projects, or internships and feedback from course instructors or internship supervisors
- Identifying any evidence that students are applying acquired skills in subsequent courses using behavior change checklists
- Documenting any evidence that students are using new knowledge and skills beyond coursework by conducting postgradation/employment surveys

Results

In Fall 2015, 2 courses, Topics in Health Care (HRS 2902) and Telemedicine, Tele-rehabilitation, and e-Health (HRS 2432), were enhanced with security and privacy content. Two brief and informal questionnaires designed by the course instructors were distributed to students in the class at the end of the semester. The questionnaires were aimed at obtaining a general measure of students' opinions on the new security and privacy contents and pedagogy. In HRS 2902, 3 brief questions were asked, and 4 students responded (see Textbox 1). In the HRS 2432 class, 4 questions were asked and 13 students responded (see Textbox 2).

During Spring 2016, a Web-based survey was implemented in all security- and privacy-enhanced courses in the new track. This survey asks questions regarding students' opinions on security and privacy in health systems before and after taking one security- and privacy-enhanced course. By December 2017, 65 students had participated in the survey, and 55 of them provided their answers beyond the basic demographic information. The results reported below are based on the analysis of these 55 students' answers. Each of these 55 students had taken at least one of the security- and privacy-enhanced courses, such as HRS 2421, HRS 2432, HRS 2902, or HRS 2425. Among these student, 56% (31/55) of students were from the HIS master's program, 16% (9/55) were from the Health Care Supervision and Management master's program (HSM), 4% (2/55) students were in the Rehabilitation Science PhD program, and 22% (12/55) were from other master's programs such as Prosthetics and Orthotics (PO, 10/55, 18%), Rehabilitation Science and Technology (RST, 1/55, 2%), and Nutrition and Dietetics (ND, 1/55, 2%). Details about these graduate programs can be found at www.shrs.pitt.edu/programs. Please note that students in programs other than the HIS master's program are not required to take security- and privacy-related courses and their future work typically does not require them to have security and privacy knowledge either.

Before performing the analysis on the collected data, we noticed that the answers from 3 students were not consistent. Since this Web-based survey was only conducted at the end of the course, instead of before and after the course, some students were confused by the change of terms in the questions for indicating time. Terms used in the questions or statements included now versus then, before versus after, nothing versus thinking back, and after versus prior to. They put some answers to precourse into the box for postcourse and the other way around in questions. For instance, in the now/then questions, these 3 students indicated that they knew significantly more about information security now (after they took the course) and they wanted to take more security courses in the future. One of them actually had already taken more than 1 security- and privacy-related courses in the new track. However, their answers to the before/after questions showed the opposite (did not learn much from the course and did not want to take more security- and privacy-related courses). In this case, we corrected the position of these 3 students' answers to make them internally consistent, assuming their first answer to this type of question is correct.

For the first 2 questions (Q1 and Q2) in the survey, we simply reported the percentage of options chosen by these 55 students since they were basic fact checking after they took the course(s). The mean and standard deviation (SD) were calculated for survey items with 5 options (either from 1=not very much to 5=very much or from 1=strongly disagree to 5=strongly agree). The distribution of the answers from these 55 students were checked and they were not normally distributed (P<.05 in the Shapiro-Wilk test on each item). Therefore, the answers before and after taking the course are compared with a nonparametric Wilcoxon signed-rank test on related samples. The results are summarized in Textbox 3 and Table 2.

Textbox 1. HRS 2902 questionnaire and answers.

Please rate your concern in security and privacy issues in the health systems before you attended the security and privacy lectures (1=not concerned at all, 10=extremely concerned)?

Students responded with ratings of 6, 7, 8, and 9. This indicates that these students had different levels of concern in security and privacy issues in the health systems before attending the security and privacy lectures.

Did the security and privacy lectures provide you with ideas and examples for security and privacy assurance in health care?

All 4 students answered yes.

Do you plan to take further courses or have the desire to learn more on security and privacy in the future?

All 4 students answered yes. Some even indicated the specific topics they would like to learn more about such as access control, authentication, and encryption.

Textbox 2. HRS 2432 questionnaire and answers.

What is your perspective on privacy and security in telehealth before taking this course?

Seven students (54%) believed security and privacy were important, one student (8%) had concerns, and 5 students (39%) did not see privacy and security as a serious issue.

What is your view of privacy and security in telehealth after taking this course?

Twelve students (92%) expressed that security and privacy are very important. One student (8%) did not believe security and privacy to be significant issues.

Please describe how beneficial the following approaches are in increasing your knowledge of privacy and security in telehealth:

Security and privacy issues are mentioned throughout the course and connected to specific projects in telehealth.

Twelve students (92%) believed that this approach was beneficial; one student did not answer.

Security and privacy issues are presented as a specific topic/module by guest lecturers.

Twelve students (92%) believed that this approach was very helpful since these guest lectures provided real world cases demonstrated how security and privacy concepts were applied in current systems. One student (8%) believed this approach was fair.

Security and privacy issues are considered as a part of the final project.

Twelve students (92%) believed that this approach was beneficial. One student (8%) believed that this approach was not beneficial.

Would you be interested in taking a more advanced course in privacy and security?

Ten students (77%) answered yes, 2 students (15%) answered no, and one student (8%) was unsure.

Textbox 3. Questions 1 and 2 and students' answers.

Q1. I am considering/would consider entering the health privacy and security track within my degree program.

Fifteen students (27%) chose yes, and 17 students (31%) chose no. Three student (6%) answered that they were already enrolled, and 19 students (35%) answered maybe.

Q2. Did you take any other courses this academic year that included security and privacy modules?

Twenty-two (40%) students answered yes, and 33 students (60%) answered no. The courses these students took were HRS 2425, HRS 2432, HRS 2903, and HRS 2421.

Table 2. A summary of the answers to Question 3 and responses to 6 statements on the Web-based survey.

Questions/statements	Before, mean (SD)	After, mean (SD)	*P* value
Q3. How much did/do you know about security and privacy in health care before/after taking the course? (1=not very much, 2=a little, 3=some, 4=a lot, 5=very much) (n=51)	2.29 (1.026)	4.87 (1.833)	<.001
Before/after taking this course with security and privacy content, rate the following statements (1=strongly disagree, 3=neither agree nor disagree, 5=strongly agree)			
S1. Security and privacy content is interesting (n=41)	3.29 (0.891)	3.77 (0.890)	.01
S2. Receiving training in security and privacy is worth the effort (n=42)	3.64 (0.821)	4.15 (0.659)	.006
S3. Improving knowledge of security and privacy is needed to ensure cybersecurity in today's health fields (n=42)	3.81 (0.862)	4.39 (0.614)	<.001
S4. Security and privacy training is a beneficial addition to my coursework (n=41)	3.76 (0.830)	4.13 (0.647)	.02
S5. I am planning to enter a career that will require knowledge of security and privacy of health information (n=41)	3.51 (1.028)	3.96 (0.779)	.003
S6. I would like to take more courses with security and privacy content (n=41)	3.20 (0.954)	3.68 (0.911)	.002

The answers to the question (Q3) before and after taking the course are statistically different (P<.001), suggesting that students know significantly more about security and privacy after taking one or more security-enhanced courses in this new track. Their opinion of security-enhanced courses also shifted in a positive direction after they took those courses, and all changes were statistically significant according to the related-samples Wilcoxon signed-rank test. In other words, after they took the courses, the students had a statistically significant stronger agreement with the 6 statements (S1 through S6), which indicated that this education program is effective in terms of improving students' knowledge in security, desire to learn more in this field, and interest in working in this area.

An independent-samples Kruskal-Wallis test was performed to determine the opinion difference between students who had taken multiple security-enhanced courses versus one such course after they took the course. The result indicated that students

who had taken multiple security-enhanced courses expressed significantly higher agreement on 2 statements: S1—Security and privacy content is interesting (P=.01) and S3—Improving knowledge of security and privacy is needed to ensure cybersecurity in today's health fields (P<.001), which was consistent with their behavior in that they took multiple security-enhanced courses in the track.

A one-way analysis of variance (ANOVA) was performed to determine the opinion difference among students who were in different programs: HIS (HIS master's program and Rehabilitation Science PhD program, n=33), HSM (n=9), and others (RST, ND, and PO, n=12). The ANOVA result indicated that students from different academic programs had statistically significant difference in their answers to 2 statements: S1 (Security and privacy content is interesting, F=5.192, P=.01), and S6 (I would like to take more courses with security and privacy content, F=4.113, P=.02). More specifically, students from the HIS program expressed significantly stronger agreement on S1 than students from HSM, PO, RST, and ND both before (P=.008) and after (P=.04) they took the security-enhanced courses; students from HIS also indicated significantly stronger agreement on S6 than students from HSM, PO, RST, and ND programs after they took the courses (P=.03). In other words, students in the HIS program considered security-related topics interesting before and after the courses and they had significantly stronger desire to take more courses with security and privacy content.

Discussion

Principal Findings

In this project, we used various approaches to enhance security and privacy materials in a new track and deliver the new materials to graduate students in the health science programs without placing a significantly heavier burden on students. More specifically, instead of simply adding one or more courses into an existing curriculum, we modified existing security and privacy courses; added security and privacy contents into other relevant courses; developed new labs, seminars, and research projects in the field of security and privacy; and provided internship experiences.

To evaluate the outcome of our approach, we used multiple surveys and collected data from 72 students who took our security- and privacy-enhanced courses. Although the backgrounds of these students were different, including their knowledge in security and privacy before taking these courses, the evaluation results indicated that students learned a lot in these courses, considered security and privacy content interesting and worth the efforts, and had the desire to learn more. We also noticed that students in programs other than HIS had a relatively lower desire to take more security and privacy courses. In other words, even though it is well accepted that security and privacy are critically important for health science students, not all students are willing to receive extensive training on this topic. Therefore, this enhanced security and privacy training cannot be required for all students in this field.

One essential component in creating the graduate security and privacy track described in this article was close collaboration between the HIM and INS departments at Pitt. This education collaboration started in 2009 in a National Science Foundation education project aimed at improving students' computational thinking ability. In that project, we had monthly meetings where all project team members sat to discuss progress. From that project, HIM and INS have gone on to develop a stronger collaborative relationship with respect to both student education and research.

The existence of this close collaboration between faculty members in HIM and INS has made it possible to make changes in course materials and schedules according to the requirements of the other department. For instance, HIM could request that the instructors of the INS courses include examples from the health care domain in their lectures or labs so that the materials are more accessible for students in the HIS graduate program.

Furthermore, Pitt's many leading security and privacy researchers have helped augment this project's success. These researchers have been recruited to help develop new labs, seminars, and research projects that ultimately serve as an advantage to this new track.

The HIM department at Pitt has active collaborations with a large number of industry partners. Thus, it is convenient for students to seek internship experiences in these organizations since there are many positions available close to Pitt's campus. This is also an important factor in the creation of this new security and privacy track.

Comparisons With Previous Work

Although researchers, educators, and health care practitioners recognized the importance of security and privacy education in health science and medical training a long time ago, many current HI-MI-NI-HIM programs still do not provide sufficient training in health information security and privacy. Some programs do not have any security- and privacy-related courses or only have a course on HIPAA regulation and other legal issues, a course about information governance, a course specifically about health information security and privacy, or a few cross-listed courses offered by a computer science or information science department. There are also some health information security and privacy certificate programs which offer one or multiple security and privacy courses.

One reason for this current situation is that it is challenging to add new content to the HI-MI-NI-HIM programs because their curriculum is full with many other essential courses on data analytics, health IT systems, statistics, databases, computer programming, health care systems, data management and regulation, quality management, coding, leadership, clinical education, finance, and internship. Therefore, if the new materials cannot be integrated into the existing courses, labs, and internships, students would not have time to learn them.

Our project offers a unique approach. The security and privacy materials are organized and distributed into multiple courses, labs, seminars, small-scale research projects, and internship. Students learn the security and privacy knowledge in specific

health care contexts and can directly apply the knowledge to their professional practice.

Limitations

The evaluation was only on a portion of the entire project. Evaluations of other parts are currently ongoing. As we mentioned earlier, we are also using other evaluation approaches such as observation, focus group, and feedback from students and faculty members to determine the effectiveness of this new track. Therefore, the reported results are still considered as preliminary and the sample size is not very large. The total number of study participants was 72. Even so, these results are consistent and valuable for making adjustments in the implementation of this new security and privacy track in our future course offering.

We noticed that a few students were confused by the terms now and then and before and after in the survey questions and statements. We should have used the terms consistently. To avoid this problem, a better solution would be to ask students to complete the same survey before and after they took the course.

Future Work

In the collaboration with the INS department at Pitt, we are exploring another approach for enhancing security and privacy education in health care: providing health science training to graduate students in the INS department with a security and privacy concentration. We will perform evaluation and comparison to determine the effectiveness of this approach compared to the approach described in this article.

A website (www.sis.pitt.edu/sahi/index.html) was created to provide further details about this security and privacy track to people who are interested in creating a similar track in their programs. The website also provides information about teaching health science to information science graduate students.

Conclusions

In close collaboration with the INS security and privacy faculty, we have created a new security and privacy track in the HIS graduate program at Pitt. Enhanced courses, course modules, labs, seminars, and research projects are currently offered to graduate students in this program. Evaluation results were generated from surveys completed by 72 students, and they can be used to guide the further implementation of this new track. We believe this program will generate health informatics professionals with stronger security and privacy skills who will be ready to contribute to the protection of critical health data.

Acknowledgments

Dilhari DeAlmeida and Andi Saptono created the brief surveys and provided the collected data to us. Keith Trahan created the Web-based survey and provided data to us. This work is funded in part by grants from the National Science Foundation (DGE1438809) and the National Institute on Disability, Independent Living, and Rehabilitation Research (90RE5018). The contents of this article do not represent the views of the National Science Foundation, the National Institute on Disability, Independent Living, and Rehabilitation Research, or the United States government.

Authors' Contributions

All authors made substantial contributions to concept and design, course creation and teaching, evaluation, drafting the article or revising it critically, and final approval of the manuscript.

Conflicts of Interest

None declared.

References

1. Informatics Academic and Training Programs. URL: https://tinyurl.com/ybtjlydt [accessed 2018-10-05] [WebCite Cache ID 6toxgTkyR]
2. Staggers N, Gassert CA, Skiba DJ. Health professionals' views of informatics education: findings from the AMIA 1999 Spring Conference. J Am Med Inform Assoc 2000 Nov 01;7(6):550-558. [doi: 10.1136/jamia.2000.0070550]
3. White P. Privacy and security issues in teleradiology. Semin Ultrasound CT MR 2004 Oct;25(5):391-395. [doi: 10.1053/j.sult.2004.02.007]
4. Meingast M, Roosta T, Sastry S. Security and privacy issues with health care information technology. In: Conf Proc IEEE Eng Med Biol Soc. 2006 Presented at: 28th Annual International Conference of the IEEE; 2006; New York p. 5453-5458. [doi: 10.1109/IEMBS.2006.260060]
5. Henriksen E, Johansen M, Baardsgaard A, Bellika J. Threats to information security of real-time disease surveillance systems. Stud Health Technol Inform 2009;150:710-714. [doi: 10.3233/978-1-60750-044-5-710]
6. Caffery L, Smith A. A transmission security framework for email-based telemedicine. Stud Health Technol Inform 2010;161:35-48. [doi: 10.3233/978-1-60750-659-1-35]
7. Jha AK, DesRoches CM, Campbell EG, Donelan K, Rao SR, Ferris TG, et al. Use of electronic health records in U.S. hospitals. N Engl J Med 2009 Apr 16;360(16):1628-1638. [doi: 10.1056/NEJMsa0900592] [Medline: 19321858]

8. Henry J, Pylypchuk Y, Seary T, Patel V. Adoption of electronic health records systems among US nonfederal acute care hospitals. 2016. URL: https://dashboard.healthit.gov/evaluations/data-briefs/non-federal-acute-care-hospital-ehr-adoption-2008-2015.php [accessed 2017-09-28] [WebCite Cache ID 6tox1a2Q7]
9. Antheunis ML, Tates K, Nieboer TE. Patients' and health professionals' use of social media in health care: motives, barriers and expectations. Patient Educ Couns 2013 Sep;92(3):426-431. [doi: 10.1016/j.pec.2013.06.020] [Medline: 23899831]
10. Pillow MT, Hopson L, Bond M, Cabrera D, Patterson L, Pearson D, Council of Residency Directors Social Media Task Force. Social media guidelines and best practices: recommendations from the Council of Residency Directors Social Media Task Force. West J Emerg Med 2014 Feb;15(1):26-30 [FREE Full text] [doi: 10.5811/westjem.2013.7.14945] [Medline: 24578765]
11. Baracaldo N, Masoumzadeh A, Joshi J. A secure, constraint-aware role-based access control interoperation framework. 2011 Presented at: 5th International Conference on Network and System Security (NSS); 2011; Milan.
12. Zhang Y, Joshi J. Role-based access control. In: Encyclopedia of Database Systems. New York: Springer; 2009:2447-2452.
13. Zhang Y, Joshi J. Temporal access control. In: Encyclopedia of Database Systems. New York: Springer; 2009:2920-2924.
14. Baracaldo N, Palanisamy B, Joshi J. Geo-Social-RBAC: a location-based socially aware access control framework. 2014 Presented at: 9th International Conference on Network and System Security (NSS); 2014; New York. [doi: 10.1007/978-3-319-11698-3_39]
15. Masoumzadeh A, Joshi J. An alternative approach to k-anonymity for location-based services. Procedia Computer Science 2011;5:522-530. [doi: 10.1016/j.procs.2011.07.068]
16. Masoumzadeh A, Joshi J. Anonymizing geo-social network datasets. 2011 Presented at: 4th ACM SIGSPATIAL International Workshop on Security and Privacy in GIS and LBS (SPRINGL); 2011; Chicago p. 25-32. [doi: 10.1145/2071880.2071886]
17. Jin L, Takabi H, Joshi J. Security and privacy risks of using e-mail address as an identity. 2010 Presented at: IEEE Second International Conference on Social Computing (SocialCom)/IEEE International Conference on Privacy, Security, Risk and Trust (PASSAT); 2010; Minneapolis p. 906-913. [doi: 10.1109/SocialCom.2010.134]
18. Masoumzadeh A, Joshi J. OSNAC: an ontology-based access control model for social networking systems. 2010 Presented at: IEEE Second International Conference on Social Computing (SocialCom)/IEEE International Conference on Privacy, Security, Risk and Trust (PASSAT); 2010; Minneapolis. [doi: 10.1109/SocialCom.2010.116]
19. Jin L, Joshi J, Anwar M. Mutual-friend based attacks in social network systems. Computers Security 2013 Sep;37:15-30. [doi: 10.1016/j.cose.2013.04.003]
20. Long X, Joshi J. A HITS-based POI recommendation algorithm for location-based social networks. Advances in Social Networks Analysis and Mining 2013:2013-2647. [doi: 10.1145/2492517.2492652]
21. Takabi H, Joshi J. SecureCloud: towards a comprehensive security framework for cloud computing environments. 2010 Presented at: 34th Annual IEEE International Computer Software and Applications Conference (COMPSAC Workshops); 2010; Seoul p. 393-398. [doi: 10.1109/COMPSACW.2010.74]
22. Takabi H, Joshi J, Ahn G. Security and privacy challenges in cloud computing environments. IEEE Secur Privacy 2010 Nov;8(6):24-31. [doi: 10.1109/MSP.2010.186]
23. Parmanto B, Pramana G, Yu DX, Fairman AD, Dicianno BE, McCue MP. iMHere: a novel mHealth system for supporting self-care in management of complex and chronic conditions. JMIR Mhealth Uhealth 2013 Jul 11;1(2):e10 [FREE Full text] [doi: 10.2196/mhealth.2391] [Medline: 25100682]
24. Parmanto B, Saptono A, Pramana G, Pulantara W, Schein RM, Schmeler MR, et al. VISYTER: versatile and integrated system for telerehabilitation. Telemed J E Health 2010 Nov;16(9):939-944. [doi: 10.1089/tmj.2010.0033] [Medline: 21034239]

Abbreviations

ANOVA: analysis of variance
eHealth: electronic health
EHR: electronic health record
FPFHC: FOCUS Pittsburgh Free Health Clinic
HI-MI-NI-HIM: health informatics, medical informatics, nursing informatics, and health information management
HIM: Health Information Management
HIPAA: Health Insurance Portability and Accountability Act
HIS: Health Information Systems
HRS: Health and Rehabilitation Sciences
HSM: Health Care Supervision and Management
INS: Informatics and Networked Systems
IT: information technology
mHealth: mobile health
ND: Nutrition and Dietetics
Pitt: University of Pittsburgh

PO: Prosthetics and Orthotics
RBAC: role-based access control
RST: Rehabilitation Science and Technology
UPMC: University of Pittsburgh Medical Center
VISYTER: Versatile and Integrated System for Telerehabilitation

Edited by P Bamidis, G Eysenbach; submitted 28.09.17; peer-reviewed by D López López, M Noman; comments to author 11.11.17; revised version received 07.04.18; accepted 25.08.18; published 21.12.18.

Please cite as:
Zhou L, Parmanto B, Joshi J
Development and Evaluation of a New Security and Privacy Track in a Health Informatics Graduate Program: Multidisciplinary Collaboration in Education
JMIR Med Educ 2018;4(2):e19
URL: http://mededu.jmir.org/2018/2/e19/
doi:10.2196/mededu.9081
PMID:30578227

Original Paper

Assessing the Impact of Video-Based Assignments on Health Professions Students' Social Presence on Web: Case Study

Jennie C De Gagne[1*], PhD, DNP, RN-BC, CNE, ANEF, FAAN; Sang S Kim[2*], PhD, RN; Ellen R Schoen[3*], MSN, RN; Hyeyoung K Park[1*], MSN, RN

[1]School of Nursing, Duke University, Durham, NC, United States

[2]Red-Cross College of Nursing, Chung-Ang University, Seoul, Republic of Korea

[3]Vanderbilt University Medical Center, Nashville, TN, United States

[*]all authors contributed equally

Corresponding Author:
Hyeyoung K Park, MSN, RN
School of Nursing
Duke University
307 Trent Drive
Durham, NC, 27710
United States
Phone: 1 9842099995
Fax: 1 9196818899
Email: hye.young.park@duke.edu

Abstract

Background: Web-based education is one of the leading learning pedagogies in health professions education. Students have access to a multitude of opinions, knowledge, and resources on Web, but communication among students in Web-based courses is complicated. Technology adds a filter that makes it difficult to decipher the emotions behind words or read nonverbal cues. This is a concern because students benefit more from Web-based classes when they have a high perception of social presence. To enhance social presence on Web, we planned to use video-based assignments (VBAs) that encourage students to interact with each other.

Objective: This case study examines the impact of VBAs on health professions students and their experiences with the technology. This study aims to provide information to the growing body of literature about strategies to develop social presence on Web.

Methods: A total of 88 students from various nursing programs participated in the study. While the control group comprised 36 students who submitted only written-based assignments (WBAs), the experimental group of 52 students submitted VBAs besides WBAs. No enrolled student had previously participated in the course, and there were no repeaters in either of the groups. Both groups participated in a weekly survey comprising 4 open-ended questions and 3 Likert items on a scale of 1-5 (1=strongly disagree and 5=strongly agree). The social presence questionnaire assessed by the experimental group comprised 16 items and a 5-point Likert scale in which higher scores represented higher levels of social presence. While quantitative data were analyzed using descriptive statistics, qualitative responses were analyzed using content analysis.

Results: No significant differences were noted between the groups regarding the program ($F_{1,87}$=0.36, *P*=.54). Regarding students' engagement, no statistically significant difference was observed between the 2 groups (t_{14}=0.96, *P*=.35). However, the experimental group's average score for engagement was slightly higher (4.29 [SD 0.11]) than that of the control group (4.21 [SD 0.14]). Comparison of the total number of responses to the weekly engagement survey revealed 88.0% (287/326) as either strongly agree or agree in the control group, whereas 93.1% (525/564) in the experimental group. No statistically significant difference was observed between VBAs and WBAs weeks (t_6=1.40, *P*=.21) in the experimental group. Most students reported a positive experience using VBAs, but technical issues were barriers to embracing this new approach to learning.

Conclusions: This study reveals that social presence and engagement are positively associated with student learning and satisfaction in Web-based courses. Suggestions are offered to enhance social presence on Web that could generate better learning outcomes and students' experiences.

(JMIR Med Educ 2018;4(2):e11390) doi:10.2196/11390

KEYWORDS

case study; engagement; multimedia; Web-based learning; social presence; students' experience

Introduction

Distance education is a phenomenon where students are presented course information remotely, with or without interaction with their instructors and fellow students. Although this may seem like a recent development, distance education appeared as early as 1880 when students received courses through the mail or radio. However, it was not until the 1990s that we saw the modern form of distance education through the development of the internet and other information technologies. Today, Web-based education—the acquisition of knowledge and skills through a mediated Web-based infrastructure—is one of the leading learning pedagogies [1]. More than 6.7 million students in the United States engage in Web-based learning, and an increase in the number of Web-based courses is a key component in the growth plans of many colleges and universities [2]. Proponents of electronic learning applaud its ability to reach a multitude of students, thus increasing the diversity and perspectives in the internet-based classroom. Students do not have to meet in a set place or at a set time, allowing for increased flexibility in accessing information. This flexibility is especially important to the growing number of nontraditional learners who may be balancing the responsibilities of full-time jobs and parenthood with their educations [3].

While students in Web-based courses have access to a multitude of opinions, knowledge, and resources, they rarely, if ever, have face-to-face interactions with their professors or classmates. This is a concern because learners get the greatest benefit from Web-based courses when they can have meaningful interactions with their classmates or establish their social presence [4]. The term *social presence* was coined by Short et al to describe the feeling of talking to a real person in mediated communication such as Web-based communication [5]. A sense of community naturally evolves in a traditional classroom setting where students spend time together and engage in face-to-face conversations. There, students can consider what is said and in what tone and read their peers' nonverbal cues during discussions. However, communication among students in Web-based courses is more complicated because technology adds a filter that makes it difficult to decipher the emotions behind words [6]. Indeed, students in Web-based courses cite feelings of isolation and a lack of connection with classmates as key factors that hindered their success in Web-based learning [1]. Undoubtedly, these feelings can contribute to dropout rates for Web-based courses, which are 10%-20% higher than traditional courses [7,8]. The necessary use of mediated communication in Web-based courses and subsequent feelings of isolation in Web-based learning may be why students in Web-based courses feel less social presence than their face-to-face counterparts.

The social presence is a critical factor for students' engagement and satisfaction and has a clear impact on student outcomes such as deeper learning or greater cognitive absorption [9]. For example, students who had higher perceptions of social presence also had better-perceived learning outcomes [4]. Similarly, Horzum demonstrated that social presence has a positive association with student satisfaction in Web-based courses [10]. Therefore, students are likely to benefit more from Web-based education if they can develop social presence and interact with other learners.

One salient strategy that can enhance social presence and learners' engagement is to use technology, such as video-based assignments (VBAs), to allow active student interactions [11]. With the wide availability of desktop and laptop cameras, students can take advantage of audio and visual expression to present information in original ways. Assignments with multimedia deliverables can encourage engagement with course materials while creating a sense of community as students share the video production process. Furthermore, when students have the capability of personalizing instructional materials themselves and have control over their own learning and production, they exhibit higher levels of satisfaction and motivation [12]. This case study aims to examine the impact of VBAs on students and other means of enhancing students' engagement and social presence in a Web-based class. Furthermore, students' perceptions and experiences with educational technology are reported.

Methods

Case Study: Description of the Course

The data used in this study came from graduate-level health professions students who took the course, *Facilitating Student Learning in Academic Setting*. This 2-credit, 8-week course focuses on theories and principles that provide a foundation for the diverse learning needs of adults and strategies to meet these needs. Major topics of this student-centered course include the principles of adult learning, the concepts of learning styles, domains of learning, and innovative teaching strategies. At the end of the course, students are expected to be able to (1) analyze how context, motivation, generational differences, and other factors affect students' engagement in the learning process; (2) propose appropriate teaching practices to facilitate learning in the 3 domains of learning; (3) examine the evidence that underlies teaching practices to identify gaps that need to be addressed through scholarly efforts; and (4) formulate well-written learning objectives for each domain of learning. The number of students enrolled in this course ranges from semester to semester, generally between 10 and 35. Regardless of the class size, students work in small groups of 4-5 so that their course loads are unlikely to be affected by the number of students enrolled.

Sakai, an electronic learning management system (LMS), is an open-source learning environment that provides instructors with tools to support their teaching. Powered by this LMS, the course first exposes students to learning materials on the class website, then follows these lessons with weekly activities such as problem-solving discussions. Sakai orientation is not provided at the course level but the school level, as this LMS is used throughout the university. Students work in groups of 4-5 to

facilitate collaborations and engagement. The course does not have a textbook, as no single book covers the entire course, and textbooks often contain only basic information, which quickly becomes outdated. Thus, materials used in this course are current, and technology resources (eg, help desk and hardware loan program) are readily available to students. Basic system requirements for the course are a desktop or laptop computer, internet access, up-to-date virus protection software, a webcam, and a headset with microphone. All learning materials, activities, and evaluations are in Sakai in a logical sequence, making the entire course an effective and engaging experience.

Innovation of the Course

Historically, this course has been text-centric (ie, written discussion forums and written assignments); driven by faculty's commitment to creating a more active, engaging learning environment, in the Fall 2015 semester, that changed. The course became multimedia-oriented with the introduction of 2 new Sakai tools as follows: (1) streaming media (WarpWire, a video-capture/sharing platform with plug-in support for different LMSs); and (2) peer assessment for students' assignments. The midterm and final course evaluations were used to determine the success of these 2 new tools; they indicated that students' presentations through WarpWire and peer assessment were effective in facilitating connectivity and presence on Web. However, WarpWire and peer-assessment tools had limited capacity and took a considerable amount to troubleshoot. An alternative technology, the YouSeeU software (YouSeeU, Loveland, CO, USA) was chosen, as it offered functions unavailable in WarpWire and the peer-assessment tool. In addition, it enabled students to create video presentations synchronized to a PowerPoint slide deck and participate in multimedia group projects either synchronously or asynchronously. They could also provide peer assessment by annotating and synchronizing comments on videos. Students were provided with specific rubrics for each assignment. A university grant purchased 60 YouSeeU licenses to provide the VBA and peer-assessment functions.

Implementation

In this study, 52 students in the experimental group were enrolled in Spring 2017 (n=27), Fall 2017 (n=11), and Spring 2018 (n=14). These students were given VBAs in addition to written-based assignments (WBAs). The control group (n=36) with WBAs consisted of students enrolled in the Fall 2016 semester. Students in both the control and experimental groups completed weekly engagement surveys. This survey included 4 open-ended questions with 3 items using a 5-point Likert scale indicating the degree of agreement with each statement (eg, 1=strongly disagree to 5=strongly agree; see Multimedia Appendix 1). These items were derived from a modified Brookfield's Critical Incident Questionnaire designed to help instructors understand their students' learning experiences better [13].

All students in the experimental group who completed the VBAs in weeks 1, 4, and 8 were encouraged to share their experiences with these assignments and assess their social presence perception by responding to a voluntary questionnaire. This questionnaire was based on the social presence scale for Web-based learning environments developed by Kilic et al [14] and the social presence questionnaire designed by Lin [15]. The social presence questionnaire used in this case study consisted of 16 items with a 5-point Likert scale for which higher scores represented higher levels of social presence. The internal consistency of the items was acceptable, with a Cronbach alpha of .752 and .782 when excluding the reverse-worded item, Question 3 (Q3): *I hesitated to ask questions to others during Web-based discussions*.

The purpose and process of each assignment were explained during the course overview at the beginning of each semester. In addition, students were informed of the course evaluation survey by *Announcement* in Sakai and assured that the anonymously recorded responses would be used for course improvement purposes only. The Institutional Review Board of Duke University deemed this course improvement project to be exempt.

Evaluation

The quantitative survey data were organized and analyzed using Excel and SPSS 23.0 (SPSS Inc, Chicago, IL). Students' characteristics were assessed using descriptive statistics, and between-group homogeneity was tested by an *F* test. In addition, differences in variables between 2 groups were evaluated using a *t* test. Qualitative responses were analyzed to identify principal messages in the content. A recursive review of the transcriptions was conducted among authors by consensus decision making to achieve full agreement with the findings [16].

Results

Principal Results

A total of 88 students participated in this study, consisting of 36 students in the control group and 52 students in the experimental group. No significant differences were noted between the groups with respect to the program in which students were enrolled. In the control group, 50% (18/36), 47% (17/36), and 3% (1/36) of the students were enrolled in the master's in nursing (MSN) program, doctor of nursing practice (DNP)/philosophy of doctorate in nursing (PhD), and others, respectively. In the experimental group, 40% (21/52) were enrolled in the MSN program, and 60% (31/52) in the DNP/PhD program.

Levels of Weekly Engagement

No statistically significant difference was observed between the 2 groups (t_{14}=0.96, *P*=.35) in terms of students' engagement. However, the average score of students' engagement was higher in the experimental group (4.29 [SD 0.11]) than that in the control group (4.21 [SD 0.14]). Comparing the total number of engagement responses, 88.0% (287/326) were reported as either *strongly agree* or *agree* to the responses in the control group, while 93.1% (525/564) of the responses were reported in the experimental group. No statistically significant difference was noted between WBA and VBA weeks in the experimental group (t_6=1.40, *P*=.21; Tables 1 and 2).

Table 1. Students' engagement between 2 groups.

Groups	Total number of responses (N)	Responses to weekly engagement surveys, n (%)					Course		
		Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Weekly engagement, mean (SD)	*t*	*P*
Control group (n=36)	326	133 (40.8)	154 (47.2)	21 (6.4)	10 (3.1)	8 (2.5)	4.21 (0.14)	0.964	.35
Experimental group (n=52)	564	211 (37.4)	314 (55.7)	31 (5.5)	8 (1.4)	0	4.29 (0.11)		

Table 2. Students' engagement between written-based assignment and video-based assignment weeks.

Weeks	Total number of responses (N)	Responses to weekly engagement surveys, n (%)					Course		
		Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Weekly engagement, mean (SD)	*t*	*P*
Written-based assignment weeks (2, 3, 5, 6, and 7)	339	126 (37.2)	201 (59.3)	9 (2.7)	3 (0.9)	0	4.22 (0.09)	1.400	.21
Video-based assignment weeks (1, 4, and 8)	225	85 (37.8)	113 (50.2)	22 (9.8)	5 (2.2)	0	4.33 (0.11)		

Perceptions of Social Presence

The experimental group that completed both WBAs and VBAs had a mean total score of 4.22 (SD 0.40) on the social presence survey. The item with the highest mean score was Q16: *Overall, I felt respected and valued by the Web-basedlearning community members* (4.83 [SD 0.38]). Students' responses indicated that they believed they had clearly expressed their ideas to their peers during Web-based discussions (4.79 [SD 0.41]), felt like they were a member of a community during Web-based discussions (4.60 [SD 0.80]), shared their opinions whether they agreed or disagreed during discussions (4.56 [SD 0.54]), and felt comfortable during YouSeeU activities (4.50 [SD 0.61]). The item with the lowest mean score was Q6: *The group project helped me accomplish the assignment with higher quality than if I were working alone* (3.48 [SD 1.21]; Figure 1; Table 3).

Figure 1. Social presence in the YouSeeU group (N=52).

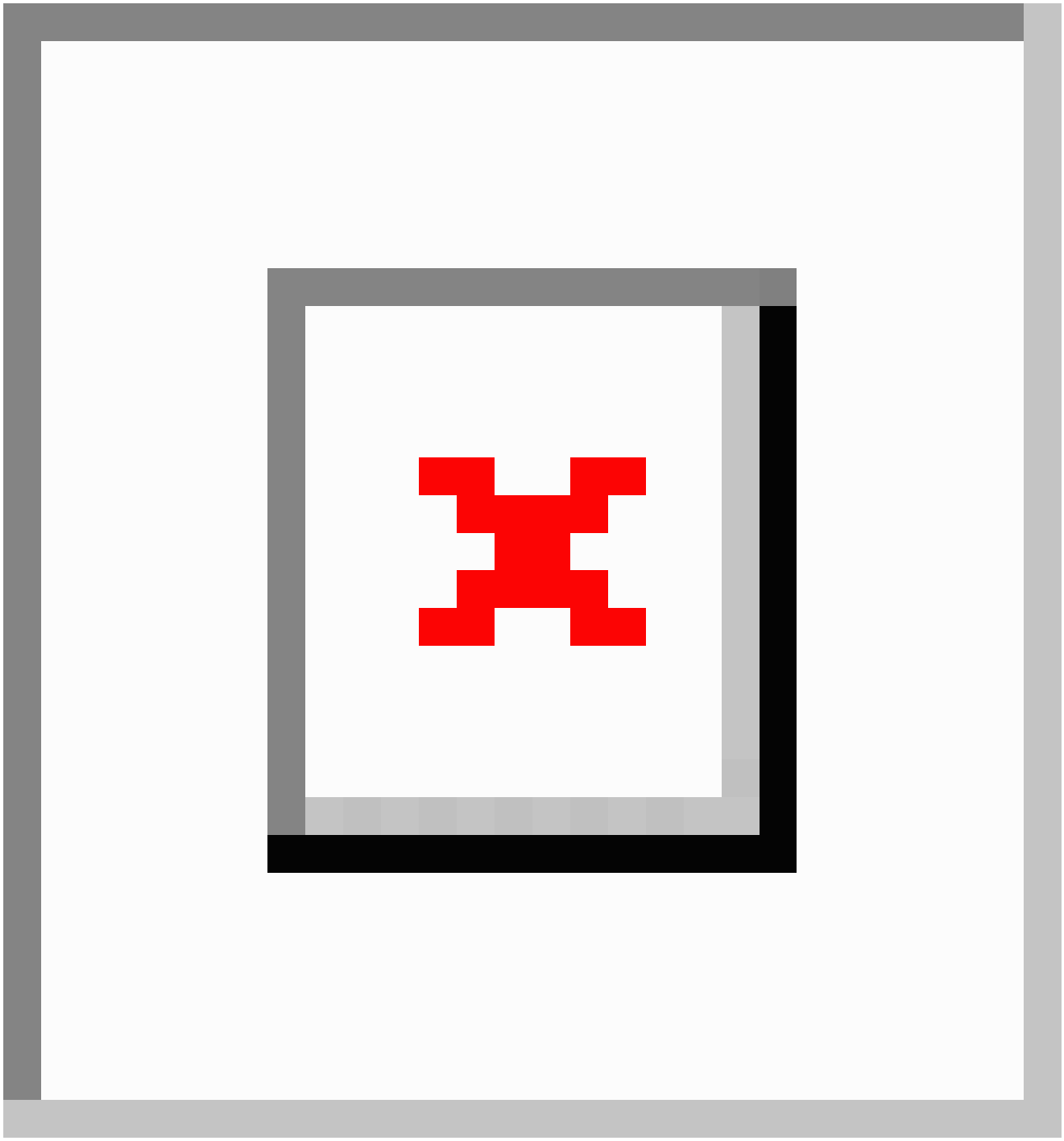


Table 3. Social presence in the YouSeeU group (N=52).

Question	Items	Mean (SD)
Q1	I shared my opinions whether I agreed or disagreed during Web-based discussions.	4.56 (0.54)
Q2	I clearly expressed my ideas to other students during Web-based discussions.	4.79 (0.41)
Q3[a]	I hesitated to ask questions to others during Web-based discussions.	3.63 (1.33)
Q4	I felt like I was a member of a group during Web-based discussions.	4.60 (0.80)
Q5	I felt that verbal discussion forums were more engaging than written Web-based discussion forums.	3.52 (1.08)
Q6	The group project helped me accomplish the assignment with higher quality than if I were working alone.	3.48 (1.21)
Q7[b]	Without the YouSeeU platform, it would have been difficult to complete a group assignment.	3.51 (1.22)
Q8	I felt comfortable expressing my feelings during YouSeeU activities.	4.50 (0.61)
Q9	I shared my opinions whether I agreed or disagreed during YouSeeU activities.	4.48 (0.61)
Q10	I felt closer to other students during YouSeeU activities than during the written Web-based discussion forums.	4.27 (0.74)
Q11	I clearly expressed my ideas to other students during YouSeeU activities.	4.42 (0.70)
Q12	I felt I came to know the other students better during YouSeeU activities than during the written Web-based discussion forums.	4.46 (0.70)
Q13	The use of YouSeeU platform has helped me to complete oral presentation assignments.	4.33 (0.92)
Q14	Overall, I feel that YouSeeU platform was intuitive and easy to use.	3.88 (1.15)
Q15	Overall, I feel that YouSeeU platform provided me with unique Web-based learning experiences.	4.48 (0.70)
Q16	Overall, I felt respected and valued by the Web-based learning community members.	4.83 (0.38)

[a]Reversed item.

[b]N=51.

Qualitative Results

Most students in both groups stated that their engagement in discussion forums by responding to other students' posts, sharing experiences, and applying new knowledge to their teaching practices was positive. The instructor gave the prompt, but discussions were facilitated by both students and the instructor. Some of the comments were as follows:

> *I enjoyed searching the readings on my own volition and picking the readings of my interest and using these readings to support my findings in response to form prompts and responding to other classmates' forums.*
>
> *Articulating my thoughts and supporting them by research really pulled everything together for me to allow a deeper understanding of the content.*
>
> *Most engagement was felt when having exchanges with my peers in terms of stories and experiences.*
>
> *I feel really passionate about the content we are learning, and I get excited when I can make connections with my past and current experiences.*

In addition to these common engagement points, the YouSeeU group students stated that using the new technology was challenging but also refreshing and motivating. They said:

> *It was my first time utilizing the YouSeeU program. I had used [A] and [B] in the past but only during live interactive Web-based sessions. This app is unique (and really neat). It allows someone to post and upload recordings for later viewing by faculty and other students.*
>
> *I enjoy the video forums. Watching people's faces and body language helps to drive the points home for me (more than the written word).*
>
> *The YouSeeU platform always makes me feel more engaged and connected with the class.*

Some students said that they felt least engaged when listening to recorded lectures, writing discussion posts, and spending time with the new technology. Furthermore, they felt less engaged when they were not prepared to respond to peer posts and had insufficient time to reflect on others' responses.

> *I felt most distant just before posting the video. The fear of the unknown. Would I get the video right? Would I answer appropriately? Would the posting upload? I did feel a bit anxious just before, but my angst was not necessary.*
>
> *I did have technical difficulties, which frustrated me when I posted on YouSeeU.*
>
> *It's a personal thing really. When I log in and see the great work of others, I immediately feel behind the curve and out of the loop. It's not the course. It's me, my generation, and my learning style.*

Discussion

Principal Findings

This case study examined multimedia-facilitated assignments and their impact on students' engagement and social presence

in the Web-based classroom. No statistically significant differences were observed in the level of engagement between the 2 groups, but students in the experimental group found VBAs to be effective and acceptable learning strategies. The experimental group reported a high level of social presence. Although this study did not measure the retention of knowledge directly, the level of cognitive absorption might have been influenced by this enhanced social presence in the experimental group [8]. While most students reported positive experiences using VBAs, technical issues posed a barrier to embracing this new approach to learning. This is consistent with other studies that found nursing students and nurse educators often struggling with emerging technologies [17,18]. Even though YouSeeU has a sync slides function for group work, the group oral presentation that required synchronization was reported as one of the most challenging tasks, as group members had to coordinate their different time zones and work schedules.

Pedagogy in the student-to-course interaction is an important aspect in developing social presence. Valenzuela et al hypothesized, "pedagogical approaches may be more important than technology in determining the effectiveness of [Web-based] courses." [19]. In addition, the use of asynchronous communication in Web-based learning can lead to feelings of discomfort among students [20]. Students who are not familiar with Web-based education and what is expected of learners in the Web-based environment have a difficult time establishing a clear identity in virtual classrooms [20]. These feelings of discomfort or failure in establishing an identity may hinder social presence in the Web-based learning environment.

Furthermore, the social presence can be affected by students' preconceived attitudes toward Web-based communications [21]. To that end, attempts were made to develop innovative ways to increase students' interaction and social presence. For example, Wang and Chen incorporated a group presentation and a virtual reality simulation into a course that required cross-cultural communication and the utilization of new technologies [22]. In their study, class discussion on group presentations had a 26% higher response rate than discussions on class readings, and 80% of students felt the group projects improved their communication skills. In another study by Akcaoglu and Lee, creating smaller groups of 4-5 students for discussions led to a higher level of social presence in terms of sociability, social space, and group cohesion [23]. These authors concluded that manipulating group size could positively affect students' relationship building in asynchronous class discussions.

This study adopted VBAs to facilitate students' engagement and enhance their social presence. This case study indicates that in both experimental and control groups, students felt comfortable voicing their opinions in the discussion forums. This is may be because most of them had taken Web-based courses before and knew how to share opinions through Web. As current or future educators in health professions, students were also highly receptive to Web-based communication tools. They believed that these tools were useful in developing their presentation skills and preparing them for their teaching careers. The learner-driven activities in VBAs, such as creating video clips and getting feedback from peers, made students feel as though learning was a partnership rather than a competition. Finally, students were encouraged to take a voluntary engagement survey every week, which may have underscored the importance of engagement in Web-based learning.

Limitations and Future Directions

The main limitation of this study is that the assessment of students' engagement and social presence was based on self-reporting rather than observation of behavior or mediating indicators. Self-reporting is effective in investigating students' satisfaction with a course, perceived engagement, and social presence, but its validity and accuracy are limited [24]. Utilizing self-reporting, Gunawardena and Zittle were among the first researchers to measure social presence in Web-based education with their social presence scale and student satisfaction scale [25]. These scales are widely used together to determine the degree of correlation and the mediating effect of social presence on students' satisfaction [4,10]. In contrast to the self-reporting style of the social presence survey, observing patterns of students' communication in Web-based forums was developed [26]. In this instrument, the social presence density of students' communication within the forum is calculated and classified as affective, cohesive, or interactive [26]. This case study did not show a significant difference between students with WBAs only and those with both WBAs and VBAs. If both self-reporting and observation had been used to collect data, results might have been different.

Another limitation of this study is that the instructor's perspective was not a part of the study outcomes. Bolliger et al incorporated the social presence principles of faculty-to-student interaction and student-to-student interaction to develop a faculty satisfaction survey for Web-based courses; this survey can identify key areas for faculty and institutional improvement in developing social presence and increasing students' satisfaction in the Web-based environment [27]. It is important to measure the faculty presence, as instructors who create a high-level presence may potentially influence students' attitudes and behaviors, making it difficult for them to share their perspectives through Web [28]. Despite these limitations, this case study provides an important contribution to the growing body of literature supporting the use of active and engaging learning strategies for developing social presence on Web.

As trends indicate a growing demand for Web-based education, it is essential that health professions stay in front of this rapidly developing field. There are a number of ways for faculty and institutions to enhance students' engagement and social presence in Web-based learning. Foremost, faculty participation is likely to facilitate social presence. Their clear communication on the course design and organization will improve students' engagement. Faculties that transition from a face-to-face to a Web-based classroom note that students on Web need more instructions about their assignments than students in a traditional classroom setting [2]. Paul and Cochran suggested a comprehensive orientation for students on Web and faculty that allows students to ask questions about the LMS [3]. This orientation could also provide students with ways to increase interaction with other students and engagement with the course material. Similarly, Northcote et al developed a comprehensive

training program for Web-based faculty, including on-site support, clear guidelines, and benchmarks for Web-based learning [29]. Professional development activities for Web-based faculty markedly increased their self-efficacy and eased anxiety about using new strategies [29].

In addition to the faculty's role, the interaction between faculty and their institutions was a key component in developing social presence [3]. Most of the time, institutions have oversight as to which tools are made available to faculty. Many Web-based faculty members are limited by the support provided to them within Web-based LMSs. Indeed, the LMS was ranked as one of the most important aspects of student learning [19], while faculty often reported dissatisfaction with institutional support for Web-based courses [27]. Similarly, faculty reported being apprehensive about their capacity to navigate the technology required to deliver a Web-based course [29]. Thus, institutional support for faculty teaching on Web can be a crucial facilitator of, or barrier to, the development of social presence in Web-based courses.

Conclusions

This study adds to the growing body of research that social presence is a key factor in the effectiveness of Web-based education. The social presence and students' engagement are positively associated with students' satisfaction and are proven to improve students' learning outcomes in Web-based courses. In addition, social presence has a positive effect on students' cognitive absorption of the course material. The effective development of social presence in Web-based learning relies on complex interactions among students, faculty, technology, and institutions. However, there are no current "best practice" guidelines for implementing Web-based education. Much of the impetus for developing social presence in Web-based learning lies on individual faculty, institutions, and students. As these faculty members work to implement innovative strategies in Web-based learning, they must also engage in the critical revision and analysis of their Web-based courses. Strategies that reduce mediated communication, such as videoconferencing and multimedia assignments, have the potential to increase social presence in Web-based learning and provide a foundation for further course development. As Web-based education continues to become a key method of content delivery and students' interaction, it is essential that health professions educators develop and revise Web-based pedagogy in a way that cultivates social presence in their Web-based courses.

Acknowledgments

This research was funded by a 2016-2018 Duke Learning Innovation Jump Start Grant awarded to JCDG. The authors would like to thank the Duke University Compact for Open Access Publishing Equity (COPE) program for its support of the open access publication of this manuscript.

Authors' Contributions

JCDG and ERS designed this study and all authors drafted the first version of the manuscript. JCDG collected data, and JCDG, SSK, and HKP participated in the analysis and interpretation of the data. JCDG and HKP reviewed the draft of the manuscript and made revision to the final manuscript. All authors have read and approved the final manuscript.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Weekly Engagement Survey.

[PDF File (Adobe PDF File), 22KB - mededu_v4i2e11390_app1.pdf]

References

1. De Gagne JC. Teaching in online environments. In: Oermann MH, De Gagne JC, Phillips BC, editors. Teaching in nursing and role of the educator: the complete guide to best practice in teaching, evaluation, and curriculum development. 2nd ed. New York: Springer; 2018:95-111.
2. Chiasson K, Terras K, Smart K. Faculty perceptions of moving a face-to-face course to online instruction. J Coll Teach Learn 2015;12(4):231-240.
3. Paul J, Cochran D. Key interactions for online programs between faculty, students, technologies, and educational institutions: A holistic framework. QRDE 2013;14(1):4789.
4. Richardson JC, Maeda Y, Lv J, Caskurlu S. Social presence in relation to students' satisfaction and learning in the online environment: A meta-analysis. Computers in Human Behavior 2017 Jun;71:402-417. [doi: 10.1016/j.chb.2017.02.001]
5. Short J, Williams E, Christie B. The social psychology of telecommunications. New York: Wiley; 1976.
6. Bentley KJ, Secret MC, Cummings CR. The Centrality of Social Presence in Online Teaching and Learning in Social Work. Journal of Social Work Education 2015 Jul 13;51(3):494-504. [doi: 10.1080/10437797.2015.1043199]

7. Leong P. Role of social presence and cognitive absorption in online learning environments. Distance Education 2011 May;32(1):5-28. [doi: 10.1080/01587919.2011.565495]
8. Bawa P. Retention in online course: Exploring issues and solutions - A literature review. Sage Open 2016;6(1):1-11. [doi: 10.1177/2158244015621777]
9. Ngoyi L, Mpanga S, Ngoyi A. The relationship between student engagement and social presence in online learning. IJACST 2014;3(4):242-247 [FREE Full text]
10. Horzum M. Interaction, Structure, Social Presence, and Satisfaction in Online Learning. EURASIA J. Math, Sci & Tech Ed 2015 Apr 27;11(3):505-512. [doi: 10.12973/eurasia.2014.1324a]
11. Bayless M, Bliss J, Johnson B. M-PBEA. 2012. The oral presentationnhancing the experience in an online business communication course URL: https://scholarworks.sfasu.edu/businesscom_facultypubs/44/ [accessed 2018-10-16] [WebCite Cache ID 73DP9zBQH]
12. Brame CJ. Effective Educational Videos: Principles and Guidelines for Maximizing Student Learning from Video Content. CBE Life Sci Educ 2016;15(4) [FREE Full text] [doi: 10.1187/cbe.16-03-0125] [Medline: 27789532]
13. Brookfield SD. The Classroom Critical Incident Questionnaire. Critical incident questionnaire URL: https://static1.squarespace.com/static/5738a0ccd51cd47f81977fe8/t/5750e567f699bbceac6e97f5/1464919400130/CIQ.pdf [accessed 2018-10-16] [WebCite Cache ID 73DSFd1WM]
14. Kiliç Çakmak E, Çebi A, Kan A. Developing a "Social Presence Scale" for E-learning Environments. ESTP 2014;14(2):764-768. [doi: 10.12738/estp.2014.2.1847]
15. Lin G. Social presence questionnaire of online collaborative learning: Development and validity. 2004 URL: https://pdfs.semanticscholar.org/eb58/14efad5120fb97b8def6c671e00dec2e6c9d.pdf [accessed 2018-06-20] [WebCite Cache ID 70J3pnSbW]
16. Hays DG, Singh AA. Qualitative inquiry in clinical and educational settings. New York: The Guilford Press; 2011.
17. Nyström A, Pålsson Y, Hofsten A, Häggström E. Nursing students' experiences of being video-recorded during examination in a fictive emergency care situation. Int J Nurs Pract 2014 Oct;20(5):540-548. [doi: 10.1111/ijn.12199] [Medline: 24118615]
18. Charrier D. The effects of technology on stress and coping strategies in nurse educators. JNEP 2017 Nov 27;8(4):28. [doi: 10.5430/jnep.v8n4p28]
19. Valenzuela F, Fisher J, Whale S, Adapa S. Developing and evaluating social presence in the online learning environment. Int P Econ Dev Res 2013;60(20):95-101 [FREE Full text]
20. Bork R, Rucks-Ahidiana Z. Role ambiguity in online courses: An analysis of student and instructor expectations. 2013 URL: https://ccrc.tc.columbia.edu/publications/role-ambiguity-in-online-courses.html [accessed 2018-06-20] [WebCite Cache ID 70IvcSJFW]
21. Kear K, Chetwynd F, Jefferis H. Online presence for learning and employability: Students' use of profiles in social networking environments. 2014 URL: http://www.open.ac.uk/about/teaching-and-learning/esteem/sites/www.open.ac.uk.about.teaching-and-learning.esteem/files/files/ecms/web-content/2014-01-Kear-Chetwynd-Jefferis-Final-Report.pdf [accessed 2018-06-20] [WebCite Cache ID 70J2B4Vpi]
22. Wang M, Chen HC. Social presence for different tasks and perceived learning in online hospitality culture exchange. AJET 2013 Nov 08;29(5). [doi: 10.14742/ajet.215]
23. Akcaoglu M, Lee E. Increasing social presence in online learning through small group discussions. Int Rev Res Open Dis 2016;17(3):2673-2617 [FREE Full text]
24. Polit DF, Beck CT. Nursing Research: Generating and assessing evidence for nursing practice. 9th Edition. Philadelphia: Lippincott Williams & Wilkins; 2012.
25. Gunawardena CN, Zittle FJ. Social presence as a predictor of satisfaction within a computer - mediated conferencing environment. American Journal of Distance Education 1997 Jan;11(3):8-26. [doi: 10.1080/08923649709526970]
26. Saude S, Puteh F, Azizan AR, Hamdan NN, Shukor NHA, Abdullah KI. Learning through the Lounge: Using Social Presence to assess the learning environment in a MyLinE online forum. Procedia - Social and Behavioral Sciences 2012 Dec;66:448-459. [doi: 10.1016/j.sbspro.2012.11.289]
27. Bolliger D, Inan F, Wasilik O. Development and validation of the Online Instructor Satisfaction Measure (OISM). Educ Technol Soc 2014;17(2):183-195.
28. Duta N, Panisoara G, Panisoara I. The Effective Communication in Teaching. Diagnostic Study Regarding the Academic Learning Motivation to Students. Procedia - Social and Behavioral Sciences 2015 May;186:1007-1012. [doi: 10.1016/j.sbspro.2015.04.064]
29. Northcote M, Gosselin K, Reynaud D, Kilgour P, Anderson M. Navigating learning journeys of online teachers: Threshold concepts and self-efficacy. IIER 2015;25(3):319-344 [FREE Full text]

Abbreviations

LMS: Learning Management System
VBAs: video-based assignments

WBAs: written-based assignments

Edited by G Eysenbach; submitted 25.06.18; peer-reviewed by Y Banerrji, S Barteit; comments to author 16.08.18; revised version received 31.08.18; accepted 22.09.18; published 26.11.18.

Please cite as:
De Gagne JC, Kim SS, Schoen ER, Park HK
Assessing the Impact of Video-Based Assignments on Health Professions Students' Social Presence on Web: Case Study
JMIR Med Educ 2018;4(2):e11390
URL: http://mededu.jmir.org/2018/2/e11390/
doi:10.2196/11390
PMID:30478027

Review

Use of Grading of Recommendations, Assessment, Development, and Evaluation to Combat Fake News: A Case Study of Influenza Vaccination in Pregnancy

Sidra Zafar[1*], MD; Yacob Habboush[1*], MD; Sary Beidas[1], MD, MBI

Department of Internal Medicine, Orange Park Medical Center, Jacksonville, FL, United States

[*]these authors contributed equally

Corresponding Author:
Sary Beidas, MD, MBI
Department of Internal Medicine
Orange Park Medical Center
2001 Kingsley Avenue
Orange Park
Jacksonville, FL, 32073
United States
Phone: 1 904 639 8500
Email: sary.beidas@hcahealthcare.com

Abstract

Background: The Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) framework is a validated evaluation tool used to assess the quality of scientific publications. It helps in enhancing clinicians' decision-making process and supports production of informed healthy policy.

Objective: The purpose of this report was two-fold. First, we reviewed the interpretation of observational studies. The second purpose was to share or provide an example using the GRADE criteria.

Methods: To illustrate the use of the GRADE framework to assess publications, we selected a study evaluating the risk of spontaneous abortion (SAB) after influenza vaccine administration.

Results: Since 2004, the Centers for Disease Control and Prevention and the Advisory Committee on Immunization Practice have recommended influenza vaccination of pregnant women. Previous studies have not found an association between influenza vaccination and SAB. However, in a recent case-control study by Donahue et al, a correlation with SAB in women who received the H1N1 influenza vaccine was identified. For women who received H1N1–containing vaccine in the previous and current influenza season, the adjusted odds ratio (aOR) for SAB was 7.7 (95% CI, 2.2-27.3), while the aOR for women not vaccinated in the previous season but vaccinated in the current season was 1.3 (95% CI, 0.7-2.7).

Conclusions: Our goal is to enable the readers to critique published literature using appropriate evaluation tools such as GRADE.

(JMIR Med Educ 2018;4(2):e10347) doi:10.2196/10347

KEYWORDS

GRADE; influenza; vaccination; spontaneous abortion; miscarriage

Introduction

The Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) framework is a validated evaluation tool used to assess the quality of scientific publications. GRADE was developed by an international group of health professionals, researchers, and guideline developers to standardize the evaluation process of publications [1]. GRADE has been adopted by many organizations including the World Health Organization, American College of Physicians, The Endocrine Society, Infectious Diseases Society of America, The Canadian Task Force on Preventive Health Care, UpToDate, and other domestic and international organizations [2]. The GRADE system helps in enhancing clinicians' decision-making process and supports the production of informed healthy policy [3].

The present review provides a demonstration of how to use the GRADE system to critique an observational study [4]. It is important to understand the impact of a study on clinical practice, especially if the media reports on the study in a manner

that, intentionally or unintentionally, changes the interpretation of the outcomes. The study we selected to demonstrate the use of GRADE was first mentioned in September 2017 in multiple news outlets, such as The Independent and The Washington Post [5]. The paper was published in the journal *Vaccine* under the title of "Association of spontaneous abortion with receipt of inactivated influenza vaccine containing H1N1pdm09 in 2010-11 and 2011-12 [4]." The paper implied a possible link between H1N1 influenza vaccine and spontaneous abortion (SAB) during the first trimester of pregnancy [4]. In response, the Centers for Disease Control and Prevention (CDC) launched a study to address the safety of the H1N1 vaccine in pregnant women. Results from the study will be available in future [6]. The aim of this review was to demonstrate the use of the GRADE framework in evaluating scientific publications to assess their overall quality.

Methods

We performed a brief review of a recent publication by Donahue et al [4]. The reviewed study is designed as an observational, retrospective, case-control study. Pregnant women with SAB were the targeted population. Eligibility criteria included patients with SAB, diagnosed using clinical examination or ultrasound; age of 18-44 years; known date of last menstrual cycle (LMP); and continuous enrollment with a health care provider for the past 12 months. Subjects with ectopic pregnancy, therapeutic abortion, and history of SAB at less than 5 weeks of gestation were excluded from the study [4].

Cases included 485 women who had SAB and 485 pregnant women in the control group. Both groups were compared to determine whether women with SAB were more likely to have received the 2010-2011 or 2011-2012 seasonal flu vaccine in the proceeding 28 days of SAB. The control cases were selected based on similar characteristics to the cases of SAB, which included maternal age group (<30 or >30 years), approximately similar date of LMP, and enrollment in the same health care plan. Adjustments between the cases and controls were made for smoking during pregnancy, diabetes type 1 or 2, obesity with a body mass index (BMI) of >30, and health care utilization in the prior 1 year. The exposure in this study was receiving the H1N1 influenza vaccine, and the observed outcome was SAB during the first trimester of pregnancy [4]. Vaccine safety data were collected using the Vaccine Safety Datalink (VSD). VSD is a monitoring tool established in 1990 through a collaboration between CDC's Immunization Safety Office and several integrated health care organizations across the United States [6]. VSD is able to utilize electronic health information from more than 9 million people and abstract information for monitoring and research purposes [6]. The authors of the study abstracted some information from the VSD records such as demographics, vaccination history, and medical outcomes [4].

A regression analysis was performed in the reviewed article; however, the analysis excluded some vital demographics, which may have affected the validity of the results. Some of the demographics are shown in Table 1.

Based on abstracted data from the VSD, the authors calculated an adjusted odds ratio (aOR) of 2.0 (95% CI, 1.1-3.6) for SAB within 1-28 days in both 2010-11 and 2011-12 seasons, comparing vaccinated to unvaccinated women in these seasons. The aORs for 2010-2011 and 2011-2012 were 3.7 and 1.4, respectively, in vaccinated compared with unvaccinated women. On the other hand, the aOR for women who received H1N1–containing vaccine during both the previous (2010-11) and current (2011-12) influenza seasons was 7.7 (95% CI, 2.2-27.3). Meanwhile, the aOR for groups that received the vaccination in 2011-12 but not in 2010-11 was 1.3 (95% CI, 0.7-2.7). When women with previous SAB were excluded, the aOR remained elevated at 6.5 (95% CI, 1.7-24.3); however, the sample size was small, which is represented by the wide CI value (95%, Cl, 2.2-27.3). The study concludes that there is a correlation between SAB and influenza vaccination in the preceding 1-28 days, particularly among women who had been vaccinated in the previous season.

Table 1. Major differences in demographics between cases and controls.

Characteristics	Cases, n (%)	Controls, n (%)	*P* value
Age, 35-44 years	157 (32.4)	128 (26.4)	N/A[a]
Body mass index≥30	134 (27.6)	112 (23.1)	N/A
Race, African American	42 (8.7)	20 (4.1)	.008
Previous spontaneous abortion			
≥1	138 (28.5)	125 (25.8)	.32
≥2	43 (8.9)	26 (5.4)	.03
Smoked during pregnancy	52 (10.7)	34 (7.0)	.05

[a]N/A: not applicable.

Results

Analyzing and Interpreting the Study Using Grading of Recommendations, Assessment, Development, and Evaluation

To combat the risks of misinterpreting the reported stories by the news outlets and to standardize the evaluation methods of publications, we recommend using the GRADE system to assess publications. In addition to its validated effectiveness for that purpose, GRADE provides a quantitative evaluation of the evidence [1]. The GRADE tool provides a quantitative score based on the previously mentioned criteria. Table 2 provides the interpretation of the quantitative scores for GRADE. In GRADE, 5 components are evaluated: type of evidence, quality, consistency, directness, and effect size. Next, we assign a value for each component.

Type of Evidence

Randomized clinical trials are assigned 4 points, while observational studies receive a score of 2 points [1]. The design of case-control studies is based on matching a group of cases to one or more similar control group(s) to compare previous exposures between the groups. Case-control studies use the OR for statistical comparison between the groups [7]. Hence, the design of the study [4] as a case-control study has a score of 2 points.

Quality

This is a component of the GRADE framework that addresses the methodology and execution of the study by assessing the blinding process, group allocations, follow-ups, and sparse data (missing data). One point is deducted for each problem identified in one of these elements with a maximum deduction of 3 points [1]. The study had 2 quality concerns. First, the 2 groups comprising cases and controls were not appropriately matched given that the authors only matched for age, VSD site, and estimated LMP. Table 1 shows that the case group had more older women aged ≥30 years, a higher BMI of ≥30, more African American women, ≥2 previous SABs, and more smokers during pregnancy [4]. Second, the matched case-control design was problematic as it raised concerns about selection bias due to the lack of appropriate matching characteristics [8]. A preferable design would have been to use a cohort design to evaluate whether pregnant women who did receive the vaccine had a higher risk of SAB. A cohort design would have also been more suitable as the follow-up period is short and all data are available through VSD [8,9]. Hence, we assigned a score of −2 for quality.

Consistency

This component assesses the consistency of outcomes. A point is deducted for inconsistent results, whereas a point is added for evidence of a dose response, or if adjustment for confounding variables would have increased the effect size [1]. Multiple previous studies have shown consistent results of influenza vaccine having no association with SAB [10-12], which is inconsistent with the conclusion drawn by Donahue et al [4]. Hence, we assigned a score of −1 for this section. Nevertheless, not all inconsistencies between outcomes of studies are “bad.”

Directness

This component evaluates the issues that may hinder the generalizability of the reported outcomes for the specified population [1]. Table 1 shows that previous SAB was twice as common in the SAB cases as in controls (43/485, 8.9%, vs 26/485, 5.4%; *P*=.03) [4]. The study did not adjust for previous SAB in their adjusted logistic regression models; consequently, this could be a confounding variable that was not accounted for [4]. It also seems quite plausible that women with previous SAB might have had conflicting decisions about whether or not to receive the flu vaccination compared with women who did not. Alternatively, it might be possible that those women could have had SAB regardless of flu vaccination status due to their increased risk for SAB from environmental or genetic risk factors.

Moreover, race was not adjusted for in the study model, even though a significant difference between cases and controls was observed in African American women as shown in Table 1 (*P*=.008). In such observational studies, researchers should always be concerned about whether unmeasured confounding variables might be causing these results [13]. For instance, could socioeconomic status influence the results in such a study? Having comparable groups and adjusting for variables have a direct effect on the internal validity of the study. Also, having a larger representative sample of the population can enhance precision and external validity [7]. Hence, we assigned a score of −1 for this section.

Effect Size

This component measures the impact of OR, relative risk (RR), or hazard ratio (HR) to provide an estimate of the significance of the results [1]. OR is a measure of association between an exposure and outcome. An OR of 1.0 represents an equal incidence of outcome in both groups, suggesting that the exposure is not a risk factor for that particular outcome. This is referred to as the null value.

Table 2. Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) score: quality and interpretation.

GRADE score	Quality	Interpretation
≤1	Very low	Any estimate of effect is highly uncertain
2	Low	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate
3	Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
≥4	High	Further research is very unlikely to change our confidence in the estimate of effect

An OR >1 reflects that the exposed population is more likely to have the observed outcome. An OR <1 means that the exposure is protective. OR is usually presented with a CI wherein the bigger the sample, the smaller the CI. In cases where the CI range crosses the value of 1.0, the OR value will be impaired due to the possibility of having a null, which implies no relationship between exposure and disease [9]. OR in case-control studies should be interpreted with caution due to the nature of the study with only 1 period of observation. Also, the OR equation does not represent the total populations in the exposed and unexposed groups; therefore, it is not possible to directly determine disease rate in such studies [9]. The reviewed study has multiple ORs that are close to the value of 1, which suggests that there is no significant difference between the groups. Hence, we assigned a score of 0 for this section. Our GRADE score for the reviewed study [4] is −2 points (+2 for observational study, −2 for quality, −1 for consistency, −1 for directness, and 0 for effect size). The total score of −2 indicates that the study is of very low evidence.

Discussion

Principal Findings

The present review has demonstrated the use of the GRADE framework to quantitively evaluate an observational study, which has been shown to be an effective tool in assessing the study's strengths and weaknesses. The GRADE framework is easy to use and provides a great estimate of publications' overall quality. The reviewed study has several limitations; they include the small number of participants, unrepresentative sample, and an observation of an outcome that is rather common during the first trimester, especially between 7th and 12th weeks, of pregnancy [14]. Therefore, the cause of SAB could be multifactorial and not due to the influenza vaccine. Moreover, there are multiple etiologies of SAB including chromosomal abnormalities, intrauterine fetal demise, molar pregnancy, maternal cervical conditions, and hormonal abnormalities. Some of these medical conditions could have made the miscarriage more likely [14].

Another major limitation is the failure to appropriately match case-control groups as the case group had an older population, more SAB, higher BMI, and more smokers during pregnancy. We also need to consider the possibility that some of the pregnant women included in the study might have received influenza vaccination in a nontraditional setting such as in a pharmacy and were not identified as recipients on their medical records [4]. The reviewed article used aOR after adjusting for some variables such as maternal age >30 years, smoking during pregnancy, diabetes type 1 or 2, obesity with a BMI >30, and health care utilization in the prior year. However, lack of adjustment for some other variables such as maternal age ≥35 years and history of SAB, race, and any concurrent infectious illnesses may have significant implications on the aOR as those groups are at higher risk for SAB.

Other issues noted in the study include the possible impact of missing data from the dataset, as 13.6% (66/485) of the data points from the cases and 7.2% (35/485) of the data points from the control group were missing. This is a significant number if we take into consideration the small sample size. Furthermore, some of the outcomes were a result of a post hoc analysis, which refers to an outcome that was not planned for in the study design and was simply noted at a later stage. This is still a major limitation of the study. Physicians should not base their practice on post hoc findings as the results might be flawed due to chance.

A recent survey conducted by the CDC in late 2017 found out that around two-thirds of pregnant women in the influenza season of 2017-18 had not been vaccinated against influenza. Furthermore, only 15.6% of pregnant women who visited a medical provider since July 2017 had received a recommendation for the influenza vaccination, but not offered one; while 25.7% neither received a recommendation nor an offer for the influenza vaccination, 58.7% of pregnant women received a recommendation and an offer to administer the influenza vaccine [15]. It is possible that the effects of mainstream media highlighting the Donahue et al [4] publication might have had an impact on clinical practice as we described.

The CDC's current recommendation is to vaccinate all pregnant women. It is challenging to convince the public that the reviewed study had various limitations and cannot be generalized to all pregnant women after a media blitz. The media have played a significant part in promoting this study, as multiple news outlets adopted this study's findings with misleading headlines such as "Miscarriages linked to flu vaccine being administered during pregnancy in new study" from The Independent news agency [5]. We believe information that is preliminary may have potential negative health impact on the general population and might need to be reviewed further before publication.

The media has a very strong impact on the way we think and act as a society [16]. We have yet to recover from the aftermath of a single publication by Wakefield et al [17] that linked autism with measles, mumps, and rubella (MMR) vaccine. Multiple studies were conducted immediately after the publication, and they refuted the proposed link between MMR vaccine and autism [18]. The negative effects from the MMR/autism study created a significant confusion in the community and might have contributed to a number of the measles outbreaks, such as the recent outbreak in Minnesota [19], due to the reluctance of the parents to allow the administration of MMR vaccine to their children [17,18].

As clinicians and researchers, we will be able to facilitate the use of GRADE to analyze the study and its statistical significance. For patients, however, it may not be that easy to find their way through the maze of variables, calculations, and adjusted rates. Therefore, a collaborative discussion with the patient is necessary to explain the overall quality of such publications and recommendations to follow.

Conclusion

The GRADE framework is a validated tool used to quantitively assess the overall quality of publications. Through the use of GRADE, we uncovered the low-evidence score for the reviewed article. Therefore, the best course of action will be to follow the CDC's recommendations by providing the influenza vaccine to all pregnant women. Physicians should adopt validated

evidence-based tools, such as GRADE, to quantitively assess the overall quality of studies and provide evidence-based practice.

Acknowledgments

This research was supported by Hospital Corporation of America (HCA) and an HCA-affiliated entity. The views expressed in this publication represent those of the authors and do not necessarily represent the official views of the HCA or any of its affiliated entities.

Conflicts of Interest

None declared.

References

1. Atkins D, Best D, Briss P, Eccles M, Falck-Ytter Y, Flottorp S, GRADE Working Group. Grading quality of evidence and strength of recommendations. BMJ 2004 Jun 19;328(7454):1490 [FREE Full text] [doi: 10.1136/bmj.328.7454.1490] [Medline: 15205295]
2. Kavanagh BP. The GRADE system for rating clinical guidelines. PLoS Med 2009 Sep;6(9):e1000094 [FREE Full text] [doi: 10.1371/journal.pmed.1000094] [Medline: 19753107]
3. Bell N, Connor GS, Tonelli M, Pottie K, Singh H, Joffres M, et al. From ABCs to GRADE: Canadian Task Force on Preventive Health Care's new rating system for clinical practice guidelines. Can Fam Physician 2013 Dec;59(12):1282-1289 [FREE Full text] [Medline: 24336539]
4. Donahue JG, Kieke BA, King JP, DeStefano F, Mascola MA, Irving SA, et al. Association of spontaneous abortion with receipt of inactivated influenza vaccine containing H1N1pdm09 in 2010-11 and 2011-12. Vaccine 2017 Dec 25;35(40):5314-5322. [doi: 10.1016/j.vaccine.2017.06.069] [Medline: 28917295]
5. Sun L. Independent. 2017 Sep 13. Miscarriages linked to flu vaccine being administered during pregnancy in new study URL: https://www.independent.co.uk/news/health/pregnancy-flu-vaccine-miscarriage-link-influenza-research-center-disease-control-prevention-amanda-a7944936.html [accessed 2018-10-17] [WebCite Cache ID 73F3iENHx]
6. Vaccine Safety. US: Centers of Disease Control and Prevention; 2018 Mar 02. Vaccine Safety Datalink (VSD) URL: https://www.cdc.gov/vaccinesafety/ensuringsafety/monitoring/vsd/index.html [WebCite Cache ID 73F2YVTSk]
7. Friis R, Sellers T. Epidemiology For Public Health Practice. Burlington, MA: Jones & Bartlett Learning; 2014.
8. Slinger R, Moher D. How to assess new treatments. West J Med 2001 Mar;174(3):182-186 [FREE Full text] [Medline: 11238353]
9. Freeman J. Quantitative Epidemiology. Infect Control Hosp Epidemiol 1996 Apr;17(4):249-255. [doi: 10.1086/647288] [Medline: 8935733]
10. Chambers CD, Johnson D, Xu R, Luo Y, Louik C, Mitchell AA, OTIS Collaborative Research Group. Risks and safety of pandemic H1N1 influenza vaccine in pregnancy: birth defects, spontaneous abortion, preterm delivery, and small for gestational age infants. Vaccine 2013 Oct 17;31(44):5026-5032. [doi: 10.1016/j.vaccine.2013.08.097] [Medline: 24016809]
11. Irving SA, Kieke BA, Donahue JG, Mascola MA, Baggs J, DeStefano F, Vaccine Safety Datalink. Trivalent inactivated influenza vaccine and spontaneous abortion. Obstet Gynecol 2013 Jan;121(1):159-165. [doi: 10.1097/AOG.0b013e318279f56f] [Medline: 23262941]
12. Moro PL, Broder K, Zheteyeva Y, Walton K, Rohan P, Sutherland A, et al. Adverse events in pregnant women following administration of trivalent inactivated influenza vaccine and live attenuated influenza vaccine in the Vaccine Adverse Event Reporting System, 1990-2009. Am J Obstet Gynecol 2011 Feb;204(2):146.e1-146.e7. [doi: 10.1016/j.ajog.2010.08.050] [Medline: 20965490]
13. Lee PH. Is a Cutoff of 10% Appropriate for the Change-in-Estimate Criterion of Confounder Identification? Journal of Epidemiology 2014;24(2):161-167 [FREE Full text] [doi: 10.2188/jea.JE20130062] [Medline: 24317343]
14. Regan L, Rai R. Epidemiology and the medical causes of miscarriage. Baillieres Best Pract Res Clin Obstet Gynaecol 2000 Oct;14(5):839-854. [doi: 10.1053/beog.2000.0123] [Medline: 11023804]
15. Helen DM. Influenza (Flu). US: Centers for Disease Control and Prevention; 2017 Nov 28. Pregnant Women and Flu Vaccination, Internet Panel Survey, United States, November 2017 URL: https://www.cdc.gov/flu/fluvaxview/pregnant-women-nov2017.htm [accessed 2018-10-17] [WebCite Cache ID 73F3Shu3B]
16. Vasconcellos-Silva PR, Castiel LD, Griep RH. The media-driven risk society, the anti-vaccination movement and risk of autismo. Cien Saude Colet 2015 Feb;20(2):607-616 [FREE Full text] [doi: 10.1590/1413-81232015202.10172014] [Medline: 25715154]
17. Wakefield AJ, Murch SH, Anthony A, Linnell J, Casson DM, Malik M, et al. Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children. Lancet 1998 Dec 28;351(9103):637-641. [Medline: 9500320]

18. Hughes J. Update on autism: a review of 1300 reports published in 2008. Epilepsy Behav 2009 Dec;16(4):569-589. [doi: 10.1016/j.yebeh.2009.09.023] [Medline: 19896907]
19. Hall V, Banerjee E, Kenyon C, Strain A, Griffith J, Como-Sabetti K, et al. Measles Outbreak - Minnesota April-May 2017. MMWR Morb Mortal Wkly Rep 2017 Jul 14;66(27):713-717. [doi: 10.15585/mmwr.mm6627a1] [Medline: 28704350]

Abbreviations

aOR: adjusted odds ratio
BMI: body mass index
CDC: Centers for Disease Control and Prevention
GRADE: Grading of Recommendations, Assessment, Development, and Evaluation
HCA: Hospital Corporation of America
HR: hazard ratio
LMP: last menstrual cycle
MMR: measles, mumps, and rubella
RR: relative risk
SAB: spontaneous abortion
VSD: Vaccine Safety Datalink

Edited by G Eysenbach; submitted 08.03.18; peer-reviewed by I Peterson, M Fadda; comments to author 01.05.18; revised version received 18.05.18; accepted 19.05.18; published 07.11.18.

Please cite as:
Zafar S, Habboush Y, Beidas S
Use of Grading of Recommendations, Assessment, Development, and Evaluation to Combat Fake News: A Case Study of Influenza Vaccination in Pregnancy
JMIR Med Educ 2018;4(2):e10347
URL: http://mededu.jmir.org/2018/2/e10347/
doi:10.2196/10347
PMID:30404772

Original Paper

A Novel Web-Based Experiential Learning Platform for Medical Students (Learning Moment): Qualitative Study

Alexander Y Sheng[1], MD; Andrew Chu[2], MD MPH; Dea Biancarelli[3,4], BHealthSc; Mari-Lynn Drainoni[3,4,5,6], MEd, PhD; Ryan Sullivan[7], MD MPH; Jeffrey I Schneider[1], MD

[1]Department of Emergency Medicine, Boston Medical Center, Boston, MA, United States
[2]Boston University School of Medicine, Boston, MA, United States
[3]Department of Health Law, Policy and Management, Boston University School of Public Health, Boston, MA, United States
[4]Evans Center for Implementation and Improvement Sciences, Boston University School of Medicine, Boston, MA, United States
[5]Section of Infectious Diseases, Department of Medicine, Boston University School of Medicine, Boston, MA, United States
[6]Center for Healthcare Organization and Implementation Research, Edith Nourse Rogers Memorial Veterans Hospital, Bedford, MA, United States
[7]Lawrence General Hospital, Lawrence, MA, United States

Corresponding Author:
Alexander Y Sheng, MD
Department of Emergency Medicine
Boston Medical Center
771 Albany Street
Dowling 1 South
Boston, MA, 02118
United States
Phone: 1 6174144849
Email: shenga@bu.edu

Abstract

Background: Experiential learning plays a critical role in learner development. Kolb's 4-part experiential learning model consists of concrete experience, reflective observation, abstract conceptualization, and active experimentation in a recurring cycle. Most clinical environments provide opportunities for experiences and active experimentation but rarely offer structured means for reflection and abstract conceptualization that are crucial for learners to learn through experience. We created Learning Moment, a novel Web-based educational tool that integrates principles of asynchronous learning and learning portfolios to fulfill the reflection and abstract conceptualization aspects of Kolb's learning cycle in the modern clinical learning environment. Medical students log concise clinical "pearls" in the form of "learning moments" for reflection, review, and sharing with peers in a community of practice.

Objective: We sought to evaluate learners' experiences with Learning Moment via a qualitative study.

Methods: We employed purposive sampling to recruit medical students who used Learning Moment during their rotation. We conducted 13 semistructured interviews (10 individual interviews and one 3-person group interview) between January and March 2017 using an ethnographic approach and utilized a general inductive method to analyze and code for potential themes.

Results: A total of 13 students (five in their third year of medical school and eight in their fourth year) voluntarily participated in our qualitative interviews. Five of the 13 (38%) students intended to pursue emergency medicine as their chosen field of specialty. The median number of "learning moments" logged by these students is 6. From our analysis, three key themes emerged relating to the perceived impact of Learning Moment on student learning: (1) logging "learning moments" enhanced memorization, (2) improved learning through reflection, and (3) sharing of knowledge and experiences in a community of practice.

Conclusions: Learning Moment was successfully implemented into the educational infrastructure in our department. Students identified three mechanisms by which the application optimizes experiential learning, including enabling the logging of "learning moments" to promote memorization, encouraging reflection to facilitate learning, and fostering the sharing of knowledge and experiences within a community of practice. The Learning Moment concept is potentially scalable to other departments, disciplines, and institutions as we seek to optimize experiential learning ecosystems for all trainees.

(JMIR Med Educ 2018;4(2):e10657) doi:10.2196/10657

KEYWORDS

experiential learning; reflection; shared learning

Introduction

Experiential learning, which incorporates both reflection and practice, is critical for successful knowledge acquisition, educational growth, and the development of new skills and behaviors [1,2]. In Kolb's 4-part model of the experiential learning cycle, (1) concrete experience forms the foundation for learning, (2) reflection subsequently makes sense of the experience alone or in a group setting, (3) abstract conceptualization uses reasoning and knowledge to grasp the situation and problem, and (4) active experimentation puts theories to the test, leading to additional experiences [2,3].

With widespread acceptance of experiential learning as a crucial component of medical education [4], prior research examined the application of Kolb's work in relation to curriculum design for continuing medical education [5]. However, there is a lack of literature exploring ways to integrate and optimize experiential learning in the modern clinical learning environment. In addition, there is increasing recognition of the importance of reflective practice in the development of medical professionals [6]. Although incorporated into medical training through the use of simulation debriefing sessions, written reflections in narrative medicine, and verbal reflections in problem-based and case-based learning, few published approaches exist to encourage reflection during day-to-day clinical practice [6-8]. While the clinical learning environment provides opportunities for experiences and active experimentation aspects of Kolb's learning model, it often lacks structured opportunities for reflective observation and abstract conceptualization. In response to these challenges, educators and learners seek alternative frameworks and mechanisms to support and foster continuous experience, learning, and reflection that can co-exist and thrive within today's changing health care landscape.

One such alternative is the use of asynchronous learning as a learner-centered method of teaching that uses online learning resources to overcome time and space constraints in order to facilitate information sharing and interaction among learners [9]. Importantly, asynchronous learning has been demonstrated to be a valued and effective method of learning [10,11]. Another method to encourage learning through experience is the use of learning portfolios, which is predicated on three fundamental components: reflection, documentation, and collaboration [12]. As described by Stanton, the use of learning portfolios stimulates additional (and self-perpetuating) learning as reflection on experiences leads to the recognition of new learning goals, which in turn renews the learning cycle [1].

We developed and implemented an innovative educational tool, Learning Moment [13], integrating principles of asynchronous learning and learning portfolios, to fulfill the reflection and abstract conceptualization aspects of Kolb's experiential learning cycle often missing in the clinical learning environment. We sought to evaluate learners' experience with this novel educational instrument via a qualitative study.

Methods

Educational Tool Design

Learning Moment is a Web-based application through which learners can document and share personal learning experiences that occur in the course of patient care (Figure 1). Learners are able to conveniently and easily record "learning moments" (defined as learner-identified learning experiences), highlight the take-away "learning pearls," and share them with peers. Through this process, learners have the opportunity to incorporate key components of Kolb's experiential learning cycle, reflective observation and abstract conceptualization in particular, that are frequently absent in the bustle and chaos often present in today's clinical learning environment.

We developed the initial build of the Learning Moment electronic platform with two specific goals in mind:

1. To provide learners with an electronic "note-taking" tool to log their own learning experiences (Figure 2) while building and contributing to their own digital personalized learning portfolio. In doing so, we endeavored to provide learners with a physical and mental space to synthesize experiences into coherent thoughts, which enhance understanding and retention through self-reflection and abstract conceptualization [14].
2. To create a searchable and shareable repository of useful, practical, high-yield educational content that benefits peers and colleagues through vicarious learning in the form of a "Community Feed" (Figure 3) [15]. Our intention was to build and support a community of practice, both live and virtual, to facilitate knowledge sharing [16,17].

Implementation

The complete description of the Learning Moment implementation process is described elsewhere [13]. In brief, we implemented Learning Moment in August 2016 at a busy (annual volume in excess of 130,000 visits), urban, tertiary care emergency department that hosts an emergency medicine residency and robust third- and fourth-year medical student clerkships. We introduced the Learning Moment platform to all rotating medical students during their orientation to the clerkship. We encouraged them to use Learning Moment on a voluntary basis to log self-selected learning experiences in the form of a "learning moment" and to view fellow students' "learning moments" through a "Community Feed" (Figure 3). Students can access the Learning Moment website on computer workstations at work, at home, or on their mobile phones.

Figure 1. Learning Moment interface.

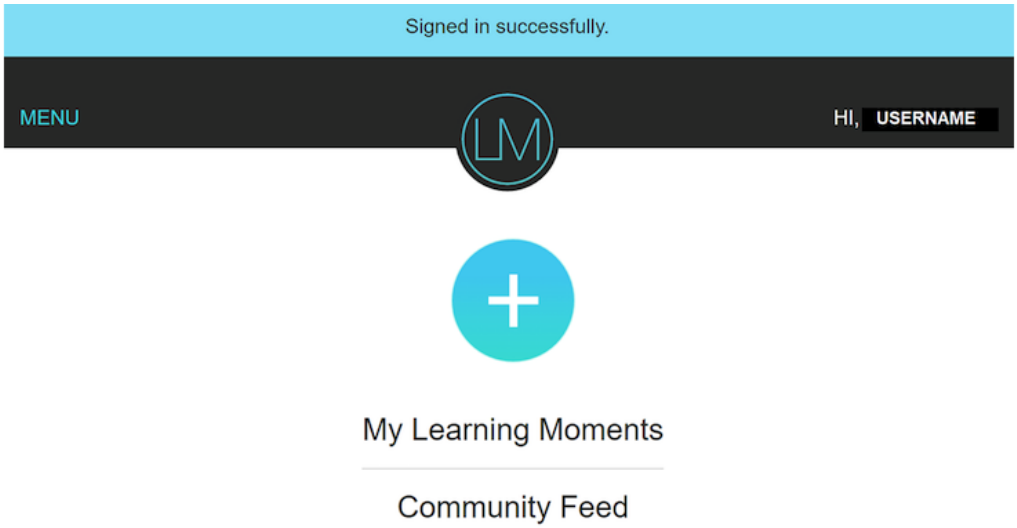


Figure 2. Logging learning experiences in Learning Moment. CT: Computerized Tomography.

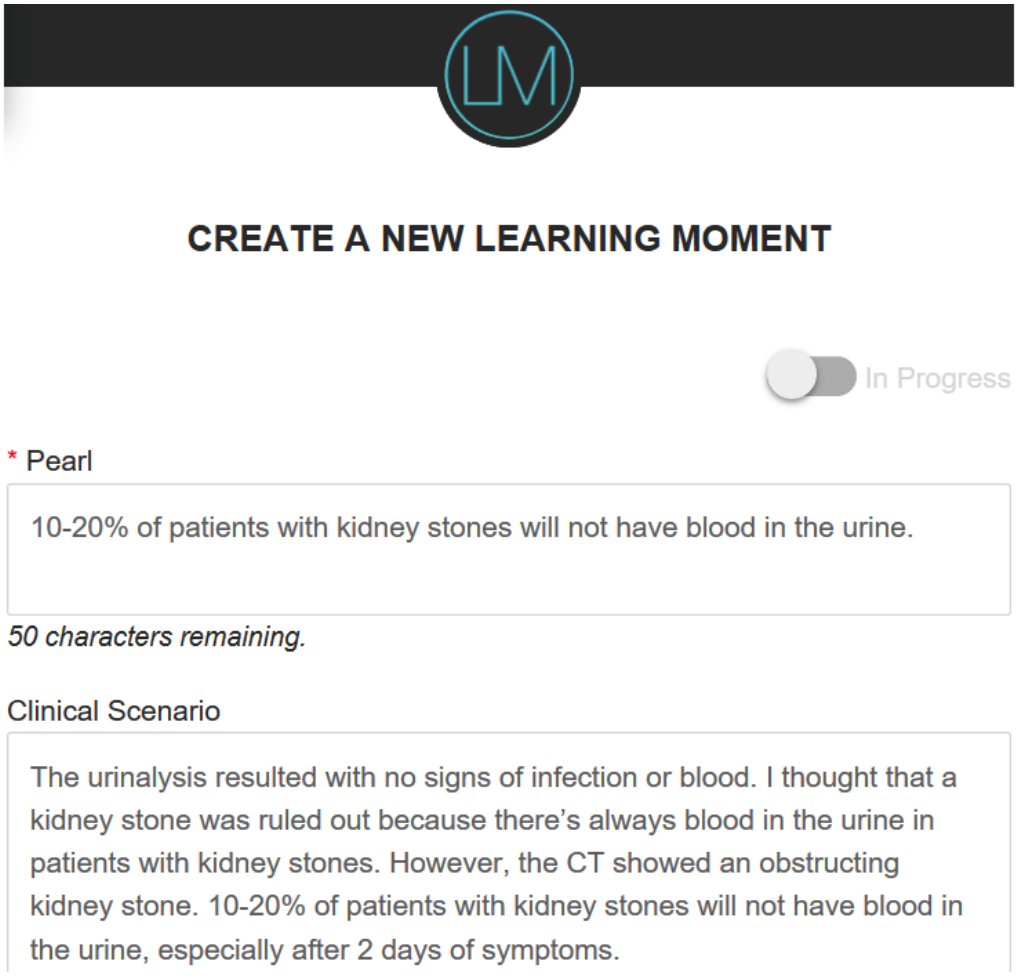


Figure 3. Learning Moment Community Feed. TPA:Tissue Plasminogen Activator.

Pearl	Date ▲	Learner	Categories
Severe hypertension defined as 180 sbp or 110 dbp	10/24/17	**Student 1**	
Cluster headaches are characterized by lacrimation and rhinorrhea and mainly affects men	10/24/17	**Student 1**	Clinical Reasoning
Protocols are useful but have pitfalls	10/24/17	**Student 2**	Patient Safety
Important test before TPA is blood glucose	10/24/17	**Student 3**	Clinical Reasoning
Ottawa Foot and ankle rules	10/24/17	**Student 2**	Evidence-Based Medicine

← Previous 1 2 **3** 4 5 6 7 8 9 … 185 186 Next →

A link to the Learning Moment website was made accessible directly from the electronic medical record system to promote ease of access. Experienced clinical faculty facilitated monthly in-person "Learning Moment Reflection" small group discussions with medical students as they reflected on and expounded on their own and peer "learning moments" with faculty guidance. We designed these discussions to complement the virtual features of Learning Moment to further encourage and fulfill the reflection and abstract conceptualization components of experiential learning.

A total of 323 "learning moments" were logged between August, 22, 2016 to Feb. 12, 2017, over the course of six 1-month-long clerkship rotations. Over three-quarters (42/53, 79.2%) of medical students who completed their emergency medicine clerkship rotation logged at least one "learning moment" with a median of six "learning moments" logged. The demographics of the medical student user cohort and frequency of logging "learning moments" are described previously [13]. We recently surpassed 1000 "learning moments" logged 16 months after implementation, demonstrating successful implementation and robust sustainability.

Study Design and Recruitment

We conducted a qualitative analysis of users' experience of Learning Moment as a learning tool for undergraduate medical education. We employed purposive sampling to recruit medical students who used Learning Moment during their rotation. We sent email invitations with subsequent reminders to all students who rotated in our emergency medicine clerkship from August 2016 to February 2017 to participate in qualitative interviews, regardless of the extent to which they used the Learning Moment platform. Our interviews focused primarily on how medical students used Learning Moment throughout their emergency medicine rotation and how it impacted their learning. We coded the data inductively using the principles of grounded theory to generate a unified, theoretical explanation on how Learning Moment impacted the learning experience of medical students. Our Institutional Review Board approved our study as exempt.

Data Collection Procedures

We conducted 13 semistructured interviews, including 10 individual interviews and one 3-person group interview, between January and March 2017. We conducted seven interviews in person and six by telephone due to difficulty arranging face-to-face meetings. In-person interviews were conducted in medical school classrooms and departmental conference rooms. We conducted interviews until we reached thematic saturation as the last several interviews yielded no additional patterns or themes. A single researcher and coauthor (AC) conducted and audiotaped all interviews using the same interview guide (see Multimedia Appendix 1). Individual interviews lasted between 5 and 20 minutes with a mean and median of 15 minutes and 16 minutes respectively. The 3-person group interview was 26 minutes in duration.

Data Analysis

After each interview was completed, the researcher and coauthor (AC) who conducted the interviews transcribed the audio recording verbatim. We reviewed all transcribed interviews to ensure accuracy. For analysis, we employed standard qualitative research methods using the principles of grounded theory [18,19]. Two coauthors (AC and DB) trained in qualitative research methods inductively analyzed the transcripts, generating common themes found in all interviews. We initially reviewed the text line-by-line and coded them to characterize comments and passages and subsequently grouped them into conceptual categories to form an initial codebook. The same coauthors then applied the initial codebook to transcripts, refining and finalizing the codebook for a "better fit" for the data. We applied the new version of the codebook by both team members to all the transcripts using qualitative software package NVivo (QRS International). After several rounds of refining and finalizing

the coding scheme, we identified overall themes related to the impact of Learning Moment on student learning and appropriately grouped them into thematic categories.

Results

Description of the Study Sample

In total, 13 students (five in their third year of medical school and eight in their fourth year) of the 53 who rotated with us during the study period voluntarily participated in our qualitative interviews. Five of the 13 (38%) students intended to pursue emergency medicine as their chosen field of specialty. Detailed demographics of participants are shown in Table 1.

The number of "learning moments" logged during their month-long emergency medicine rotation by each of the 13 students who participated in our qualitative interviews are shown in Table 2. The median number of "learning moments" logged by these students is 6.

Overview of Qualitative Themes

The interview data provided a deeper understanding of learner views and experiences using Learning Moment. Three key themes relating to the impact of Learning Moment on student learning emerged from our analysis: (1) learners expressed that the act of logging of "learning moments" enhanced memorization, (2) learners attributed self-perceived improvement in learning to reflection, and (3) learners appreciated sharing knowledge and experiences in a community of practice.

Theme 1: Learners Expressed that Logging "Learning Moments" Enhanced Memorization

Learners believed that the physical act of logging a "learning moment" facilitated memorization. Learners appreciated the platform to record information in an easily digestible format thus enabling future review and stimulating knowledge retention.

Table 1. Demographics of participating medical students (N=13).

Characteristics	Participants, n (%)
Year	
Third year of medical school	5 (38)
Fourth year of medical school	8 (62)
Gender	
Female	11 (85)
Male	2 (15)
Field of interest	
Emergency Medicine	5 (38)
Other or unsure	8 (62)

Table 2. Number of "learning moments" logged during their month-long emergency medicine rotation by each student who participated in our qualitative interviews.

Student	"Learning moments" logged, n
1	3
2	13
3	6
4	2
5	14
6	8
7	9
8	2
9	4
10	6
11	5
12	9
13	22

> *If I don't write them down or type them out, then I don't remember. I like to have them logged in somewhere so, one day, when I review them, I'm like "Oh yeah, I remember learning about that," and that solidifies what I learned on my rotation.* [Student 3]
>
> *The thing I took from it the most was the reinforcement of my own learning. Usually you hear clinical pearls from attendings or residents, and you can think about it for that moment. But then you might forget it later on...actually being able to type it down in this database really reinforces that information that you just learned. And then, I think because of that, I was able to retain this information much better.* [Student 6]

Not only was the act of typing out "learning moments" viewed as helpful for memorization, but students also commented that recording these "pearls" and thus building their learning portfolios was an effective method to capture, easily organize, and review this information. Students noted that when documenting new learning "pearls" they often looked back and reviewed previously recorded "pearls," thus refreshing their memory of those previous learning experiences:

> *You also have the ones you wrote down in the past, so it all kind of jogs your memory. I think it's a memory tool that lets you quantify some kind of learning that you had every day for every shift.* [Student 3]
>
> *Later on, it helped me remind me of things I had learned, and that I might have forgotten I have, so it was nice to have that refresher. Because the ones I input are the ones that I remember best.* [Student 4]

Theme 2: Learners Attributed Self-Perceived Improvement in Learning to Reflection

Learners reported that the often chaotic and frenetic pace of a busy emergency department made it difficult to synthesize and reflect on learning experiences. Learners articulated that Learning Moment provided an intentional and deliberate moment to pause and reflect on the learning that occurred that day and allowed them to think about how to apply it in the future. Through this process, learners recounted more opportunities to reinforce the learning that does occur.

> *So, I think that being in the emergency room is a very unique setting. So, when you're in the emergency department as a student, things are very fast-paced...I think in those really quick moments, there are moments of learning and teaching that's happening that might not otherwise be apparent. So even though you're working in a fast-paced learning environment...the program really helped me to reflect in that way to synthesize...after a really busy 8-hour shift.* [Student 12]
>
> *The one good thing that it did was that it forced me to stop after every shift...to think about what they actually learned. Because it's so easy to pop in for eight hours, go in, do your thing, and then leave...not really reflect back on what had happened that day. Because the emergency room is pretty busy, so being able to stop and think about what had happened...that retrospective approach was one of the benefits that LM [Learning Moment] offered.* [Student 5]
>
> *Most useful was the reflecting. You know, because in a shift, you see a whole bunch of patients. So, reflecting on: was there anything new or different about one of those patients who came in, so that we can think about that patient in the future when other patients come in.* [Student 8]
>
> *So, I think that the main purpose of it is to give you a chance to step back from the action-packed environment of the emergency department to give you a pointed purpose and opportunity to think beyond what's going on right now.* [Student 9]

Theme 3: Learners Appreciated Sharing Knowledge and Experiences in a Community of Practice

Learners believed that the sharing of learning "pearls" facilitated knowledge transfer within a community of practice. Learned enjoyed reviewing the Learning Moment "Community Feed" to learn from the "pearls" and experiences of their peers. Learners appreciated that every "learning moment" recorded was highly applicable in the clinical setting and might not be taught in traditional sources, such as textbooks. Learners frequently referenced that sharing their learning experiences benefited everyone within the community of practice and that Learning Moment encouraged "an environment of teaching" [Student 12].

> *But also, be able to tap into clinical pearls that other people in the department are gathering. Sort of like collect all that information in one space so you can have like a high yield bank of pearls and things that'll help you on the floor...And so it is really nice that I could type in a keyword and get all of these clinical pearls, both my own and other people's. And I liked the fact that we could learn from other people's pearls.* [Student 7]
>
> *And skimming through other people's "learning moments" was also useful and interesting. One of the benefits of using LM.* [Student 6]
>
> *I think the purpose of the LM was to encourage an environment of teaching. So not only was it to have students and residents reflect on things that they learned during their shift...also to encourage attendings and more senior providers to teach more and provide those learning moments for students on shift. I think that was encouraged, so that aspect of the program was pretty cool.* [Student 12]

Learner experiences using Learning Moment were impacted by the level of involvement by others from the ground up. While the current iteration of Learning Moment is focused on medical students in a single emergency medicine clerkship rotation, increasing participation and support from residents and faculty as well as adapting Learning Moment to other rotations are potential future directions as suggested by our learners.

> *I think the thing with LM is that you need a lot of buy-in for it to be good...if I were using that on every single rotation, or if it were in my residency and everyone in my residency was using it...I would totally use it, because I think it's a good tool. If everybody's using it or is using it consistently throughout the year, I would totally use it.* [Student 7]
>
> *I think if it was part of the curriculum where I was, it would be useful. I don't think if I was just doing it my own thing that I would use it. If it wasn't a part of my residency, I don't know that I would use it.* [Student 2]
>
> *Incorporating into the culture of the residency. I remember when I was rotating through, somebody brought up LM during our weekly conference and was like, "Oh look at all these learning moments," and clearly, someone was looking at it, and someone shared different learning moments, and that would be encouraging more people to participate. Whereas if it was something that wasn't utilized, if I was the only one doing it, then it would be a little harder to incorporate into my daily tasks.* [Student 1]

Discussion

Principal Findings

While there is literature supporting the need for educators to design continuing medical education curriculums that transition learners through each stage in sequence of the Kolb experiential learning cycle in order to promote the application of all learning styles [5], there is no such structured approach to support learners in the same way in the clinical environment. Without such infrastructure, learners may fail to assimilate and transform experiences into knowledge [2,4]. Learners are assumed to learn during clinical work through experience in a productive manner despite the lack of structure or framework that fosters learning and reflection [20]. As a result, some have advocated for the creation and incorporation of curricular spaces within the medical curriculum and clinical settings in order to provide opportunities for learners to incorporate experiences into their professional identity through reflection [21]. For example, Shaughnessy and Duggan introduced reflective exercises in the form of Web-based "clinical blogs" into their family medicine residency curriculum. While perceived as valuable for self-development, the participating residents expressed unease in setting aside dedicated time for reflection amid the professional duties and time pressures they face on a daily basis [22]. In most clinical settings, particularly within a busy emergency department, it may be even more difficult to devote valuable time protected from clinical duties solely for the purposes of reflection. Learning portfolios have been increasingly used in various health professions including medicine, nursing, and dentistry to promote learner metacognition and even faculty development [23-29]. However, the vast majority of portfolios used in undergraduate medical education featured reflective writing focusing on ethical and professional issues, as opposed to day-to-day clinical learning [23]. One e-Portfolio was used to define learning activities of final year medical students during the emergency medicine clerkship by recording patient demographics, chief complaints, and procedures. However, consideration of learning pearls or sharing of knowledge and experiences were not mentioned [30].

To explicitly address these gaps, we sought to integrate the concepts of asynchronous learning and learning portfolios, while leveraging technology, to fulfill aspects of Kolb's learning cycle that are often absent in the clinical learning environment, specifically reflection and abstract conceptualization. According to Kolb, learning is an active, collaborative, and interactive process "whereby knowledge is created through the transformation of experience" [2]. Our results suggest that Learning Moment facilitates the transformation of clinical experiences into existing cognitive frameworks. Reflection can occur *during* (reflection in action) or *after* the experience (reflection on action), and both are critically important for the development of reflective physicians [14]. Learners can leverage the Learning Moment platform for reflection on action, by logging "learning moments" asynchronously (online) or through in-person "Learning Moment Reflection" discussion groups. Additionally, Learning Moment also provides a potential means by which learners can reflect in action or in the context of an active educational experience that allows for opportunity to do so.

Furthermore, our data suggest that the Learning Moment platform encourages group learning through sharing of knowledge and experiences within a community of practice. Learning Moment creates a shareable repository of knowledge that benefits the community of practice through vicarious learning [15]. In such an environment, knowledge acquisition can occur not only via first-hand experiences but also indirectly through the experiences of others. There is an increasing awareness and understanding within higher education of students' ability to learn from each other's experiences [31-34]. But vicarious learning is not well described in the medical education literature despite its widespread use (eg, through story telling in social interactions, structured discussions like morbidity and mortality conferences). Learning Moment's "Community Feed" feature, which fosters the sharing of knowledge and experiences through vicarious learning, was identified as a strength by users.

Terms like learning management system, course management system, and virtual learning environment have been used somewhat interchangeably to describe integrated suites of tools used in e-learning such as Blackboard [35], New Innovations [36] and E-Value [37]. They are effective and widely used tools that support the administration, logistics, communication, and book-keeping aspects of educational courses and programs [38]. Learning Moment on the other hand, through its innovative approach to learner documentation and sharing of learning experiences, can genuinely be considered a virtual learning environment in the true sense of the term because it not only supports the educational process but also generates valuable educational content and maintains a virtual environment in which to maximize experiential learning.

Limitations

Our study has several important limitations. The sample size was small with only 13 voluntary interview participants. Logistic

restrictions from rigorous schedules of medical students, many of whom were from out of state, doing rotations away, or traveling while interviewing for residency positions during the study period significantly limited our efforts to conduct more interviews. As a result, we performed one 3-person group interview in order to accommodate participant schedules. Despite a relatively small sample size, we reached thematic saturation. Learners who self-selected to participate in the study may have strong positive or negative views towards Learning Moment, thus subjecting our results to participation bias. Although in our recruiting email describing the voluntary nature of participation, we stressed that participation would not affect their grade or ranking for residency application in any way, participants may have been motivated to report positive experiences with Learning Moment, thus biasing our results. In addition, our study did not include a control arm. Since we sought to evaluate learners' experiences with Learning Moment, interviewing learners who did not use Learning Moment was not part of our initial study design. However, exploring reasons behind why some learners did not use Learning Moment despite its availability during the rotation would have been a worthy venture. Last, our results reflect learner perceived impact of Learning Moment on their learning. We cannot comment on specific learning outcomes as we did not measure knowledge acquisition, retention, or change in practice, specifically. Nevertheless, our study was the first of its kind to explore learner experiences regarding their use of our innovative experiential learning platform.

Conclusion

We successfully implemented Learning Moment into the educational infrastructure of our department. Student users identified three mechanisms by which the application was perceived to optimize experiential learning, including enabling the logging of "learning moments" to promote memorization and retention, encouraging reflection to facilitate learning, and fostering sharing of knowledge within a community of practice. While currently institution-based, further research addressing refinements to and enhancements of the tool, as well as potential adoption of the Learning Moment model to new learning environments, potentially as an open-access platform, is warranted as we seek to optimize experiential learning ecosystems for all trainees.

Acknowledgments

The authors humbly acknowledge the Boston University Digital Learning Initiative for providing generous funding to the Learning Moment project. The authors also acknowledge the talented and dedicated Web designers at Vermonster LLC for developing the Learning Moment initial build.

Conflicts of Interest

Three of the authors (AYS, RS, JIS) were directly involved in designing and building the Learning Moment platform. However, those who conducted the semistructured interviews, qualitative data collection, and analysis (AC, DB, MLD) did not participate in the development of Learning Moment.

Multimedia Appendix 1

Interview guide.

[PDF File (Adobe PDF File), 29KB - mededu_v4i2e10657_app1.pdf]

References

1. Stanton F, Grant J. Approaches to experiential learning, course delivery and validation in medicine. A background document. Med Educ 1999 Apr;33(4):282-297. [Medline: 10336759]
2. Kolb D. Experiential Learning: Experience as the Source of Learning and Development. Upper Saddle River, New Jersey: Prentice Hall; 1984.
3. Lisko SA, O'Dell V. Integration of theory and practice: experiential learning theory and nursing education. Nurs Educ Perspect 2010;31(2):106-108. [Medline: 20455368]
4. Yardley S, Teunissen PW, Dornan T. Experiential learning: AMEE Guide No. 63. Med Teach 2012;34(2):e102-e115. [doi: 10.3109/0142159X.2012.650741] [Medline: 22289008]
5. Armstrong E, Parsa-Parsi R. How can physicians' learning styles drive educational planning? Acad Med 2005 Jul;80(7):680-684. [Medline: 15980086]
6. Plack MM, Greenberg L. The reflective practitioner: reaching for excellence in practice. Pediatrics 2005 Dec;116(6):1546-1552. [doi: 10.1542/peds.2005-0209] [Medline: 16322184]
7. Charon R. What to do with stories: the sciences of narrative medicine. Can Fam Physician 2007 Aug;53(8):1265-1267 [FREE Full text] [Medline: 17872831]
8. Hart D, McNeil MA, Griswold-Theodorson S, Bhatia K, Joing S. High fidelity case-based simulation debriefing: everything you need to know. Acad Emerg Med 2012 Sep;19(9):E1084 [FREE Full text] [doi: 10.1111/j.1553-2712.2012.01423.x] [Medline: 22978737]

9. Mayadas F. Asynchronous learning networks: A Sloan Foundation perspective. Journal of Asynchronous Learning Networks 1997;1(1):1-16.
10. Hiltz SR. Impacts of college-level courses via Asynchronous Learning Networks: Some Preliminary Results. Journal of Asynchronous Learning Networks 1997;1(2):1-19.
11. George DR, Dellasega C. Use of social media in graduate-level medical humanities education: two pilot studies from Penn State College of Medicine. Med Teach 2011;33(8):e429-e434. [doi: 10.3109/0142159X.2011.586749] [Medline: 21774639]
12. Zubizarreta J. The Learning Portfolio: A Powerful Idea for Significant Learning. Idea Paper #44 2009:1-6.
13. Sheng AY, Sullivan R, Kleber K, Mitchell PM, Liu JH, McGreevy J, et al. Fantastic Learning Moments and Where to Find Them. West J Emerg Med 2018 Jan;19(1):59-65 [FREE Full text] [doi: 10.5811/westjem.2017.10.35179] [Medline: 29383057]
14. Bernard AW, Gorgas D, Greenberger S, Jacques A, Khandelwal S. The use of reflection in emergency medicine education. Acad Emerg Med 2012 Aug;19(8):978-982 [FREE Full text] [doi: 10.1111/j.1553-2712.2012.01407.x] [Medline: 22818356]
15. Roberts D. Vicarious learning: a review of the literature. Nurse Educ Pract 2010 Jan;10(1):13-16. [doi: 10.1016/j.nepr.2009.01.017] [Medline: 19251480]
16. Cruess RL, Cruess SR, Steinert Y. Medicine as a Community of Practice: Implications for Medical Education. Acad Med 2018 Feb;93(2):185-191. [doi: 10.1097/ACM.0000000000001826] [Medline: 28746073]
17. Barnett S, Jones SC, Bennett S, Iverson D, Bonney A. General practice training and virtual communities of practice - a review of the literature. BMC Fam Pract 2012 Aug 21;13:87 [FREE Full text] [doi: 10.1186/1471-2296-13-87] [Medline: 22905827]
18. Glaser BG, Strauss AL. The Discovery of Grounded Theory: Strategies for Qualitative Research. New York, NY: Routledge; 2017.
19. Pope C, Ziebland S, Mays N. Qualitative research in health care. Analysing qualitative data. BMJ 2000 Jan 08;320(7227):114-116 [FREE Full text] [Medline: 10625273]
20. Gibbs G. Learning by doing: a guide to teaching and learning methods. Great Britain: Further Education Unit; 1988.
21. Wear D, Zarconi J, Kumagai A, Cole-Kelly K. Slow medical education. Acad Med 2015 Mar;90(3):289-293. [doi: 10.1097/ACM.0000000000000581] [Medline: 25426738]
22. Shaughnessy AF, Duggan AP. Family medicine residents' reactions to introducing a reflective exercise into training. Educ Health (Abingdon) 2013;26(3):141-146 [FREE Full text] [doi: 10.4103/1357-6283.125987] [Medline: 25001346]
23. Chertoff J, Wright A, Novak M, Fantone J, Fleming A, Ahmed T, et al. Status of portfolios in undergraduate medical education in the LCME accredited US medical school. Med Teach 2016 Sep;38(9):886-896. [doi: 10.3109/0142159X.2015.1114595] [Medline: 26652913]
24. Anderson KM, DesLauriers P, Horvath CH, Slota M, Farley JN. From Metacognition to Practice Cognition: The DNP e-Portfolio to Promote Integrated Learning. J Nurs Educ 2017 Aug 01;56(8):497-500. [doi: 10.3928/01484834-20170712-09] [Medline: 28787073]
25. Tonni I, Mora L, Oliver RG. Postgraduate Orthodontics Students' and Mentors' Perceptions of Portfolios and Discussion as Tools for Development of Reflection. J Dent Educ 2016 Sep;80(9):1098-1108 [FREE Full text] [Medline: 27587577]
26. Vance GHS, Burford B, Shapiro E, Price R. Longitudinal evaluation of a pilot e-portfolio-based supervision programme for final year medical students: views of students, supervisors and new graduates. BMC Med Educ 2017 Aug 22;17(1):141 [FREE Full text] [doi: 10.1186/s12909-017-0981-5] [Medline: 28830499]
27. Gibson C, Chandratilake M, Hull A. Use of portfolios for assessment of global health residents: qualitative evaluation of design and implementation. Can Med Educ J 2018 May;9(2):e20-e32 [FREE Full text] [Medline: 30018681]
28. Cunningham H, Taylor D, Desai UA, Quiah SC, Kaplan B, Fei L, et al. Looking Back to Move Forward: First-Year Medical Students' Meta-Reflections on Their Narrative Portfolio Writings. Acad Med 2018 Jun;93(6):888-894. [doi: 10.1097/ACM.0000000000002102] [Medline: 29261540]
29. Kopechek J, Bardales C, Lash AT, Walker C, Pfeil S, Ledford CH. Coaching the Coach: A Program for Development of Faculty Portfolio Coaches. Teach Learn Med 2017;29(3):326-336. [doi: 10.1080/10401334.2016.1273781] [Medline: 28632014]
30. Cevik AA, Shaban S, El Zubeir M, Abu-Zidan FM. The role of emergency medicine clerkship e-Portfolio to monitor the learning experience of students in different settings: a prospective cohort study. Int J Emerg Med 2018 Apr 12;11(1):24 [FREE Full text] [doi: 10.1186/s12245-018-0184-9] [Medline: 29651758]
31. Ashworth PD. Understanding as the transformation of what is already known. Teaching in Higher Education 2004 Apr;9(2):147-158. [doi: 10.1080/1356251042000195385]
32. Ellis RA, Calvo R, Levy D, Tan K. Learning through discussions. High Educ Res Dev 2004;23(1):73-93. [doi: 10.1111/j.1467-8535.2005.00519.x]
33. Northedge A. Enabling Participation in Academic Discourse. Teaching in Higher Education 2003 Apr;8(2):169-180. [doi: 10.1080/1356251032000052429]
34. Nehls N. Narrative pedagogy: rethinking nursing education. J Nurs Educ 1995 May;34(5):204-210. [Medline: 7790971]
35. Blackboard. 2018. URL: http://www.blackboard.com/ [accessed 2018-02-23] [WebCite Cache ID 6xRfNnZaf]
36. New Innovations. 2018. URL: https://www.new-innov.com/pub/ [accessed 2018-02-23] [WebCite Cache ID 6xRfRXwJH]

37. E*VALUE. 2018. URL: https://www.e-value.net/login.cfm [accessed 2018-02-23] [WebCite Cache ID 6xRfZM9aJ]
38. Ellaway R, Masters K. AMEE Guide 32: e-Learning in medical education Part 1: Learning, teaching and assessment. Med Teach 2008 Jun;30(5):455-473. [doi: 10.1080/01421590802108331] [Medline: 18576185]

Abbreviations

LM: Learning Moment

Edited by G Eysenbach; submitted 31.03.18; peer-reviewed by O Las Vergnas, S Barteit, L DelSignore; comments to author 12.07.18; revised version received 23.07.18; accepted 16.08.18; published 17.10.18.

Please cite as:
Sheng AY, Chu A, Biancarelli D, Drainoni ML, Sullivan R, Schneider JI
A Novel Web-Based Experiential Learning Platform for Medical Students (Learning Moment): Qualitative Study
JMIR Med Educ 2018;4(2):e10657
URL: http://mededu.jmir.org/2018/2/e10657/
doi:10.2196/10657
PMID:30333094

Original Paper

Cyberincivility in the Massive Open Online Course Learning Environment: Data-Mining Study

Jennie C De Gagne[1], PhD, DNP, RN-BC, CNE, ANEF, FAAN; Kim Manturuk[2], PhD; Hyeyoung K Park[1], RN, MSN; Jamie L Conklin[3], MSLIS; Noelle Wyman Roth[4], MEM; Benjamin E Hook[5], MS; Joanne M Kulka[6], DNP, APRN-BC

[1]School of Nursing, Duke University, Durham, NC, United States

[2]Learning Innovation, Duke University, Durham, NC, United States

[3]Health Sciences Library, University of North Carolina, Chapel Hill, Chapel Hill, NC, United States

[4]Social Sciences Research Institute, Duke University, Durham, NC, United States

[5]School of Medicine, University of South Carolina,, Greensville, SC, United States

[6]Nursing, Sandhills Community College, Pinehurst, NC, United States

Corresponding Author:
Hyeyoung K Park, RN, MSN
School of Nursing
Duke University
DUMC 3322
307 Trent Drive
Durham, NC, 27710
United States
Phone: 1 984 209 9995
Fax: 1 919 681 8899
Email: hp80@duke.edu

Abstract

Background: Cyberincivility is a pervasive issue that demands upfront thinking and can negatively impact one's personal, professional, social, and educational well-being. Although massive open online courses (MOOCs) environments could be vulnerable to undesirable acts of incivility among students, no study has explored the phenomena of cyberincivility in this learning environment, particularly in a health-related course in which mostly current or eventual health professions students enroll.

Objective: This study aimed to analyze the characteristics of text entries posted by students enrolled in a medicine and health care MOOC. The objectives were to (1) examine the prevalence of posts deemed disrespectful, insensitive or disruptive, and inconducive to learning; (2) describe the patterns and types of uncivil posts; and (3) highlight aspects that could be useful for MOOC designers and educators to build a culture of cybercivility in the MOOC environment.

Methods: We obtained data from postings in the discussion forums from the MOOC Medical Neuroscience created by a large private university in the southeast region of the United States. After cleaning the dataset, 8705 posts were analyzed, which contained (1) 667 questions that received no responses; (2) 756 questions that received at least one answer; (3) 6921 responses that applied to 756 posts; and (4) 361 responses where the initiating post was unknown. An iterative process of coding, discussion, and revision was conducted to develop a series of a priori codes. Data management and analysis were performed with NVivo 12.

Results: Overall, 19 a priori codes were retained from 25 initially developed, and 3 themes emerged from the data—Annoyance, Disruption, and Aggression. Of 8705 posts included in the analysis, 7333 (84.24%) were considered as the absence of uncivil posts and 1043 (11.98%) as the presence of uncivil posts, while 329 (3.78%) were uncodable. Of 1043 uncivil posts analyzed, 466 were coded to >1 a priori codes, which resulted in 1509 instances. Of those 1509 instances, 826 (54.74%) fell into "annoyance", 648 (42.94%) into "disruption", and 35 (2.32%) into "aggression". Of 466 posts that related to >1 a priori codes, 380 were attributed to 2 or 3 themes. Of those 380 posts, 352 (92.6%) overlapped both "annoyance" and "disruption," 13 (3.4%) overlapped both "disruption" and "aggression," and 9 (2.4%) overlapped "annoyance" and "aggression," while 6 (1.6%) intersected all 3 themes.

Conclusions: This study reports on the phenomena of cyberincivility in health-related MOOCs toward the education of future health care professionals. Despite the general view that discussion forums are a staple of the MOOC delivery system, students

cite discussion forums as a source of frustration for their potential to contain uncivil posts. Therefore, MOOC developers and instructors should consider ways to maintain a civil discourse within discussion forums.

(JMIR Med Educ 2018;4(2):e12152) doi:10.2196/12152

KEYWORDS

aggression; cyber incivility; discussion forums; education; massive open online courses

Introduction

Background

Cyberincivility—defined as disrespectful, insensitive, or disruptive internet behavior—is a pervasive problem. This widespread misbehavior can negatively affect personal, professional, and social well-being [1]. With the proliferation of online classes, more and more health professions students are exposed to these behaviors, which include negative comments about patients, peers, the work environment, or the profession itself; profanity, breaches of patient confidentiality, and discriminatory language can be found on social media sites, blogs, and even in Web-based discussion forums [1,2].

The problem is growing as an increasing number of learners are taking online courses to obtain their degrees and seek out distance-based learning for their personal and professional growth [3]. Despite the popularity of such courses and their potential to address geographical and financial barriers, the Web-based format can leave participants in the anonymity, asynchronicity, and casual instant discourse that characterizes cyberspaces [4]. As a result, discussions may be less effective than they would be if participants were face-to-face in a traditional classroom.

While participants have less anonymity and more personal relationships in a traditional closed online course in higher education, it is not the case when classes are open to the public and mostly free of charge as in massive open online courses (MOOCs) [5]. As such, MOOCs, by virtue of a large number of students and their anonymity, leave participants particularly susceptible and vulnerable to undesirable acts of incivility. However, no study has explored forms and patterns of cyberincivility in the MOOC environment, particularly in a health professions course. Thus, this study investigates this issue and discusses its implications for health professions education.

Pedagogy of Massive Open Online Courses

Although MOOCs have been available since 2008, their popularity blossomed in 2012 when Stanford University and Michigan Institute of Technology offered a joint course in artificial intelligence; some 160,000 individuals from around the world registered for the class [6,7]. Other disciplines including health professions rapidly followed suit. For example, Goldschmidt and Greene-Ryan created a mini MOOC titled "*Gateway to Online Learning* " aimed at registered nurses who had been in the field and out of the classroom for a long period [8]. They described their course as a tool to prepare nursing students for the rigors of Web-based learning and viewed MOOCs as a means of allowing more health profession students better access to higher education [8,9]. Liyanagunawardena et al agreed, calling *MOOCs an* effective strategy for gaining knowledge in the health care field [10]. However, MOOCs are not without controversy.

MOOCs differ from traditional and even online college classes in several key ways. First, learners who enroll are generally not required to complete prerequisite courses or demonstrate course readiness [5]. Second, course content is usually delivered through short videos, and there is little, if any, direct student-to-professor interaction [5,11]. This means that MOOCs rely more on peer-to-peer discussions to resolve questions and problems than a traditional course where an instructor would answer most questions [5]. Finally, MOOCs are more likely than traditional courses to be taken as stand-alone experiences [5]. Students in a MOOC may not have taken or do not plan to take other courses. They may not have the same writing or study skills that many college students have. This means that they may rely, to a greater extent, on class discussion forums for help with their coursework [12]. Thus, discussion forums play a key role in the MOOC environment, and ensuring civil exchanges is crucial to facilitate learning.

MOOCs offer a variety of communication platforms such as peer grading for feedback, automated feedback for quizzes, social networking, and asynchronous discussions [13]. Commonly used in almost all online courses, asynchronous discussion forums are a staple of the MOOC delivery system. Often unstructured, unsupervised, and with optional participation, a MOOC discussion forum is considered to be a means of developing a peer-supported learning environment [12]. In addition, discussion forums may contain some of the richest data because they allow students to engage in collaboration and cocreation of knowledge resources to reach mutual goals [12]. Furthermore, the asynchronicity of forum discussions gives students time to reflect and process information before they add their input [14]. However, the relative anonymity of discussion forums also seems to encourage less civil behaviors that could be destructive [15].

Objectives

This study aimed to examine the environment created by a medicine and health care MOOC by studying students' posts in the course's Web-based discussion forum. The objectives were to (1) examine the prevalence of posts deemed disrespectful, insensitive or disruptive, and inconducive to learning; (2) describe the patterns and types of uncivil posts; and (3) highlight aspects that could be useful for MOOC designers and educators to build a culture of cybercivility in the MOOC environment. The findings of this study will inform the parameters of future investigations and suggest preventive measures to deal with cyberincivility in the MOOC learning environment.

Methods

Context of the Study

The data used in this research came from the discussion forum of the MOOC *Medical Neuroscience*, offered by a large private university in the southeast region of the United States. Designed for first-year students in graduate-level health professions programs, this course was taught by a long-time professor in the university's physical therapy department [16]. Initially launched in 2014, this course was offered 4 times. Each time, students were required to take the course as a cohort, working at the same pace. In 2016, the course relaunched as an on-demand course in which students could take the course at their own pace. Students were loosely grouped into cohorts based on enrollment dates, but those who wanted to take more time to complete the course were automatically rolled over to the next cohort.

The sociodemographics of the learners enrolled in the course diverge in a few ways from the typical MOOC enrollment profile, and most of the university's MOOCs as well [17]. First, 50% of learners in the Medical Neuroscience MOOC were females; Bayeck's review of the literature found that that the number was typically around 43% [17]. Second, a much higher-than-average percentage of learners enrolled in the Medical Neuroscience MOOC were current students somewhere at the time of enrollment. Reportedly, the average of full-time students across all Coursera courses is 28% [17]. In this course, 41% of learners were full-time students, and another 11% were attending part-time. As a result of the course enrolling a higher percentage of current students, a lower-than-average percentage of participants already had a college degree (73% vs 77% Coursera average) or were employed (65% vs 74% Coursera average) [17]. Consistent with courses across the Coursera platform, 25% of learners were located in the United States. Because our sociodemographic data are based on a survey conducted by Coursera in 2014, individuals who joined Coursera after 2014 are not reflected in the data. While we have no evidence of a marked shift in the sociodemographics since then, there may be some differences in the numbers we report.

Data Collection

The data were collected on May 9, 2017. At that time, the course had already been available on demand for 11 months and had enrolled approximately 56,000 students. About 25% of these students subsequently became *active learners* in the course. Active learners are defined as students who enroll in a course and watch at least one video, attempt at least one assessment, or participate in the discussion forum as either author or viewer [18]. The course included a discussion forum where students could post information/questions, known as initiating posts, and respond to posts from other learners.

One of the biggest challenges associated with analyzing discussion forum data is that the data files contain a lot of "noise"—records that do not contain valid, user-entered data. In the files obtained for this analysis, out of 21,101 posts in the dataset, 12,396 (58.75%) were cleaned from the final research data file because they contained one or more types of invalid data. While this initially appears to be a high percent of missing data, it is typical for our Coursera courses given some of the technical difficulties inherent in how these data are recorded and retrieved. This is primarily attributed to the way data are stored in the structured query language files on the back-end of the course platform, in that most of these unusable data records never contained valid data. For example, if a learner clicks on a button to generate a reply to a discussion post and then cancels that action, a record remains in the dataset, indicating the initial attempt, but there are no valid data in the said record. The data file we obtained for this analysis records such events with empty HTML tags such as "<co-content><text></text></co-content>." We determined that these records were not valid data and, therefore, should be cleaned up without analysis. Other learner actions that generate data records, which are not analyzable, include creating a post that contains only symbols, images, emojis, or external links.

We identified 2 types of posts that potentially included valid data, but that we removed from our analysis. The first of these were duplicate posts that likely occurred owing to a technical problem on the user end. For example, the dataset contained 12 posts that all read, "I consider myself to be a lifelong learner and decided to take this course because it seemed interesting and challenging. Good luck to everyone!"; these were all posted within a span of about 10 seconds. In cases such as these, we retained only the first post and removed the duplicates from our dataset. Finally, we determined that some data records were truncated or recorded as a string of characters at the point that certain HTML codes were entered manually by a learner. If that happened at the beginning of a post, the subsequent data were lost. An example of this is a post that was recorded as, "<co-content><text>ÿ¨ÿ≤ÿßŸÉ ÿßŸÑŸÑŸá ÿÆŸäÿ±ÿß</text></co-content>." Because we have no way to reconstruct what this post originally said, we deleted it from the dataset.

Thus, the final dataset in our analysis included 41.25% (8705/21,101) posts consisting of the following: (1) 667 questions that received no responses; (2) 756 questions that received at least one answer; (3) 6921 responses that applied to 756 posts; and (4) 361 responses where the initiating post was unknown (Figure 1).

Data Analysis and Rigor

Data management and analysis were performed with NVivo 12 (QSR International Pty Ltd.). The unit of analysis was each post in a MOOC discussion thread. For analysis, posts were organized by question title, question text, and answer text. A comment in the forum may contain any combination of question title, question text, and answer text. In other words, if a comment included a question title and question text, it was coded and counted as 2 posts.

Uncivil Web-based behavior is that which does not conform to norms or values held by most members of society [19]. In analyzing 8705 posts, we considered uncivil posts as "features of discussion that convey an unnecessarily disrespectful tone toward the discussion forum, its participants, or its topics" [20]. Our definition is consistent with the definition of cyberincivility set forth by De Gagne et al [1]. Putting this definition in the context of MOOC learning, the coding team sorted out uncivil posts first. When gray areas existed, the coding team members

asked themselves whether they would have posted such a comment (considering both content and communication style) in the discussion forum; if their answer was no, then the comments were coded as uncivil. Using the iterative process of coding, a series of *a priori* codes were developed from the conceptual framework [20-22], the systematic review [1], and the empirical studies of cyberincivility [23,24] (Figure 2).

Figure 1. Data file record types.

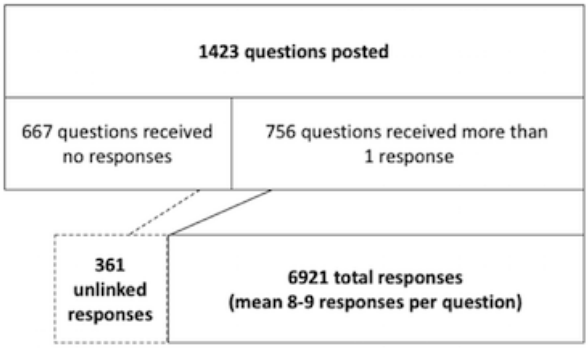
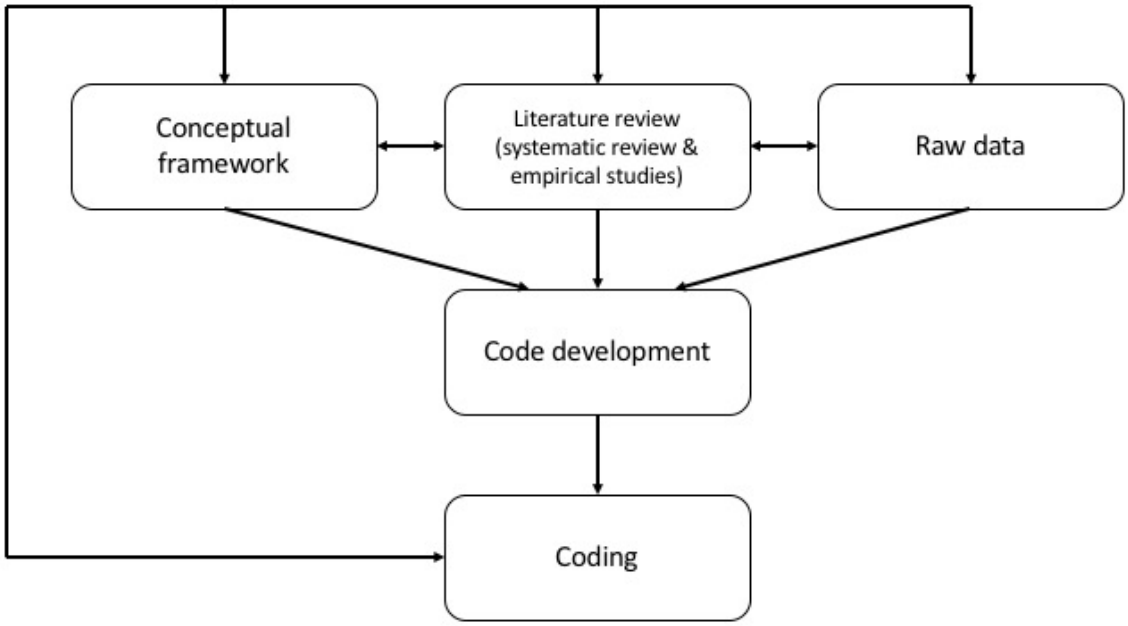


Figure 2. Iterative process of coding.



Textbox 1. Codebook: A list of codes and their definitions as needed (a priori codes (1-25); emergent codes (26-27); *a priori codes not found in this study).

1. Ambiguous or vague responses (a lack of clarity in meaning, imprecise, or unclear use of language)
2. Becoming offended easily by opposing ideas posted on Web (being unnecessarily critical or unfriendly toward others)*
3. Blaming technology for failure of communication, assignment completion, or submissions
4. Breaching patient's privacy*
5. Challenging faculty knowledge or credibility
6. Cheating on exams or quizzes
7. Criticizing course or instructor publicly
8. Criticizing non-traditional sub-cultures (negativism toward groups other than one's own)
9. Derogatory remarks about another profession*
10. Derogatory remarks about one's institution*
11. Does not contribute to the conversation (lacking responsiveness and engagement)
12. Does not relate to content (off topic)
13. Failing to complete assignments in a timely manner
14. Failing to fulfill group responsibilities
15. Flooding a Web-based environment with comments or messages
16. Making personal attacks or threatening comments*
17. Making racial, ethnic, sexual, or religious slurs*
18. Posting others' personal information*
19. Posting short, terse responses (abrupt posts that do not add meaning to the discussion)
20. Refusing to participate in required Web-based discussions
21. Spelling or grammar errors, incomplete sentences
22. Taking credit for others' work (not giving proper credit for someone else's ideas)*
23. Too casual (use of smiley faces or linguistic shortcuts, joking, colloquial, too personal)
24. Using displays of attitude such as capitalizing or boldfacing
25. Vulgarity (use of cursing, swearing, or profane words or foul languages or expressions)
26. Posting in a non-English language
27. Making a provocative statement (remarks that trigger emotional reactions)

In addition, each coder's reflective, analytic memos enhanced interpretations of the findings [25]. Most codes were self-explanatory, while others needed to be defined in the context of the study. The team collaboratively developed a set of short definitions for each code to ensure for clarity and consistency in the analysis (Textbox 1). Among the codes presented in the textbox, 1-25 are *a priori* codes (of which 2, 4, 9, 10, 16-18, and 22 were not found in this study) and 26-27 are emergent codes.

Coders (BEH, HKP, and JCDG) had regular meetings and cross-checked the codes to ensure a high degree of reliability [26]. They coded the posts to uncivil posts based on the *a priori* codes, then compared their results, and discussed disagreements, as well as emergent codes. Using the consensus approach, the team agreed to all codes applied to all posts flagged as uncivil [27].

After coding each post, the team collaboratively structured all codes into themes. Clark's conceptualization of the *continuum of incivility* guided the development of 3 broader themes—annoyance, disruption, and aggression—depending on the degree and impact of the uncivil posts [28]. Annoying posts were defined as those that did not interrupt the teaching and learning process but may have had an impact on the learning environment [22]. Disruptive posts were those that substantially or repeatedly impeded either the instructor's ability to teach or the students' ability to learn [29]. Aggressive posts were defined as those amounting to intimidation, humiliation, violence, or breach of confidentiality, all of which being likely to bring emotional pressure on members of a teaching and learning community [22]. Posts that contained >1 kind of *a priori* codes were assigned multiple codes.

Results

Prevalence of Uncivil Postings

Of 8705 posts included in the analysis, 1043 (11.98%) were considered as the presence of uncivil posts and 7333 (84.24%)

as the absence of uncivil posts, while 329 (3.78%) were treated as missing data as they were uncodable (ie, HTML code, random characters, repeated entries that indicate a data processing error). As shown in Textbox 1, of 25 *a priori* codes, 8 were not present in this study, and 2 new codes emerged (ie, posting in a non-English language and making a provocative statement). These 19 *a priori* codes were organized under the themes of *annoyance*, *disruption*, and *aggression*. Of 1043 uncivil posts, 466 were coded into >1 *a priori* codes, which rendered 1509 instances. Of those 1509 total instances, 826 (54.74%) were put into annoyance, 648 (42.94%) into disruption, and 35 (2.32%) into aggression. Figure 3 depicts the occurrences of each code in each theme.

Annoyance

Of 826 instances that were in the "annoyance" theme, short or terse responses were most common, followed by too casual (eg, "jajaja, i agree with you."). About one-fifth of posts contained ambiguous or vague responses (eg, "why we call the eyes the window of soul. It is because retina derived from brain [diencephalon], so our thought process reflected in eyes, either we say true or false"). Less common were posts that contained spelling or grammar errors, blamed technology for a miscommunication, and failed to submit or complete an assignment in a timely manner.

Disruption

Of 648 instances in the "disruption" theme, posts that did not contribute to the discussion were most common. In addition, students posted comments that were not related to the course content. For instance, one post declared, "I just stop in front of the amazing brain which God give us and I can say how much is the mighty of God!!!" Students also refused to participate in the discussion by posting, for example, "sorry, I'm not into this kind of task." Some openly disclosed acts of academic dishonesty. For example, "I only skimmed through the first week and took the quiz without watching all the videos. Is there any way to mark the videos as watched without watching them?" Posts that flooded the discussion forum with self-bragging or complaints and failed to fulfill group responsibilities or group assignments were also found.

Aggression

A total of 35 instances in the "aggression" theme were divided into 3 scales of aggression based on the scope of impact—(1) microaggression (individuals or group members); (2) mesoaggression (the learning community as a whole); and (3) macroaggression (societal or global effect outside of the learning environment). First, as shown in Figure 3, microaggressive comments were present but uncommon (eg, "Damn, this is a lot of information to learn in one week...someone got any tips?"). Second, mesoaggressive comments were found more frequently. The most common type of mesoaggression was a criticism of the course or instructor (eg, "I will complete this course of study for merit. There are high school students that are studying Neuroscience at an equivalent level. Disappointed."), followed by displaying aggressiveness by capitalizing or boldfacing. In addition, challenging of faculty knowledge or credibility was noted.

Figure 3. Themes and frequencies of uncivil postings.

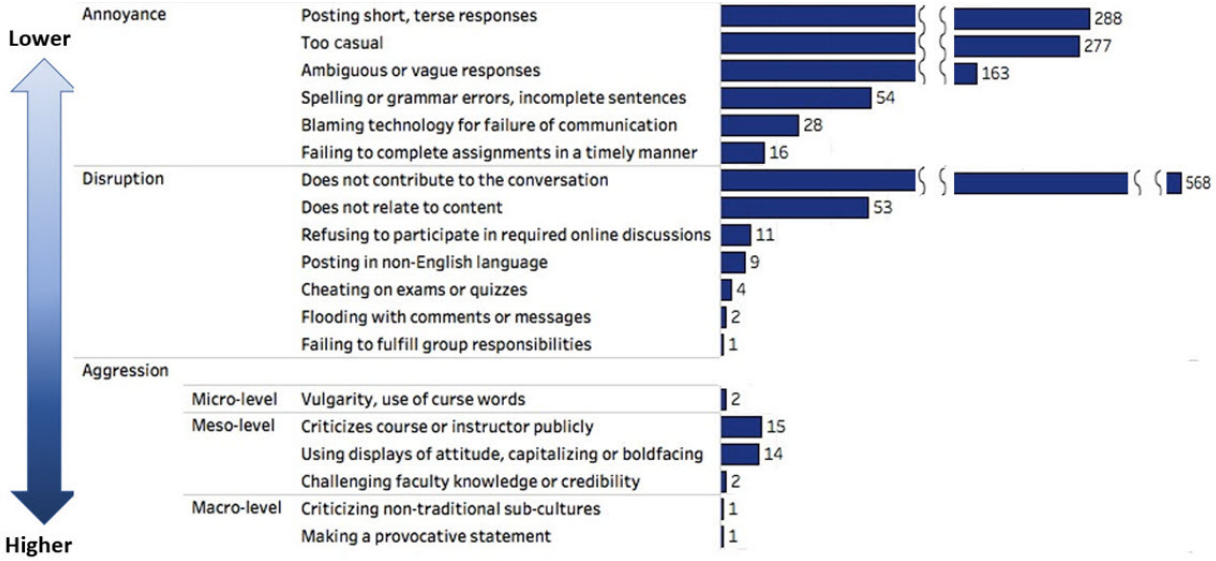
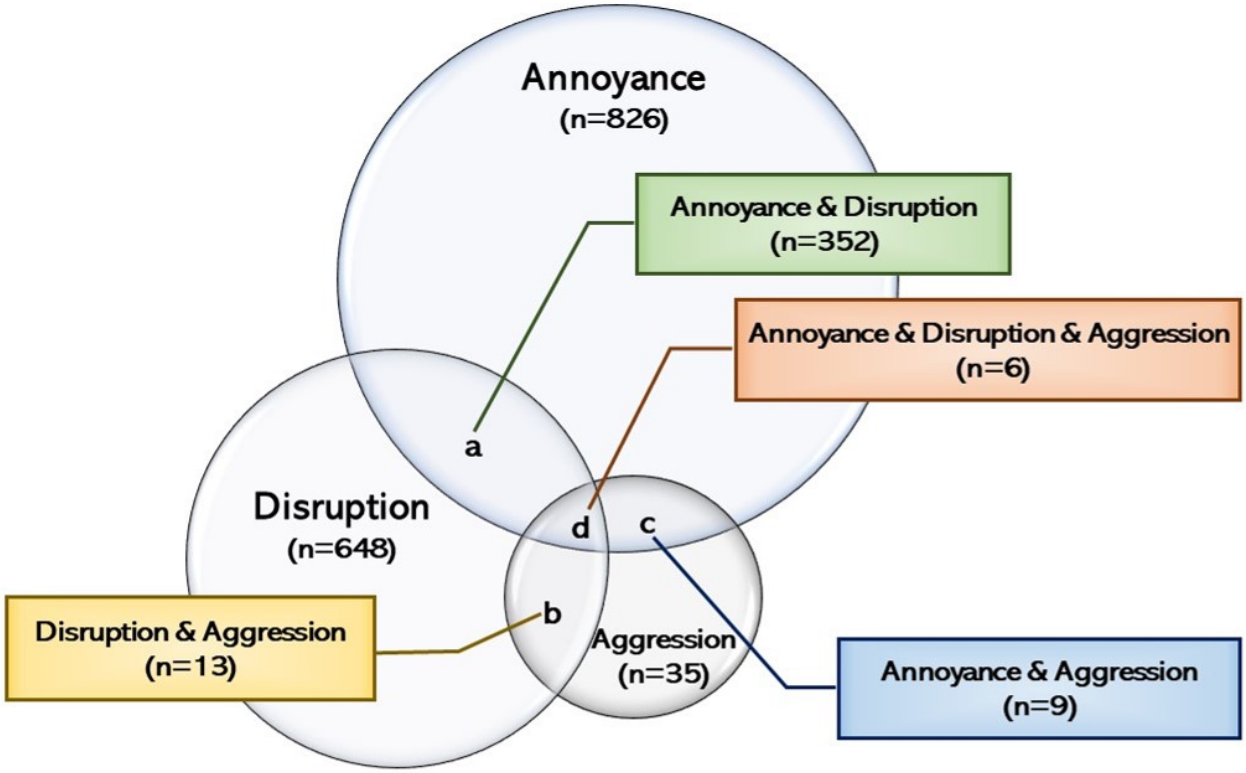


Figure 4. Overlaps between annoyance, disruption, and aggression.



Finally, 2 posts revealed macroaggression. One post criticized nontraditional subcultures as in "My apologies to our Chinese colleagues—I realize my above comment just sounded horrible." The other made a provocative statement in regard to a discussion thread, saying "a person is no longer a person, if they become disabled (or belong to a group persecuted in Nazi Germany)... The Nazi's believed that homosexuals, mentally retarded, deformed individuals (ugly), gypsies, Jews and others were non-persons...the Nazi's systematically murdered (exterminated) those persons." While this post was confusing and it was difficult to discern the intention of posting, the coding team considered it a substantial risk to conflict within and outside the learning environment.

Patterns of Uncivil Posting

While some posts were coded to have only one type of *a priori* code, 466 posts had >1 code. Of those 466, 380 posts were attributed to 2 or 3 themes. Within those 380, 352 (92.6%) overlapped both "annoyance" and "disruption," 13 (3.4%) overlapped both "disruption" and "aggression," 9 (2.4%) overlapped both "annoyance" and "aggression," while 6 (1.6%) intersected all 3 themes (Figure 4).

Annoyance and Disruption (n=352)

The heaviest overlap was between the disruption and annoyance groups (n=344). A further breakdown of posts "not contributing to the conversation" revealed that most posts were too casual (n=232), ambiguous or vague (n=42), contained spelling or grammar errors, or incomplete sentences (n=25), and blamed technology for a communication failure (n=24). For example, this post was coded as not contributing to the conversation (disruption) and too casual (annoyance): "I meant to type idea...not Ida. Ugh, the autocorrect feature on my iPad touch keyboard is killing me! Lol." A few posts considered "too casual" also signaled a refusal to participate in required Web-based discussions (n=7). Examples of these posts were "Not now, thanks!" or "SORRY, NO TIME."

Disruption and Aggression (n=13)

Most disruptive uncivil behaviors in the discussion forum overlapped with mesoaggression (n=12). Within mesoaggression, posts criticizing the course or instructor publicly and posts using displays of attitude were the most frequent. For instance, the most common intersection of coding was between posts criticizing the course or instructor publicly and posts not contributing to the conversation (n=4). One such post asked, "How can I follow if the lecturer is online or offline? or does the lectures occur in a way of offline that there is no active online classes? someone make me to understand that point plz..." Four posts were coded to displays of attitude (mesoaggression), as well as not contributing to the conversation (disruption), such as "FASTER" or "ITS GOOD LECTURE." Within macroaggression, one post was coded as both not contributing to conversation and making a provocative statement. One post was coded to disruption and macroaggression, and no posts were coded to disruption and microaggression.

Annoyance and Aggression (n=9)

Uncivil posts that fell into the annoyance group overlapped with the meso level of aggression; nothing was coded to annoyance and microaggression or macroaggression. Within mesoaggression and annoyance, 7 posts criticized the course or instructor publicly and were considered annoying. One example, "IT IS POSSIBLE TO EXTEND THE TIME FOR THE COURSE OF THIS FIRST WEEK BECAUSE FOR ME IT IS

A LITTLE MORE SLOW TRANSLATION AND THIS SO INTERESTING THAT I SHOULD GO TAKE NOTE I WOULD APPRECIATE YOUR HELP," was coded as failing to complete assignments in a timely manner (annoyance) and using displays of attitude, capitalizing, or boldfacing (mesoaggression).

Annoyance, Disruption, and Aggression (n=6)

Six posts were coded as all 3 types of uncivil behavior. For example, a post stating that the course was "too hard" was coded as too casual (annoyance), short, terse responses (annoyance), does not contribute to the conversation (disruption), and criticizes course or instructor publicly (mesoaggression). Another post, "I didnt [sic] realise I should delete my name and retype it. Now I miss my deadline. I feel like quitting. Not fair!" was coded as blaming technology (annoyance), does not contribute to the conversation (disruption), and criticize course or instructor publicly (mesoaggression).

Discussion

Principal Findings

Using the data from Web-based discussion forums, this study investigated the prevalence, content, and characteristics of uncivil posts made by students in the MOOC Medical Neuroscience. Results indicate that the majority of posts in our sample contained no uncivil behavior. Those that did tended to be annoying and disruptive rather than aggressive. This finding suggests that, overall, students participating in the MOOC used the discussion forum appropriately to engage in the material with others. With that said, the most prevalent form of uncivil posts was "does not contribute to the conversation" (568/1509, 37.64%), suggesting that students did not always use the discussion forum effectively for learning purposes.

These findings are similar to those of other studies. Bonafini et al analyzed forum posts in a Creativity, Innovation, and Change MOOC and found learners' posts to be mostly "polite and friendly" [30]. While the researchers did not analyze the relevancy of posts, they did analyze the level of learning and determined that the posts indicated students were learning about each other and the content, but not demonstrating deep learning or critical thinking. Within a closed Web-based forum experiment, Berg compared posts on a controversial topic with a noncontroversial topic in both an anonymous and nonanonymous format; the researcher found no posts coded for incivility (defined as verbalizing threats or assigning stereotypes) and a more respectful tone present in the forum around the controversial topic regardless of anonymity [31]. In addition, irrelevant posts were common at 14% for the controversial topic and 8% for the noncontroversial, suggesting that topic had a larger impact on the discussion quality while anonymity had no effects [31]. A future study may be warranted to explore how controversial topics would affect the quality of discussion forum in a MOOC environment.

Our study did not reveal 8 *a priori* codes that were widely addressed in cyberspace (see Textbox 1); this could be attributed to a number of factors. Foremost, it is likely that our population of premed students were not yet working with other medical personnel to care for patients. Therefore, they had no ability to breach a patient's privacy, such as by sharing their real-world experiences. In addition, they would have had no remarks—derogatory or not—to share regarding another professional or their own institution. The anonymity of the MOOC environment itself, perhaps, led to the absence of posting others' personal information and taking credit for others' work, which may be easier to do in an environment where learners know each other. The absence of several codes, namely becoming offended by opposing ideas, making personal attacks, and making racial, ethnic, sexual, or religious slurs may relate to the content of the MOOC itself. For example, Coe et al found that papers centered on health topics garnered a lot fewer uncivil posts in a Web-based news forum than did topics such as sports, politics, economics, crime, and taxes [20]. The characteristics of the population and the nature of the subject might explain why certain uncivil behaviors found in Web-based discussions were absent in our study findings.

The 2 emergent codes in this study occurred infrequently and relate to 2 separate phenomena. The first—posting in non-English language (n=9, 0.6%)—was considered a disruption to the learning environment where the use of English was expected in Web-based forums. Considering that 75% of learners in this study were located outside the United States, its infrequency is somewhat surprising. However, other studies show that nonnative English-speaking students forgo posting in Web-based forums when they lack confidence in their English writing skills [32], when their cultures do not place a high value on dialogue [33], and when their learning preferences do not include group discussions [32]. Therefore, it could be that nonnative speakers opted not to post questions, thereby reducing the instances of this emergent code. Likewise, some international students, including Koreans, may learn English with a focus on correct grammar rather than on speaking and listening skills; these students may decide not to post to forums [32]. In this study, there were 3.58% (54/1509) of spelling and grammar errors that could be interpreted as an annoyance to other learners; these instances may prove to be a minor price for the much larger added benefit of encountering diverse perspectives from a variety of countries.

The second emergent code, making a provocative statement, occurred only once but is noted to highlight the potential harm of this form of incivility. We defined provocative statements as those that trigger emotional reactions. Gervais considered similar statements when conducting an experiment to study incivility in an Web-based forum with a political topic [34]; in this study, participants were subjected to uncivil posts, including extreme statements and hyperbolic spins defined as "use of an inflammatory word or phrase that makes individual or action seem more radical, immoral, or corrupt," as well as histrionics, which included language suggesting an "individual or group should be feared or is responsible for sadness" and the inclusion of emotional cues like the use of exclamation points and uppercase letters [34]. Histrionics, especially the added exclamation points and capitalization, heightened feelings of anger, and offensiveness led to more uncivil reactions. Although this study was specific to political discourse, it shows the

importance of paying close attention to this type of behavior within MOOC discussion forums.

The Web-based discussion forum is one of many ways for students to engage in the learning material within MOOCs. Studies indicate that students differ in their levels of participation in forums, assessments, and lecture content [35], and those who participate in discussion forums tend to have higher completion rates [30,35-37]. At the same time, students identify discussion forums as a source of frustration for their potential to contain rude posts and cause information overload owing to their sheer volume [38]. In response, MOOC developers and instructors would do well to maintain a civil discourse within discussion forums and decrease off-topic and redundant posts and discussion threads.

To minimize irrelevant posts and decrease the volume of learner-created threads, instructors could prepopulate forums with threads related to specific weekly content or themes [38]. In addition, instructors could clearly label threads meant to answer students' course-related questions from those meant to engage other students in topical discussions. This way, instructors can intentionally create discussion prompts that would lead to conversations consisting of higher levels of learning—from critical thinking to applying course concepts [30].

MOOC instructors can increase their presence by interacting with students in Web-based forums. Effective ways of doing so include beginning with a greeting, using learners' names, and incorporating self-disclosure of one's own real-world experiences, opinions, and values [39]. In addition, instructors can hire and train teaching assistants to monitor discussion forums, to answer students' questions promptly, and to steer conversation as needed [40]. MOOC instructors might best support a culturally inclusive learning environment with additional visual and audio aids [41], translating content into one or more languages [40], and facilitating multicultural learning communities within Web-based discussion forums [42]. Scheduling live video-streamed discussions would provide students—native and nonnative speakers alike—another opportunity to engage with the course content and the instructors in a different format [38]. To further support students, these live discussions could be held at varying times throughout the week and recorded for asynchronous viewing [43].

Limitations

This study has several limitations. First, our findings represent a single MOOC enrolling learners interested in neuroscience. Therefore, our analysis may not be representative of other MOOCs, including those focused on the humanities, social sciences, and other subject disciplines. Second, our analysis of posts lacked context; in other words, we were unable to read posts in the order in which they were posted to determine how an uncivil post affected later posts. Third, our data were deidentified, and as anyone can enroll in a MOOC, we could not discern if a particular post represented a single person or possibly multiple individuals enrolling in the MOOC and working together. Finally, it is difficult to standardize personal opinions about what interactions are considered uncivil in Web-based communication—especially in a MOOC environment.

Future Directions

Further studies might compare our findings to those in other MOOCs. It could be that certain courses, such as one focused on politics or current events, would garner more instances of incivility. One study, for example, found a higher prevalence of incivility (22%) in Web-based discussions on the Arizona Daily Star Web-based news site compared with the prevalence of incivility we found (12.0%) [21]. It would be worth determining if the topic area or the platform had more to do with the prevalence of incivility. Another study found a much lower prevalence of incivility (4.6%) when analyzing 8934 tweets from nurses and nursing students [44]. Nurses were involved in uncivil behavior that included profanity, product promotion that lacked evidence, and both interprofessional and intraprofessional aggression. Therefore, it would also be worthwhile to study a MOOC geared more toward health professionals and others working in the field to determine whether the prevalence and types of incivility would shift from those found in our study.

Conclusions

To the best of our knowledge, this is the first study to explore the phenomena of cyberincivility in the health-related MOOC toward the education of future health care professionals. In the current age of interconnectivity and the internet, cyberincivility is a challenging concept as it is difficult to create a set of universal standards for what we as educators and students consider civil or uncivil cyber behavior. However, there are certainly gross examples of cyberincivility in almost all forms of Web-based communication. Many of these issues arise during every day in-person communication as well, but the lack of face-to-face interaction on Web exacerbates the problem. In addition, owing to the worldwide reach of MOOCs, differences in culture and language often lead to misinterpretations. While accessibility and affordability add to the attractiveness of MOOCs in health professions education, the relative anonymity of this environment may encourage bolder and less civil discussions than those occurring in closed online courses. Our findings contribute to the body of knowledge into a deeper understanding of cyberincivility in Web-based learning; these also offer some insights useful both to MOOC designers and educators in enhancing student learning. It would be worthwhile to conduct more empirical research that explores issues around cyberincivility, their possible impacts, and the implications for MOOC practitioners. This type of work may help education policy makers to understand better how to create a culture of cybercivility in the MOOC environment.

Acknowledgments

The authors would like to thank the Duke University Compact for Open Access Publishing Equity program for its support of the open access publication of this manuscript. This research was funded by a 2017-2018 Duke Learning Innovation MOOC Research Grant awarded to JCDG.

Authors' Contributions

JCDG, KM, and JMK designed the study and drafted the introduction. KM, a Head of Evaluation and Learner Experience Research, cleaned and migrated a big dataset from the massive open online course discussion forum and drafted the context of study and data collection. JCDG, BEH, and HKP constituted the coding team that developed codes and analyzed the data iteratively. JCDG, HKP, and NWR drafted data analysis and the results. JCDG and JLC interpreted the results and drafted the discussion and conclusion.

Conflicts of Interest

None declared.

References

1. De Gagne JC, Choi M, Ledbetter L, Kang HS, Clark CM. An Integrative Review of Cybercivility in Health Professions Education. Nurse Educ 2016;41(5):239-245. [doi: 10.1097/NNE.0000000000000264] [Medline: 27022683]
2. De Gagne JC, Yamane SS, Conklin JL, Chang J, Kang HS. Social media use and cybercivility guidelines in U.S. nursing schools: A review of websites. J Prof Nurs 2018;34(1):35-41. [doi: 10.1016/j.profnurs.2017.07.006] [Medline: 29406136]
3. Siri A, Rui M. Distance Education for Health Professions' Students. Procedia - Social and Behavioral Sciences 2015 Feb;174:730-738. [doi: 10.1016/j.sbspro.2015.01.608]
4. Wankel L, Wankel C. Misbehavior online in higher education. In: Misbehavior Online in Higher Education. UK: Emerald Group Pub Ltd; 2018.
5. Zhan Z, Fong P, Mei H, Chang X, Liang T, Ma Z. Sustainability Education in Massive Open Online Courses: A Content Analysis Approach. Sustainability 2015 Feb 25;7(3):2274-2300. [doi: 10.3390/su7032274]
6. Chapman SA, Goodman S, Jawitz J, Deacon A. A strategy for monitoring and evaluating massive open online courses. Eval Program Plann 2016 Dec;57:55-63. [doi: 10.1016/j.evalprogplan.2016.04.006] [Medline: 27213994]
7. Mahraj K. Using Information Expertise to Enhance Massive Open Online Courses. Public Services Quarterly 2012 Oct;8(4):359-368. [doi: 10.1080/15228959.2012.730415]
8. Goldschmidt K, Greene-Ryan J. A "Mini MOOC": Outcomes of a gateway introductory course for online learners. 2013 Presented at: 7th International Technology, Education and Development Conference; Mar 4-5, 2013; Valencia, Spain.
9. Goldschmidt K, Greene-Ryan J. Massive open online courses in nursing education. J Pediatr Nurs 2014;29(2):184-186. [doi: 10.1016/j.pedn.2013.12.001] [Medline: 24412250]
10. Liyanagunawardena T, Adams A, Williams S. MOOCs: A systematic study of the published literature 2008-2012. 2013. URL: http://centaur.reading.ac.uk/33109/6/MOOCs_%20AsystematicStudyOfThePublishedLiterature2008-2012.pdf [WebCite Cache ID 74UT6xKnD]
11. Hansen JD, Reich J. Democratizing education? Examining access and usage patterns in massive open online courses. Science 2015 Dec 04;350(6265):1245-1248. [doi: 10.1126/science.aab3782] [Medline: 26785488]
12. Zhang J, Skryabin M, Song X. Understanding the dynamics of MOOC discussion forums with simulation investigation for empirical network analysis (SIENA). Distance Education 2016 Sep 05;37(3):270-286. [doi: 10.1080/01587919.2016.1226230]
13. Rehfeldt RA, Jung HL, Aguirre A, Nichols JL, Root WB. Beginning the Dialogue on the e-Transformation: Behavior Analysis' First Massive Open Online Course (MOOC). Behav Anal Pract 2016 Mar;9(1):3-13 [FREE Full text] [doi: 10.1007/s40617-015-0102-z] [Medline: 27606235]
14. De Gagne JC. Teaching in online environments. In: Teaching in nursing and role of the educator: the complete guide to best practice in teaching, evaluation, and curriculum development. New York: Springer; 2018:95-111.
15. De Gagne JC, Yamane SS, Conklin JL. Evidence-based strategies to create a culture of cybercivility in health professions education. Nurse Educ Today 2016 Oct;45:138-141. [doi: 10.1016/j.nedt.2016.07.007] [Medline: 27472429]
16. Coursera. 2018. Medical Neuroscience URL: https://www.coursera.org/learn/medical-neuroscience [accessed 2018-08-29] [WebCite Cache ID 721crXxwe]
17. Bayeck R. Open Praxis. 2016. Exploratory study of MOOC learners' demographics and motivation: The case of students involved in groups URL: https://oerknowledgecloud.org/sites/oerknowledgecloud.org/files/282-1432-2-PB.pdf [WebCite Cache ID 74UTIl6a8]
18. Khalil M. arXiv.org e-Print archive. Learning Analytics in Massive Open Online Courses URL: https://arxiv.org/abs/1802.09344 [accessed 2018-06-11] [WebCite Cache ID 7067gEAkN]
19. Sternberg J. Misbehavior in Cyber PlacesMisbehavior in cyber places: The regulation of online conduct in virtual communities on the internet. Lanham, MD: University Press of America; 2012.

20. Coe K, Kenski K, Rains S. Online and Uncivil? Patterns and Determinants of Incivility in Newspaper Website Comments. J Commun 2014 Jun 16;64(4):658-679. [doi: 10.1111/jcom.12104]
21. Clark CM, Werth L, Ahten S. Cyber-bullying and incivility in the online learning environment, Part 1: Addressing faculty and student perceptions. Nurse Educ 2012;37(4):150-156. [doi: 10.1097/NNE.0b013e31825a87e5] [Medline: 22688872]
22. Feldmann LJ. Classroom Civility is Another of Our Instructor Responsibilities. College Teaching 2014 Jun 11;49(4):137-140. [doi: 10.1080/87567555.2001.10844595]
23. De Gagne JC, Conklin JL, Yamane SS, Kang HS, Hyun M. Educating Future Health Care Professionals About Cybercivility: Needs Assessment Study. Nurse Educ 2018;43(5):256-261. [Medline: 29206713]
24. De Gagne JC, Covington K, Conklin JL, Yamane SS, Kim SS. Learning Cybercivility: A Qualitative Needs Assessment of Health Professions Students. J Contin Educ Nurs 2018 Sep 01;49(9):425-431. [doi: 10.3928/00220124-20180813-08] [Medline: 30148540]
25. Creswell J, Creswell J. Research design: Qualitative, quantitative, and mixed methods approaches. Thousand Oaks, California: Sage Publications; 2018.
26. DeCuir-Gunby JT, Marshall PL, McCulloch AW. Developing and Using a Codebook for the Analysis of Interview Data: An Example from a Professional Development Research Project. Field Methods 2010 Dec 27;23(2):136-155. [doi: 10.1177/1525822X10388468]
27. Hays D, Singh A. Qualitative inquiry in clinical and educational settings. New York City: Guilford Press; 2011.
28. Clark CM, Barbosa-Leiker C, Gill L, Nguyen DT. Division of Research and Economic Development. 2015. Continuum of Incivility URL: https://research.boisestate.edu/ott/files/2015/08/Continuum-of-Incivility1.pdf [WebCite Cache ID 721eQEEOx]
29. Teaching and Learning Transformation Center. University of Maryland: Teaching & Learning Transformation Center. Disruptive, Demanding or Threatening Student Behavior URL: https://tltc.umd.edu/disruptive-demanding-or-threatening-student-behavior [accessed 2018-08-02] [WebCite Cache ID 71Miwlfbg]
30. Bonafini FC, Chae C, Park E, Jablokow KW. How Much Does Student Engagement with Videos and Forums in a MOOC Affect Their Achievement? OLJ 2017 Dec 01;21(4). [doi: 10.24059/olj.v21i4.1270]
31. Berg J. The impact of anonymity and issue controversiality on the quality of online discussion. Journal of Information Technology & Politics 2016 Mar 07;13(1):37-51. [doi: 10.1080/19331681.2015.1131654]
32. Cho M, Byun M. IRRODL. 2017. Nonnative English-speaking students' lived learning experiences with MOOCs in a regular college classroom URL: https://files.eric.ed.gov/fulltext/EJ1152006.pdf [WebCite Cache ID 74UTbN06B]
33. Liu Z, Brown R, Lynch C, Barnes T, Baker R, Bergner Y, et al. MOOC Learner Behaviors by Country and Culture; an Exploratory Analysis. In: educationaldatamining.org. 2016 Presented at: Proceedings of the 9th International Conference on Educational Data Mining; June 29-July 2, 2016; Raleigh, NC, USA URL: http://www.educationaldatamining.org/EDM2016/proceedings/paper_121.pdf
34. Gervais BT. Incivility Online: Affective and Behavioral Reactions to Uncivil Political Posts in a Web-based Experiment. Journal of Information Technology & Politics 2015 Jan 14;12(2):167-185. [doi: 10.1080/19331681.2014.997416]
35. Kahan T, Soffer T, Nachmias R. Types of Participant Behavior in a Massive Open Online Course. IRRODL 2017 Sep 25;18(6):1-18. [doi: 10.19173/irrodl.v18i6.3087]
36. Gillani N, Eynon R. Communication patterns in massively open online courses. The Internet and Higher Education 2014 Oct;23:18-26. [doi: 10.1016/j.iheduc.2014.05.004]
37. Swinnerton BJ, Morris NP, Hotchkiss S, Pickering JD. The integration of an anatomy massive open online course (MOOC) into a medical anatomy curriculum. Anat Sci Educ 2017 Jan;10(1):53-67. [doi: 10.1002/ase.1625] [Medline: 27315160]
38. Hew K. Unpacking the strategies of ten highly rated MOOCs: Implications for engaging students in large online courses. Teach Coll Rec 2018;120(1).
39. Watson S, Watson W, Janakiraman S, Richardson J. IRRODL. 2017. A team of instructors' use of social presence, teaching presence, and attitudinal dissonance strategies: An animal behaviour and welfare MOOC URL: https://files.eric.ed.gov/fulltext/EJ1138906.pdf [WebCite Cache ID 74UTekqDr]
40. Ding Y, Wang M, He Y, Ye AY, Yang X, Liu F, et al. "Bioinformatics: introduction and methods," a bilingual Massive Open Online Course (MOOC) as a new example for global bioinformatics education. PLoS Comput Biol 2014 Dec;10(12):e1003955 [FREE Full text] [doi: 10.1371/journal.pcbi.1003955] [Medline: 25503717]
41. Liu X, Liu S, Lee S, Magjuka R. Cultural differences in online learning: International student perceptions. Educ Technol Soc 2010;13(3):177-188.
42. Colas J, Sloep PB, Garreta-Domingo M. The Effect of Multilingual Facilitation on Active Participation in MOOCs. IRRODL 2016 Jul 08;17(4). [doi: 10.19173/irrodl.v17i4.2470]
43. Pickering JD, Henningsohn L, DeRuiter MC, de JPGM, Reinders MEJ. Twelve tips for developing and delivering a massive open online course in medical education. Med Teach 2017 Jul;39(7):691-696. [doi: 10.1080/0142159X.2017.1322189] [Medline: 28485629]
44. De Gagne JC, Conklin J, Hall K, Yamane S, Kim S. Cyberincivility: Nurses and nursing g students on Twitter. 2018 Presented at: Sigma Theta Tau International 29th International Nursing Research Congress; July 19-23, 2018; Melbourne, Australia.

Abbreviations

MOOC: massive open online course

Edited by G Eysenbach; submitted 08.09.18; peer-reviewed by M Hoy, E Toki; comments to author 24.10.18; revised version received 31.10.18; accepted 31.10.18; published 21.12.18.

Please cite as:
De Gagne JC, Manturuk K, Park HK, Conklin JL, Wyman Roth N, Hook BE, Kulka JM
Cyberincivility in the Massive Open Online Course Learning Environment: Data-Mining Study
JMIR Med Educ 2018;4(2):e12152
URL: http://mededu.jmir.org/2018/2/e12152/
doi:10.2196/12152
PMID:30578221

Original Paper

How an Environment of Stress and Social Risk Shapes Student Engagement With Social Media as Potential Digital Learning Platforms: Qualitative Study

Becky Hartnup[1], BSc Econ, MBA; Lin Dong[1*], BA (Hons), MSc; Andreas Benedikt Eisingerich[1*], BSc, MPhil, PhD

Imperial College Business School, Imperial College London, London, United Kingdom

[*]these authors contributed equally

Corresponding Author:
Lin Dong, BA (Hons), MSc
Imperial College Business School
Imperial College London
South Kensington Campus
London, SW7 2AZ
United Kingdom
Phone: 44 020 7589 5111
Email: lin.dong13@imperial.ac.uk

Abstract

Background: Social media has been increasingly used as a learning tool in medical education. Specifically, when joining university, students often go through a phase of adjustment, and they need to cope with various challenges such as leaving their families and friends and trying to fit into a new environment. Research has shown that social media helps students to connect with old friends and to establish new relationships. However, managing friendships on social media might intertwine with the new learning environment that shapes students' online behaviors. Especially, when students perceive high levels of social risks when using social media, they may struggle to take advantage of the benefits that social media can provide for learning.

Objective: This study aimed to develop a model that explores the drivers and inhibitors of student engagement with social media during their university adjustment phase.

Methods: We used a qualitative method by interviewing 78 undergraduate students studying medical courses at UK research-focused universities. In addition, we interviewed 6 digital technology experts to provide additional insights into students' learning behaviors on social media.

Results: Students' changing relationships and new academic environment in the university adjustment phase led to various factors that affected their social media engagement. The main drivers of social media engagement were maintaining existing relationships, building new relationships, and seeking academic support. Simultaneously, critical factors that inhibited the use of social media for learning emerged, namely, collapsed online identity, uncertain group norms, the desire to present an ideal self, and academic competition. These inhibitors led to student stress when managing their social media accounts, discouraged them from actively engaging on social media, and prevented the full exploitation of social media as an effective learning tool.

Conclusions: This study identified important drivers and inhibitors for students to engage with social media platforms as learning tools. Although social media supported students to manage their relationships and support their learning, the interaction of critical factors, such as collapsed online identity, uncertain group norms, the desire to present an ideal self, and academic competition, caused psychological stress and impeded student engagement. Future research should explore how these inhibitors can be removed to reduce students' stress and to increase the use of social media for learning. More specifically, such insights will allow students to take full advantage of being connected, thus facilitating a richer learning experience during their university life.

(JMIR Med Educ 2018;4(2):e10069) doi:10.2196/10069

KEYWORDS

social media; online learning; digital engagement; stress; social risk; digital platforms; education; university adjustment

Introduction

Background

Medical education is about more than developing necessary technical knowledge and skills; interpretation and communication skills are also required. Doctors need to be able to understand people, to empathize, and to break bad news. As students, and then as practitioners, those working in medicine must learn to deal with ambiguity and associated risks. This factor can cause student frustration and anxiety and, potentially, burnout.

As a medical undergraduate student noted in an interview with us, "Medical students are often anxious, questioning if they have made a right decision. Should they persist or jump?" The medical student further noted that:

> *We set up a precourse Facebook group for students. It helps us to bond. That is important because medicine needs to be collaborative. Why is collaboration so important? Medical practitioners need to learn about collaboration, teamwork, acknowledgement of uncertainty, knowing when to be curious and when to be brave, understanding the nature of risk.*

However, in the interview, the medical student also noted that:

> *Additional pressure on medical students exists with what they post on social media because of fitness to practice. If they say something inadvisable on social media, it can be held against them in their career. As a result there is a swing from more public forums to Snapchat where things do not persist permanently. Managing multiple images is more difficult for medical students.*

The increasing ubiquity of social media use in medical education has transformed how students learn and interact with their peers at school and beyond [1,2]. For example, universities encourage online collaborative learning. Students participate in online microcommunities to facilitate academic discussion, especially when they enter a new environment that requires fast adaptation [3,4]. For medical students, using social media to seek academic support is particularly pervasive.

Medicine is one of the most information-rich professions, where scientific progress is rapid and scientific breakthroughs happen almost on a daily basis [5]. Despite the wide recognition for social media's potential to facilitate knowledge sharing and encourage discussion, we still lack understanding of the key factors that motivate or inhibit students' engagement with social media as an effective tool for learning.

Thus, we aimed to explore two important questions: what role does social media play in medical students' personal lives and learning experience in their phase of university adjustment? How does such experience affect their engagement with social media?

University adjustment, also recognized as emerging adulthood, is a distinct period in students' lives [6] (pg 469). It refers to the transition phase to university. More specifically, students move away from their long-term social relationships, reestablish themselves with new social groups [7], and explore their roles and identities in new and unfamiliar environments. In addition to this, they need to cope with academic pressures. While adults may have a better capability to adjust to various life transformations, research into this earlier life stage and the challenges of transition has highlighted the potential negative impacts on mental health linked to failure to adjust, which, in turn, can affect students' academic performance [8]. In contrast, successful adjustment has been noted to facilitate better academic results and, therefore, better life outcomes [9].

Notably, on average, medical students experience a higher level of depression and anxiety [10,11]. A combination of academic training, clinical visits, internal examinations, and external licensing examinations can be stressful for medical university students [12,13]. They may need to visit patients, be responsible for taking care of them, and prepare themselves to perform irreversible, high-risk treatments in the future [14]. These pressures add more challenges to medical students' university life and to going through the phase of university adjustment.

Research has suggested that social media might facilitate students' successful university adjustment, well-being, and learning outcomes [15]. To cope with pressures in the new environment, students use social media to communicate with friends, to seek academic support, and to relax. However, these online activities are visible and might also create social risks [16-18]. In the offline environment, people manage their identities and the perceptions that others have of them in social interactions using social monitoring to fit different versions of themselves to different social groups and conversations. This method is untenable online because social media brings different social groups into one common place [19]. People now have pressures to present a single online identity to multiple offline audiences [20]. For university students, these audiences could be old friends, new friends, and academic peers.

Except for complex audience groups, on social media, users are able to create an idealized version of themselves [21,22] by, for example, selectively posting photos and sharing articles. It helps to build their desired personal images among the audience to increase self-acceptance [23]. For example, students may use Instagram, a visual platform, to share carefully edited photos of themselves and evaluate the popularity of these posts [24]. These concerns complicate the process when students try to use social media to manage their social relationships and improve their academic performance.

Objective

Critical gaps remain in our understanding of what drives students to actively engage with social media and the barriers that impede such engagement in the phase of university adjustment. The lack of understanding prevents us from maximizing the benefits that social media can provide for students, such as creating new opportunities for learning and enhancing learning efficiency.

Thus, this study, we aimed to (1) investigate the drivers and inhibitors of social media engagement among first-year undergraduate students in medical schools, and (2) based on

our findings, develop a framework for understanding students' behavioral patterns on social media platforms and their effects.

Methods

Overview

Because of the limited understanding of medical students' online behaviors in university adjustment, we conducted a qualitative study, as it suited the exploratory nature of the research [25]. We carried out 78 in-depth interviews with undergraduates in medical schools about their online behaviors and 6 interviews with digital technology industry experts. With the permission of our interviewees, we recorded and transcribed all the student and industry expert interviews. We used thematic analysis to identify the emerging themes and patterns [24]. We obtained ethics approval for this study from the Imperial College London, London, UK.

Participant Recruitment

In-Depth Interviews With Students

We conducted all interviews face-to-face with 78 undergraduate students studying academic medical courses at universities in the United Kingdom. Interviews took place at the end of the summer holiday and during the fall term of 2017. Because social media use is a personal topic to discuss, we adopted an informal tone that suited the students in order to make them feel comfortable and be willing to reveal their true self [24]. Some students also showed us their social media pages to demonstrate their views. Students were informed of the broad scope ahead of the interviews and reassured regarding confidentiality of their answers.

We recruited interviewees through posters on university campuses. The main criteria were availability for a face-to-face interview and willingness to talk about personal social media behaviors. The initial interviews were relatively open and led by the interviewees, around the broad themes of social media use and university adjustment. As the interviews progressed and themes began to emerge, the interviews became semistructured, but with room for interviewees to open their discussion onto the issues that they felt were more relevant in the context of social media use and online learning.

Interviews With Industry Experts

We carried out interviews face-to-face and by telephone with 6 digital technology experts. We employed convenience sampling among interviewees that we approached through our personal network. More specifically, these experts had worked in a digital learning environment for several years. Some of them helped build online courses at a research-led university in the United Kingdom. Others had worked in a digital learning environment (developing or managing online courses) internationally. The primary purpose was to obtain additional insights into students' engagement with social media in the context of learning and additional views on students' behavioral patterns on social media.

Data Analysis

One author (BH) used thematic analysis to identify the drivers and inhibitors of social media engagement. First, we separated the data into meaningful fragments about how, why, and when students used social media. We labeled these fragments using descriptive codes.

Then we looked for the relationships among these codes and aggregated them into themes such as maintaining existing relationships and building new relationships. We sought to combine these themes and develop a simpler and parsimonious framework that demonstrates drivers and inhibitors of social media use, the elicited stress, and behavioral outcomes.

Results

Summary of Findings

All interviewees were living away from home and were between the ages of 19 and 22 years. The interviewees were ethnically diverse, and 49 of 78 (63%) interviewees were female.

Combining our student interviews with the experts' observations, we found that maintaining existing relationships, building new relationships, and seeking academic support drove students to engage with social media and use it for learning. The key inhibitors that emerged from our data were (1) collapsed online identity, (2) unclear and even conflicting norms, (3) the desire to present an ideal self, and (4) perceived academic competition within their social groups. The findings also highlight that students engaged with various social media platforms in different ways. In the following section, we elaborate on the key drivers and inhibitors of social media engagement in greater detail.

Drivers of Social Media Engagement

First, our findings showed that social media was critical for *maintaining existing relationships*. Students engaged with social media because they wanted to stay in touch with their friends at home after entering university by checking the content created and shared by their friends from home. Figure 1 shows sample quotes posted to Instagram and Snapchat, including quotes relating to maintaining existing relationships. As Table 1 shows, numerous students mentioned social media's role in keeping relationships they had prior to joining university. The effort to maintain old friendships helped students to reactivate them easily when they returned home. In addition, social media provided social support for students when they faced difficulties in university, as the student quotes in Table 2 illustrate.

Second, at universities, students *built new relationships*. Such new relationships formed a significant part of students' experience at university and beyond, as this experience may shape their future social network and influence potential opportunities related to employment after graduation. As a result, students usually made some effort to explore more information about their new contacts. Social media offered a shortcut to gain deeper insights into new contacts and people they had never met before.

Figure 1. Social media use by medical undergraduate students.

Table 1. Samples of student interview quotes: social media for maintaining existing relationships.

Interviewee number	Sample quote
8	Instagram allows me to stay in touch with my old friends from home. It makes me feel I am not alone at uni. It's just nice.
24	Sometimes the posts on Instagram make me feel connected to home and my friends there. We share clips. I tell them about my uni life and they share interesting articles and clips with me. I even use it for my assignments.
47	It is how I keep in touch with people. Without Facebook I wouldn't be friends with those people.
50	See what pictures they're posting, what they're up to. Gives me an idea of what's going on with them. Otherwise, I wouldn't know what's going on—I'd go back home once a year and listen to their updates from the whole year. But I can listen to their updates every day.
2	I wouldn't want to miss my friends from home. Use Snapchat to share and send stuff. Makes me happy and helps me with stress.

Table 2. Samples of student interview quotes: social media for social support.

Interviewee number	Sample quote
11	I can't ever imagine what it would be like to have gone off to different universities and not have the things we have—I wouldn't be friends with half the people I am now. You can send someone a Snapchat once a week and keep that friendship as strong as when I left. It was comforting. We had a shared WhatsApp group and we all knew where everyone was going, so it was like "What's yours like?" It was like a safety net.
69	Looking at all these new profiles can be overwhelming. When I see a familiar face on Instagram or Snapchat it puts a smile on my face.
17	For me it's incredibly important to keep my friendships. I don't want to lose my friends from home. Otherwise they will ask "hello stranger, where have you been?" WhatsApp chats keep us connected.
30	I would feel very lonely with my old friends. They know me so well. I know them. It's just different with new people. I connect with my friends on a regular basis. They are on my WhatsApp. We also use Instagram. Without them I don't think I would have had the same experience at university.

Table 3. Samples of student interview quotes: social media for seeking academic support.

Interviewee number	Sample quote
54	A couple of friends have asked me about how I do a problem; sometimes without telling the answer I show them the workings so it helps with actually...helping people when they are not even there. If they are all the way over in South Kensington I can just help them and tell them how to do a problem without even seeing them. And it feels good to do that...Facebook has enabled me to help others and also to receive help when I need it.
4	Organizing all these group meetings can be a bloody nightmare. Without WhatsApp it would be impossible. I honestly have no idea how students in previous generations managed without WhatsApp.
18	We connect via Snapchat all the time. We even use it during lectures and classes. Don't always feel comfortable asking the lecturer. Then I ask my peers on WhatsApp if they understand something. Or we decide who to ask the lecturer during the class. Makes learning easier.
46	Group assignments, feedback, and topics are all discussed on WhatsApp. Instagram and Snapchat are more for entertainment but that's also important sometimes. WhatsApp is used for group discussions and preparations more than any other app and definitely more than the university app offered.
9	For each group exercise we form a chat group on WhatsApp. Sometimes we also share on Instagram.
27	Even one of our lecturers connected with students on WhatsApp. Some students said this was not appropriate, but others liked it. Of course only academic content should be shared and discussed maybe.

According to a student interviewee:

> *I would know a person more if I have looked at their profile and understand what kind of things they are doing or what kind of status they like or what kind of pages they like.* [Interviewee #3]

It should be noted that social media not only was an independent platform that students used to build direct online relationships, but also integrated their online and offline social interactions. As a student shared with us:

> *For example, for nights out people will say if they're interested or if they're willing to go so I'll look at who is going, who is interested and make my decision as to whether I should go.* [Interviewee #20]

Third, students saw social media as an important tool to *seek academic support*. It provided a convenient platform to create and maintain social ties for academic purposes, such as group work for assignments and examinations. For example, Table 3 lists some examples of how students thought about social media in terms of academic support.

Inhibitors of Social Media Engagement

Interestingly, social media assisted students to deal with challenges related to university adjustment; however, the interaction of relationship management and academic activities triggered multiple concerns. First, maintaining existing friendships and building new ones led to *collapsed online identity*. Students needed to manage their identity across multiple audience groups. The types of audiences determined the level of self-revelation. Students directly linked this concern to being more cautious when posting on social media (see Table 4).

Second, students were *uncertain about social norms* when establishing new networks. Students' online activities could be evaluated by various audiences, depending on social and relational contexts. During the university transition period, students' networks expand and become more diverse, with the potential for a clash of social norms. Most of the social media activities are documented and visible, so students tended to be more conservative about their online activities (eg, see Figure 1). One student shared with us about his experience that:

> *There have been one or two occasions after two weeks when I haven't posted anything...I've been seeing other people's videos, or I've been liking people's pictures on Instagram, but I haven't contributed on my profile. I haven't contributed on Instagram. Lots of other people have been commenting on how they've been spending their time and I've not been doing that. I've had a couple of occasions when I've been thinking why I haven't posted stuff...Probably it's because I've forgotten. Since more recently I've been more into what I've been posting I will have that sense of something is missing. This awkward feeling "should I possibly post something or should I not?" If you'd asked me that question a year ago when I was at school I honestly would not have cared.* [Interviewee #26]

The uncertainty about social norms encouraged students to observe others' behaviors in order to identify the appropriate and acceptable online behaviors. As a student told us,

> *Before I post anything on WhatsApp in the discussion groups, I check what others have to say. I do not want to be the first one to post and share.* [Interviewee #76]

Third, students saw the profile on social media as a proxy for self and wanted to *present an ideal self*. As students actively reviewed others' profiles, they became aware that they were also being judged by others, which may bring social risks if they do not manage the account appropriately (Table 5).

Table 4. Samples of student interview quotes: collapsed online identity as an inhibitor to using social media for learning.

Interviewee number	Sample quote
65	The people who know me in the university versus the people who know me back in [my home country]—it's a different person. If I was travelling I wouldn't mind posting, but a personal newsfeed—I wouldn't put something on there.
12	I do not share everything with everyone. I do not feel comfortable asking for help sometimes. It would make me look stupid in front of some people. I would not like that.
21	I don't want everyone to see what I wear every day or where I hang out. When I share a picture of myself on Instagram, it's out there. Snapchat is easier. Few people can see it and then it's gone.
50	Some may judge you for doing things. I don't like that. On social media everything gets judged by everyone all the time. That's social media for you nowadays.
56	On Facebook you don't know who can see your profile. People share information freely. I am uncomfortable disclosing my status to everyone in my learning group. I rather not share at all. I don't want all of my study group members to see my pictures and who I am with. I'd rather keep things separate.

Table 5. Samples of student interview quotes: social media and presenting an ideal self.

Interviewee number	Sample quote
10	I've made an active change because my Instagram used to be trashy. Say it was a friend's birthday or we were drunk. It wouldn't be good quality and the captions would be inside-jokes. And then I realized, when I went to university, if I was talking about someone, everyone used to pull them up on Facebook, but now people pull them up on Instagram. It would be shameful. So now it's nice pictures and better quality.
40	If I'm choosing a profile photo – I'll ask other people's opinion. I want to look good, I want it to look nice.
12	It can take me forever to take a selfie. I naturally want to look good in the pictures I share with people that just met me. With my old friends it is not a big issue. They know me but for new people I want to be at my best. I go shopping for new T-shirts, bras, put on makeup and take at least 20 different pictures.
13	There's a lot of pressure to look at your best. It's a real problem for many people. Cyberbullying and body judgements are a constant. I feel uncomfortable posting a picture on Instagram and others not liking it. Nobody wants to look like a fool. I am worried to share questions on Facebook and WhatsApp. I know other people must think I am not smart or ask stupid questions.
33	Instagram makes me feel I am not leading a great life. Everyone else looks so fab in their pictures. Big smiles and all that. Everyone is running marathons and looking hot, playing cool, studying hard. I feel the pressure to do the same. It's not really me but I feel I have to do it.
9	People comment on others saying 'this is a dumb point' or 'you are not smart enough to be here'. It's mean. Then you have people posting all these super-genius things. People use social media to look smarter than they are. Definitely I try to use WhatsApp that way. Everyone does.

When managing their posts and comments, students also wanted to attain endorsement from their peers through "likes." This is important to their self-esteem because likes signal a student's popularity and status among their peers. According to one of our interviewees,

> *...if I change a profile picture I'm not anticipating thousands of likes, but some would be nice. If its no-one I would be quite disappointed.* [Interviewee #45]

The desire to idealize the self on social media made visible behaviors, such as posting and sharing, became high-risk activities that required cognitive effort. It also shaped students' perceptions of offline reality. For example, a student shared with us that

> *...coming into university, I do feel that how you perceive yourself online has a great impact on what reality is like.* [Interviewee #59]

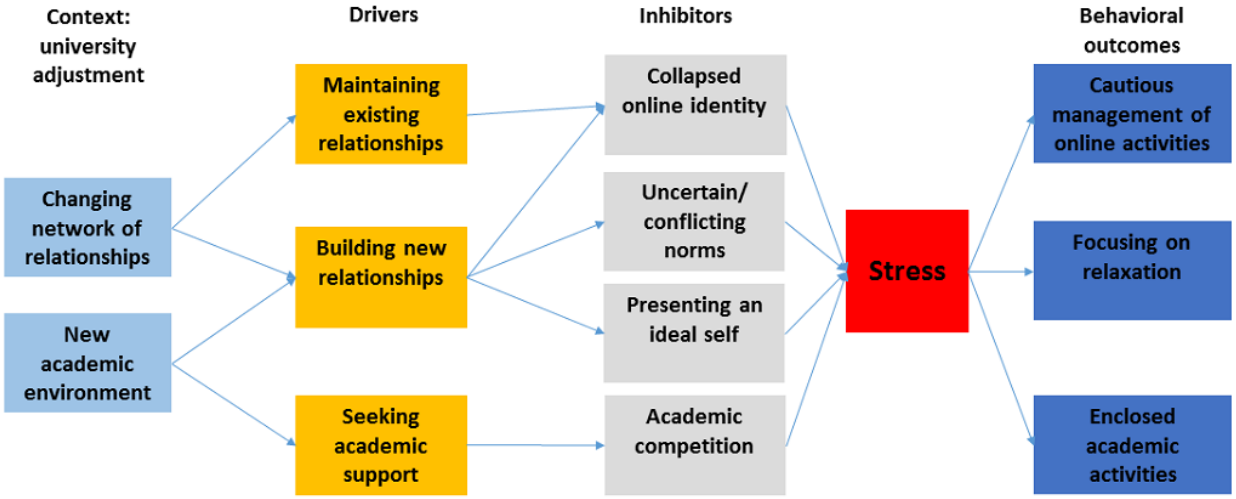
Thus, the relationship between online identity and self was more complex than a straightforward self-presentation on a digital profile. Any visible engagement on social media contributed to external perceptions of an individual and to the way in which an individual saw and felt about themselves.

Fourth, because of the visibility of social media activities, posting related academic content might elicit a sense of *academic competition*. Even though academic communication plays a central role in students' daily lives, sharing relevant information online might be sensitive. Students tended to be cautious about whether the learning content should be shared with their peers. According to our interviewees,

> *If it is very close friends, we will share everything...but there is a line between being friends and being in competition. I wouldn't want to share everything.* [Interviewee #7]

> *No way, I am not sharing my studies with peers. They are my competitors. If they find out what I read, they will read it too. I do not share my learning material on social media at all. Once it's on social media, it is everywhere and my competitive advantage is gone.* [Interviewee #63]

Figure 2. Social media engagement in university adjustment: framework of drivers and inhibitors.



Stress

The interaction among drivers and inhibitors of using social media mentioned above consequently created psychological stress for students. First, students needed to manage their online identities to appeal to new friends. They edited their posts and managed other online activities carefully. Students were particularly concerned about the norms related to how to behave in universities in order to fit in.

Second, students faced the challenges of establishing an online persona on social media for different audiences, including old friends from home and new friends from university.

Third, the pressure from academic studies also acted as both motivation and inhibition for students. They used social media to work with their peers. However, this process led to a sense of competition in which students may put extra efforts into evaluating whether the learning content should be shared.

Behavioral Outcomes

Three behavioral patterns emerged in response to stress. First, students became more cautious about their online activities to manage their identity and guard against the offline impacts. They may have sought private solutions to support their educational attainments, such as searching for online content or contacting their close friends for discussion. Second, they passively consumed content with positive valence for relaxation. Third, students relied on social media such as YouTube (see Figure 1) to reduce their level of stress. As shared by our interviewees, using social media to relax after a busy and stressful day at university played a big part in their university life.

> *At the end of a long day YouTube is my best friend. It is super relaxing.* [Interviewee #29]
>
> *I use YouTube to learn and watch new things. It also motivates me and keeps me going.* [Interviewee #44]
>
> *YouTube offers great lecture series by different universities. Often the recording is of better quality than the recordings of my lectures at uni.* [Interviewee #36]
>
> *It's not like I don't want to study, it's just that I am tired at the end of the day. I want to put on my comfy clothes and watch some funny clips on YouTube.* [Interviewee #25]

Experts have also been aware of the challenges of university adjustment for students and how students engage with different social media as potential learning platforms. Experts affirmed that students at the phase of university adjustment are difficult to engage on social media. Within private groups, where students are not observed, they communicate freely. Even though both experts and students acknowledge the potential for social media to deliver a transformed learning experience, the outcome highly depends on the engagement behaviors of students. To offer more learning support on social media, relevant stakeholders such as universities and publishers need to eliminate students' stress and encourage them to actively engage on social media.

On the basis of our interview findings, we developed a framework that highlights the driving factors and inhibiting factors that can help us to understand students' social media engagement behaviors stemming from relationship management and fitting into the academic environment in university adjustment (see Figure 2).

Discussion

Principal Findings

That students' social media activities are heavily influenced by an environment of stress is not a particularly new finding. Students during university adjustment may face consistent volatility of their lives, including regularly changing living arrangements, social and romantic fluidity, and flexible courses where they meet new classmates with each module. Wohn and LaRose [8] described this as a period "fraught with both psychological and academic stress" (pg 158). Adding to our understanding of social media use among students, this study clarified how relationship management in a new academic environment shapes their social media engagement behaviors for learning.

This study's findings extend those of previous studies, which showed that social media empowers students to manage their existing and new relationships, and to support their learning [3,10,11]. In the phase of university adjustment, however, the interaction among these factors impedes students' engagement with social media. This study can inform educators and publishers and help them to better understand the challenges of engaging students online when promoting social media as a learning tool.

In line with prior work, this study indicates that social interaction and social support are the most common motivations to use social media [22,26,27], particularly on Facebook [28]. Specifically, social media facilitates friendship establishment and maintenance because it allows communication without time and distance limitation [21]. For university students, social media, such as Instagram, Facebook, and WhatsApp, enables them to stay close to their home and school friends [9]. This may help reduce the negative effects of friendsickness (defined by Paul and Brier as the "preoccupation with and concern for the loss of or change in precollege friendships" [29]) experienced by many students.

In our study, informed by friendsickness, maintaining existing relationships is one of the main drivers of using social media. Students actively interact with their friends from home by reading and responding to their posts. This may provide a safe opportunity for self-revelation to a more established connection in their network and a means of alleviating possible isolation.

Interestingly, although social media enables students to build new relationships, the visibility of their online activities raises the challenge of managing an online identity or presenting a single self to diverse audiences. The discrepancy between the "home" self and the "university" self acts as a strong barrier to posting personal material. Students may be connected to family members from whom they wish to conceal their new selves. This can even affect offline behaviors to avoid inappropriate photographs appearing [30].

Furthermore, university contacts are not a homogeneous group but may often include people from different cultures and backgrounds. This acts as an inhibitor because the increased diversity of the network leads to uncertain social norms and a higher potential for accidentally violating them. The risk of ostracism [31] or desire to avoid the disappointment of not receiving likes [32] leads students to avoid posting and sharing online. As a result, minimal interaction becomes common. Furthermore, when viewing profiles to evaluate new contacts, students realize that their profiles are viewed and judged by others in the same way. As they become conscious of their social media persona being judged, they edit it, not only to impress others but also to reflect and build their ideal selves.

For medical students, academic pressures from assignments and examinations drive them to use social media and support each other [5,33]. Online peer support in small groups is perceived as a low-risk environment by students. This can build genuinely supportive, reciprocal relationships, particularly in courses where a comprehensive set of skills is required, so that a student who is strong in one area may require support in another.

Importantly, by untangling and examining these factors, our findings show that academic use of social media and relationship management affect one another, which leads to stress and more conservative online behaviors. This prevents educators and publishers from promoting social media as a communication and sharing platform in education contexts.

Digital environments and social media in particular can enable interaction [34-36], collaboration [37], and information and resource sharing [38]. Social media has been advocated as an effective tool for medical education [4]. Our study suggests that it is necessary for educators to assist students to remove the identified inhibitors and to cope with their stress. For example, for students' concerns about sharing learning materials with their peers on social media, platforms such as Facebook can offer services that enable students to access the shared learning material if they actively contribute to the academic discussion. This would encourage students to help each other rather than only receiving support from their peers. Open discussion and exchange of information would facilitate students' learning and keep them updated with the knowledge advances in medicine.

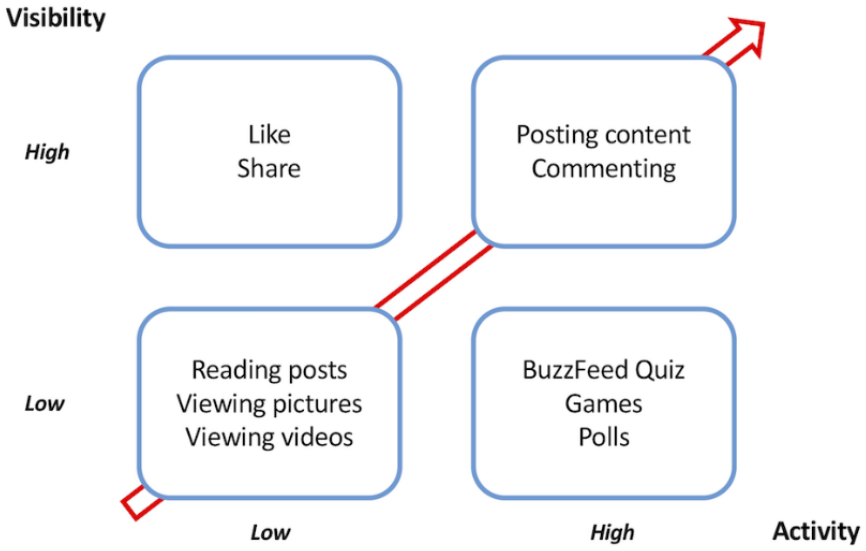
Limitations and Future Research

Several limitations of our study offer avenues for future research projects. First, to present a simple and parsimonious model, we considered stress as the main route to explain how inhibitors lead to conservative social media engagement and learning behaviors. It should be noticed that factors such as uncertain social norms might lead to cautious use of social media as well. For instance, gamification [39] or enhanced empowerment and hedonic well-being [40,41] as part of the online education platform design may strengthen user engagement and willingness to acquire critical new knowledge. Future research should explore other explanations and relationships among these factors to complement the framework proposed in this study.

Second, the research was limited by the relatively small number of participants. The research was qualitative and self-reported. It did not elicit information about how much time students spent on social media, or data to carry out a robust investigation into the nature of the content that they consumed and shared on various social media platforms. Future research should expand on the findings by collecting survey data or studying actual content shared on social media.

Third, this research took a single snapshot in the time of university adjustment. Future research should conduct a longitudinal study to explore medical students' behavior change over time. For example, it would be intriguing to investigate whether the caution of using social media decreases by the end of university and increases again as students enter the workplace. In addition, in terms of supporting the student transition and learning outcomes, it would be interesting to track the relationship and situational pressures over time to see whether building certain kinds of personal relationships on social media during the early period translates into peer-to-peer academic support later on.

Figure 3. Effect of visibility and activity on user behaviors.



We also wonder whether enhanced transparency as part of online learning may reduce students' stress and increase their willingness to engage in online learning tools. Prior work has shown that transparency of organizations is associated with greater levels of trust and people's willingness to engage in open and responsible behaviors themselves when they see other relationship partners (eg, organizations) acting in a transparent way [42-45]. Furthermore, sharing critical information through customer education [45-48] has been demonstrated to positively affect people's willingness to participate and offer critical and valuable feedback [49-51]. In addition to the factors identified in this study, how can social media be adapted effectively to reduce uncertainties [52,53] and to promote medical students' learning and participation in the online learning environment? We invite future research to address this important question.

Finally, given student preferences, it seems that highly visual and seemingly low-risk platforms like Snapchat, with its disposable images, will continue to rise, and this should be a subject for additional research. There is empirical evidence for people getting instantaneously attached to digital services they use [54]. This can be because of an appealing interface, use of logos [55], the ethical standards of the service offering [56], or the versatility of the functional benefits provided [57]. Which social platform can medical students identify with based on the various benefits these platforms have to offer and their identification with work [58]? Interestingly, our interviews also revealed an increased preference by students to engage with Instagram rather than Facebook. Figure 3 highlights the effect of user visibility and activity on user behaviors, where the red arrow reflects increasing potential cost and therefore difficulty in driving the behavior. Additional research that tests the effects of visibility and activity on digital learning is rich in potential.

Conclusion

This research explored student engagement with social media in the context of university adjustment. By presenting a view of students as an intentionally cautious group of social media users, we showed how students actively managed their engagement with social media as a significant part of their identity strategy. They carefully balanced the benefits of engagement, such as social support, peer learning support, and positive valence, with the potential risks to their identity. The more visible the engagement is, the more significance these engagement activities have in enhancing their identities. This has implications for understanding students' online behaviors and the specific barriers that we should remove in order to use social media as a more effective learning tool.

Acknowledgments

The dissemination of these research findings was funded by the UK Economic and Social Research Council (grant reference #ES/M500562/1).

Conflicts of Interest

None declared.

References

1. O'Sullivan E, Cutts E, Kavikondala S, Salcedo A, D'Souza K, Hernandez-Torre M, et al. Social media in health science education: an international survey. JMIR Med Educ 2017 Jan 04;3(1):e1 [FREE Full text] [doi: 10.2196/mededu.6304] [Medline: 28052842]

2. Prescott J, Stodart M, Becket G, Wilson S. The experience of using Facebook as an educational tool. Health Soc Care Educ 2015 Dec 15. [doi: 10.11120/hsce.2013.00033]
3. Pinilla S, Nicolai L, Gradel M, Pander T, Fischer MR, von der Borch P, et al. Undergraduate medical students using Facebook as a peer-mentoring platform: a mixed-methods study. JMIR Med Educ 2015 Oct 27;1(2):e12 [FREE Full text] [doi: 10.2196/mededu.5063] [Medline: 27731859]
4. Shenson JA, Adams RC, Ahmed ST, Spickard A. Formation of a new entity to support effective use of technology in medical education: the student technology committee. JMIR Med Educ 2015 Sep 17;1(2):e9 [FREE Full text] [doi: 10.2196/mededu.4676] [Medline: 27731843]
5. Judd T, Elliott K. Selection and use of online learning resources by first-year medical students: cross-sectional study. JMIR Med Educ 2017 Oct 02;3(2):e17 [FREE Full text] [doi: 10.2196/mededu.7382] [Medline: 28970187]
6. Arnett JJ. Emerging adulthood. A theory of development from the late teens through the twenties. Am Psychol 2000 May;55(5):469-480. [Medline: 10842426]
7. Yang CC, Brown BB. Online self-presentation on Facebook and self development during the college transition. J Youth Adolesc 2016 Feb;45(2):402-416. [doi: 10.1007/s10964-015-0385-y] [Medline: 26534776]
8. Wohn DY, LaRose R. Effects of loneliness and differential usage of Facebook on college adjustment of first-year students. Computers & Education 2014 Jul;76:158-167. [doi: 10.1016/j.compedu.2014.03.018]
9. Gray R, Vitak J, Easton EW, Ellison NB. Examining social adjustment to college in the age of social media: factors influencing successful transitions and persistence. Comput Educ 2013 Sep;67:193-207. [doi: 10.1016/j.compedu.2013.02.021]
10. Dahlin M, Joneborg N, Runeson B. Stress and depression among medical students: Aa cross-sectional study. Med Educ 2005 Jun;39(6):594-604. [doi: 10.1111/j.1365-2929.2005.02176.x] [Medline: 15910436]
11. Rotenstein LS, Ramos MA, Torre M, Segal JB, Peluso MJ, Guille C, et al. Prevalence of depression, depressive symptoms, and suicidal ideation among medical students: a systematic review and meta-analysis. JAMA 2016 Dec 06;316(21):2214-2236 [FREE Full text] [doi: 10.1001/jama.2016.17324] [Medline: 27923088]
12. Liu S, Zhu M, Yu DJ, Rasin A, Young SD. Using real-time social media technologies to monitor levels of perceived stress and emotional state in college students: a web-based questionnaire study. JMIR Ment Health 2017 Jan 10;4(1):e2 [FREE Full text] [doi: 10.2196/mental.5626] [Medline: 28073737]
13. Hatzipanagos S, John B, Chiu YLT. The significance of kinship for medical education: reflections on the use of a bespoke social network to support learners' professional identities. JMIR Med Educ 2016 Mar 03;2(1):e1 [FREE Full text] [doi: 10.2196/mededu.4715] [Medline: 27731848]
14. Elani HW, Allison PJ, Kumar RA, Mancini L, Lambrou A, Bedos C. A systematic review of stress in dental students. J Dent Educ 2014 Feb;78(2):226-242 [FREE Full text] [Medline: 24489030]
15. Johnston K, Tanner M, Lalla N, Kawalski D. Social capital: the benefit of Facebook ‘friends’. Behav Inf Technol 2013 Jan;32(1):24-36. [doi: 10.1080/0144929X.2010.550063]
16. Eisingerich AB, Chun HH, Liu Y, Jia H, Bell SJ. Why recommend a brand face-to-face but not on Facebook? How word-of-mouth on online social sites differs from traditional word-of-mouth. J Consum Psychol 2015 Jan;25(1):120-128. [doi: 10.1016/j.jcps.2014.05.004]
17. Kaplan AM, Haenlein M. Users of the world, unite! The challenges and opportunities of social media. Bus Horiz 2010 Jan;53(1):59-68. [doi: 10.1016/j.bushor.2009.09.003]
18. Nadkarni A, Hofmann SG. Why do people use Facebook? Pers Individ Differ 2012 Feb 01;52(3):243-249 [FREE Full text] [doi: 10.1016/j.paid.2011.11.007] [Medline: 22544987]
19. Marwick AE, boyd D. I tweet honestly, I tweet passionately: Twitter users, context collapse, and the imagined audience. New Media Soc 2010 Jul 07;13(1):114-133. [doi: 10.1177/1461444810365313]
20. DeAndrea DC, Walther JB. Attributions for inconsistencies between online and offline self-presentations. Commun Res 2011 Jan 10;38(6):805-825. [doi: 10.1177/0093650210385340]
21. Michikyan M, Dennis J, Subrahmanyam K. Can you guess who I am? Real, ideal, and false self-presentation on Facebook among emerging adults. Emerg Adulthood 2015;3(1):55-64. [doi: 10.1177/2167696814532442]
22. Whiting A, Williams D. Why people use social media: a uses and gratifications approach. Qual Mark Res 2013;16(4):362-369. [doi: 10.1108/QMR-06-2013-0041]
23. Ryff CD. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. J Pers Soc Psychol 1989;57(6):1069-1081. [doi: 10.1037/0022-3514.57.6.1069]
24. Sheldon P, Bryant K. Instagram: motives for its use and relationship to narcissism and contextual age. Comput Hum Behav 2016;58:89-97. [doi: 10.1016/j.chb.2015.12.059]
25. Eisenhardt KM. Building theories from case study research. Acad Manage Rev 1989;14(4):532-550. [doi: 10.2307/258557]
26. Silverman D. Doing Qualitative Research: A Practical Handbook. London, UK: SAGE; 2005.
27. Pinkerton S, Tobin JL, Querfurth SC, Pena IM, Wilson KS. “Those sweet, sweet likes”: sharing physical activity over social network sites. Comput Hum Behav 2017;69:128-135. [doi: 10.1016/j.chb.2016.12.028]
28. Oh S, Syn SY. Motivations for sharing information and social support in social media: a comparative analysis of Facebook, Twitter, Delicious, YouTube, and Flickr. J Assoc Inf Sci Technol 2015;66(10):2045-2060. [doi: 10.1002/asi.23320]

29. Paul EL, Brier S. Friendsickness in the transition to college: precollege predictors and college adjustment correlates. J Couns Dev 2011;79(1):77-89. [doi: 10.1002/j.1556-6676.2001.tb01946.x]
30. Marder B, Joinson A, Shankar A, Houghton D. The extended 'chilling' effect of Facebook: the cold reality of ubiquitous social networking. Comput Hum Behav 2016;60:582-592. [doi: 10.1016/j.chb.2016.02.097]
31. McLaughlin C, Vitak J. Norm evolution and violation on Facebook. New Media Soc 2011;14(2):299-315. [doi: 10.1177/1461444811412712]
32. Burrow AL, Rainone N. How many likes did I get?: purpose moderates links between positive social media feedback and self-esteem. J Exp Soc Psychol 2017;69:232-236. [doi: 10.1016/j.jesp.2016.09.005]
33. D'Souza K, Henningham L, Zou R, Huang J, O'Sullivan E, Last J, et al. Attitudes of health professional educators toward the use of social media as a teaching tool: global cross-sectional study. JMIR Med Educ 2017;3(2):e13 [FREE Full text] [doi: 10.2196/mededu.6429] [Medline: 28778841]
34. Eisingerich AB, Kretschmer T. In e-commerce, more is more. Harv Bus Rev 2008;86(3):20-21.
35. Tudor-Sfetea C, Rabee R, Najim M, Amin N, Chadha M, Jain M, et al. Evaluation of two mobile health apps in the context of smoking cessation: qualitative study of cognitive behavioral therapy (CBT) versus non-CBT-based digital solutions. JMIR Mhealth Uhealth 2018;6(4):e98 [FREE Full text] [doi: 10.2196/mhealth.9405] [Medline: 29669708]
36. Park CW, MacInnis D, Eisingerich AB. Brand Admiration: Building a Business People Love. New York, NY: John Wiley & Sons; 2016.
37. Merlo O, Eisingerich AB, Auh S. Why customer participation matters. MIT Sloan Manage Rev 2014;55(2):81-88 [FREE Full text]
38. Cao B, Liu C, Durvasula M, Tang W, Pan S, Saffer AJ, et al. Social media engagement and HIV testing among men who have sex with men in China: a nationwide cross-sectional survey. J Med Internet Res 2017;19(7):e251 [FREE Full text] [doi: 10.2196/jmir.7251] [Medline: 28724510]
39. El-Hilly AA, Iqbal SS, Ahmed M, Sherwani Y, Muntasir M, Siddiqui S, et al. Game on? Smoking cessation through the gamification of mHealth: a longitudinal qualitative study. JMIR Serious Games 2016;4(2):e18 [FREE Full text] [doi: 10.2196/games.5678] [Medline: 27777216]
40. Lin YT, Tudor-Sfetea C, Siddiqui S, Sherwani Y, Ahmed M, Eisingerich AB. Effective behavioral changes through a digital mHealth app: exploring the impact of hedonic well-being, psychological empowerment and inspiration. JMIR mhealth uhealth 2018;6(6):e10024 [FREE Full text] [doi: 10.2196/10024] [Medline: 29907557]
41. Park CW, Eisingerich AB, Park JW. Attachment–aversion (AA) model of customer–brand relationships. J Consum Psychol 2013;23(2):229-248. [doi: 10.1016/j.jcps.2013.01.002]
42. Eisingerich AB, Bell S. Maintaining customer relationships in high credence services. J Serv Mark 2007;21(4):253-262. [doi: 10.1108/08876040710758559]
43. Foscht T, Lin Y, Eisingerich AB. Blinds up or down? The influence of transparency, future orientation, and CSR on sustainable and responsible behavior. Eur J Mark 2018;52(3/4):476-498. [doi: 10.1108/EJM-10-2016-0576]
44. Liu Y, Eisingerich AB, Auh S, Merlo O, Chun HEH. Service firm performance transparency:How, when, and why does it pay off? J Serv Res 2015;18(4):451-467. [doi: 10.1177/1094670515584331]
45. Eisingerich AB, Bell SJ. Customer education increases trust. MIT Sloan Manage Rev 2008;50(1):10-11.
46. Bell SJ, Auh S, Eisingerich AB. Unraveling the customer education paradox: when, and how, should firms educate their customers? J Serv Res 2017;20(3):306-321. [doi: 10.1177/1094670517691847]
47. Eisingerich AB, Bell SJ. Perceived service quality and customer trust: does enhancing customers' service knowledge matter? J Serv Res 2008;10(3):256-268. [doi: 10.1177/1094670507310769]
48. Bell SJ, Eisingerich AB. Work with me. Harv Bus Rev 2007;85(6):32.
49. Eisingerich AB, Auh S, Merlo O. Acta non verba? The role of customer participation and word of mouth in the relationship between service firms' customer satisfaction and sales performance. J Serv Res 2013;17(1):40-53. [doi: 10.1177/1094670513490836]
50. Eisingerich AB, Bhardwaj G, Miyamoto Y. Behold the extreme consumers and learn to embrace them. Harv Bus Rev 2010;88(4):30-31.
51. Park CW, MacInnis DJ, Priester J, Eisingerich AB, Iacobucci D. Brand attachment and brand attitude strength: conceptual and empirical differentiation of two critical brand equity drivers. J Mark 2010;74(6):1-17. [doi: 10.1509/jmkg.74.6.1]
52. Seifert M, Siemsen E, Hadida AL, Eisingerich AB. Effective judgmental forecasting in the context of fashion products. J Oper Manage 2015;36:001-045. [doi: 10.1016/j.jom.2015.02.001]
53. Seifert M, Siemsen E, Hadida AL, Eisingerich AB. When to forget the rearview mirror. Harv Bus Rev 2015;93(6):30-30.
54. Fritze MP, Eisingerich AB, Benkenstein M. Digital transformation and possession attachment: examining the endowment effect for consumers' relationships with hedonic and utilitarian digital service technologies. Electron Commer Res 2018. [doi: 10.1007/s10660-018-9309-8]
55. Park CW, Eisingerich AB, Pol G. The power of a good logo. MIT Sloan Manage Rev 2014;55(2):10-12.
56. Eisingerich AB, Bhardwaj G. Does corporate social responsibility help protect a company's reputation? MIT Sloan Manage Rev 2011;52(3):18.

57. Chun HEH, Park CW, Eisingerich AB, MacInnis DJ. Strategic benefits of low fit brand extensions: when and why? J Consum Psychol 2015;25(4):577-595. [doi: 10.1016/j.jcps.2014.12.003]
58. Gill-Simmen L, MacInnis DJ, Eisingerich AB, Park CW. Brand-self connections and brand prominence as drivers of employee brand attachment. AMS Rev 2018 Mar 15:1-19. [doi: 10.1007/s13162-018-0110-6]

Edited by G Eysenbach; submitted 07.02.18; peer-reviewed by T Judd, A Benetoli, K Aguirre; comments to author 05.03.18; revised version received 20.04.18; accepted 21.06.18; published 13.07.18.

Please cite as:
Hartnup B, Dong L, Eisingerich AB
How an Environment of Stress and Social Risk Shapes Student Engagement With Social Media as Potential Digital Learning Platforms: Qualitative Study
JMIR Med Educ 2018;4(2):e10069
URL: http://mededu.jmir.org/2018/2/e10069/
doi:10.2196/10069
PMID:30006324

Viewpoint

Expanding Opportunities for Professional Development: Utilization of Twitter by Early Career Women in Academic Medicine and Science

Jaime D Lewis[1], MD; Kathleen E Fane[2], MD, MS; Angela M Ingraham[3], MD, MS; Ayesha Khan[4], MD, MPH; Anne M Mills[5], MD; Susan C Pitt[3], MPSH, MD; Danielle Ramo[6], PhD; Roseann I Wu[7], MD, MPH; Susan M Pollart[8], MD, MS

[1]Department of Surgery, College of Medicine, University of Cincinnati, Cincinnati, OH, United States
[2]Department of Emergency Medicine, Temple University Hospital, Philadelphia, PA, United States
[3]Department of Surgery, School of Medicine and Public Health, University of Wisconsin, Madison, WI, United States
[4]Department of Emergency Medicine, Stanford University School of Medicine, Stanford, CA, United States
[5]Department of Pathology, School of Medicine, University of Virginia, Charlottesville, VA, United States
[6]Weill Institute for Neurosciences, Department of Psychiatry, University of California San Francisco, San Francisco, CA, United States
[7]Department of Pathology and Laboratory Medicine, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States
[8]Department of Family Medicine, School of Medicine, University of Virginia, Charlottesville, VA, United States

Corresponding Author:
Jaime D Lewis, MD
Department of Surgery
College of Medicine
University of Cincinnati
231 Albert Sabin Way
ML 0558
Cincinnati, OH, 45267
United States
Phone: 1 513 584 8900
Email: jaime.lewis@uc.edu

Abstract

The number of women entering medical school and careers in science is increasing; however, women remain the minority of those in senior faculty and leadership positions. Barriers contributing to the shortage of women in academics and academic leadership are numerous, including a shortage of role models and mentors. Thus, achieving equity in a timelier manner will require more than encouraging women to pursue these fields of study or waiting long enough for those in the pipelines to be promoted. Social media provides new ways to connect and augments traditional forms of communication. These alternative avenues may allow women in academic medicine to obtain the support they are otherwise lacking. In this perspective, we reflect on the role of Twitter as a supplemental method for navigating the networks of academic medicine. The discussion includes the use of Twitter to obtain (1) access to role models, (2) peer-to-peer interactions, and continuous education, and (3) connections with those entering the pipeline—students, trainees, and mentees. This perspective also offers suggestions for developing a Twitter network. By participating in the "Twittersphere," women in academic medicine may enhance personal and academic relationships that will assist in closing the gender divide.

(JMIR Med Educ 2018;4(2):e11140) doi:10.2196/11140

KEYWORDS

female; leadership; social media; academic success; professional development

Introduction

The number of women pursuing seats in medical schools continues to increase, and women comprise nearly one-half of applicants and more than half of matriculants [1,2]. These statistics remain stable throughout medical school and residency; however, just over one-third of junior faculty in academic medicine are women [1]. Women in senior faculty and

leadership are even less common, with women holding only 22.8% of full professor, 15% of permanent chair, and 16% of dean positions [1,3]. In science, technology, engineering, and mathematics (STEM) disciplines, women are less likely to be hired into any faculty position than men and less likely to be retained in appointments in mathematics [4]. Though the number of women entering medical and STEM careers has been steady for some years, advancement to leadership positions continues to lag. The dearth of women in these top positions is no longer a "pipeline" issue [5].

Challenges Experienced by Women in Academic Medicine

Women who leave academics early in their careers cite multiple concerns, including inequalities in compensation, lack of role models, difficulties achieving work-life integration, effects of unconscious and implicit bias on experiences, frustrations in research including funding gaps, and a non-collaborative, and biased work environment [6,7]. In academic medicine, women continue to receive lower salaries and women researchers receive smaller startup packages and less funding from organizations such as the National Institutes of Health, have fewer opportunities to publish, and are promoted at slower and lower rates [8-10]. Though initiatives are being developed at multiple levels to help advance and promote women to leadership positions, these concerns persist for women attempting to climb the ladders in academic medicine [11]. Women must consider supplemental approaches to obtain necessary skills for career advancement and to navigate the networks and societies that are central to academic success.

The Association of American Medical Colleges (AAMC), whose mission it is to "improve the nation's health through the advancement of academic medicine" [12], is attempting to bridge the gender gap in academic medicine by providing yearly leadership retreats for women faculty at the early and mid-career levels. Retreats are designed to help women learn to "navigate the academic medicine enterprise as well as continue on the path to leadership" [13]. At the 2017 AAMC Early Career Women Faculty Leadership Development Seminar, the authors of this article connected through Twitter engagement by using the meeting hashtag, #EWIMS (Early Career Women in Medicine and Science). This multidisciplinary group of junior faculty, along with one senior conference faculty member, then met in person to discuss our struggles and successes as women in academic medicine. Our conversation about the impact of Twitter on our professional lives led to the conclusion that social media can fill some of the gaps in support that women in academic medicine endure, and it gave rise to this collaborative piece. In our experience, the Twittersphere is a unique resource for fostering relationships within and outside of medicine as it expands critical planes of engagement through (1) access to role models potentially leading to mentorship and sponsorship, (2) networking, peer-to-peer support, and education, and (3) connection with students, trainees, and mentees.

Access to Mentorship and Sponsorship

Mentorship is important for increasing diversity at the top and identifying a role model who "looks like you" makes it easier to follow suit [14,15]. Several excellent avenues exist to provide mentorship for early career women faculty. Institutions and departments frequently offer formal mentoring programs. Conferences such as the AAMC Women's Leadership Seminars (@AAMCMeetings) or groups like the American Medical Women's Association (@AMWAdoctors) strive to connect women in academic medicine with support, mentorship, potential sponsors, and opportunity [16,17]. However, the capacity of leadership, senior faculty, and these programs to connect with junior faculty are limited by factors such as distance, time, finances, low mentor to mentee ratio, and availability.

Educators have also realized the need to draw on informal learning networks to complement formal supports and institutions and have turned to Twitter and other social media platforms as extensions of the learning environment [18]. Relationships developed on Twitter may help fill the gaps in more traditional methods of face-to-face role modeling, mentoring, and sponsorship [19,20]. One #EWIMS participant described presenting her poster to a prominent physician at a conference. Their relatively formal interaction quickly became warm and jovial the instant the two recognized one another from prior interactions on Twitter. That afternoon, they met for coffee to discuss the #EWIMS participant's career plans and are now collaborating on a review paper. Others have described collegial relations formed on Twitter as "some of the strongest professional relationships" they developed [21].

The value of access to a large pool of same-gender role models, mentors, and sponsors accessible on Twitter may be particularly important in situations where these relationships are not uniformly available to junior faculty [22-25]. For example, women in cardiac and thoracic surgery hold well under 10% of faculty positions in leading academic facilities [26]. While it is unlikely that women in these fields will hold positions at the same institution, they can identify one another and build relationships online (@WomenInThoracic). Similar relationships and their value in professional development have been described by public health professionals who have connected despite geographic distance and learners experiencing the "3C's of Twitter"—Community, Communication, and Casual (informal) Learning—and contribute positively to building social capital [20,27,28].

In addition, as men currently hold the majority of leadership positions, it is imperative that women identify and build relationships with men who are gender inclusive in supporting the development of leaders [14,29]. Professional organizations may unknowingly maintain an isolating and gender-divisive atmosphere during after-hours events that can prove a barrier to women attempting to develop relationships with leaders in their fields. Twitter provides an alternate forum for faculty to connect with leadership outside of gendered-organized spaces. Movements such as #HeforShe highlight this need as well as identify those who are willing participants [29]. Though the

280-character messages provided on Twitter are unlikely to constitute substantive mentoring, the platform sets the stage for rising faculty to access more senior role models with whom they might not otherwise have the opportunity to connect. These connections may then promote informal and formal mentorship and sponsorship assisting in the advancement of women physicians [30].

Peer Support and Education

Intra- and interdisciplinary peer-to-peer connections may develop through participation in Twitter-based movements, chats, journal clubs, and other educational platforms. These allow individuals to create personal learning networks (PLNs), systems of "interpersonal connections and resources that support informal learning" [20,21,31]. Teachers have used similar PLNs as accessible and transformative alternatives to traditional modules for professional development [21].

Physicians across the country and worldwide have met virtually and in person and garnered support from participation in #ILookLikeASurgeon, #NYerORCoverChallenge, #WomenInMedicine, and #MeTooMedicine [32,33]. Several chat groups focused on challenges and opportunities experienced by women in medicine meet regularly. These include #AWSchat hosted by @WomenSurgeons and #WomenInMedicine hosted by @womeninmedchat. Twitter users can follow their professional organizations, such as the American College of Surgeons (@AmCollSurgeons) for up to date information on advocacy and other news, and journals such as Journal of the American Medical Association (@JAMA_current), and the New England Journal of Medicine (@NEJM) for the latest breaking research. Each of these illustrates Twitter as an environment for networked learning and development of a community of practice, common in the field of education offline, and online [34,35].

There are many hashtags devoted to teaching vignettes (often image based as those that involve pathology and radiology, #radpath) and journal clubs like general surgery (#UMichSurgJC), trauma surgery (#EASTjc), Association of Women Surgeons (#AWSchat), nephrology (#nephJC), and pathology (#pathJC). Sharing conference material with the use of a specific hashtag allows interested parties to follow meeting content and participate in the conversation regardless of physical presence at the event. For example, the #EWIMS hashtag facilitated connectivity for the varied communities of conference attendees, faculty, and worldwide followers. In addition to ease of participation, an international group of researchers recently showed that the perceived costs of conference participation via social media were far lower than live attendance while nearly half of respondents felt that they would learn the same or more from the social media-based format [36]. When following conferences, "backchannels" may form leading to the identification of and deeper conversation with others of similar interests [37].

Connections to Students, Trainees, and Mentees

Twitter also provides a platform from which to reach and inspire girls and women who are students and trainees, especially those who might not otherwise have access to women role models. Social media can help faculty to connect with talented students, residents, and others for inspiration, promotion of program and institution, and recruitment. Pearls of wisdom and other messages are shared broadly among communities of medical educators and learners using hashtags such as #DearFutureMD, #MedEd, and #SurgEd. Students in other fields, including art and history, have also realized the value of access to multiple educators and peers outside of their classrooms to provide feedback and leading them to explore national organizations, institutions, and publications that they otherwise may not have been aware [35]. Among medical students participating in social media use curriculum, positive experience including a mechanism for connecting and sharing was expressed and a trend towards personal growth including a more humanistic approach to patients [38].

One example of how Twitter can facilitate such a relationship includes an #EWIMS participant who was contacted by a high school student who lived over a thousand miles away. This connection led to a Skype Chat with the student's all-female medicine interest club, a behind-the-scenes tour of the student's local academic medical center arranged by the #EWIMS participant, and ongoing mentorship via Twitter, and other social media outlets.

Limitations to the Use of Twitter

Like any tool, there are challenges when utilizing Twitter for the above pursuits. Messages must be concise, despite a recent doubling of the length, as tweets are limited to 280 characters. Most of this work is often performed before or after hours and on personal devices as many organizations block the use of social media sites [20,21]. Those who use Twitter often rate themselves higher on measures of general technology proficiency [21].

While popular among many, the reach of Twitter is limited as only 23% of active American internet users (or 20% of the adult population) have a Twitter account [39]. Also, the use of Twitter declines by over 50% in users over the age of 50, a limitation in access to more experienced role models, mentors, and sponsors [40]. As the "net generation" continues to age, we expect to see significant changes in these statistics [38,41].

Some consider Twitter to be "frivolous, superficial, or dangerous" and do not find professional value in social media [21,42]. Other barriers to use include concerns regarding cyberbullying, time requirements, privacy concerns, and the blurring of lines between learners and educators as well as health professionals and patients, inappropriate sharing of protected health information and violation of confidentiality, and potential risks of sharing misinformation or something that is (perceived as) unethical or unprofessional [21,38,43]. Among nonusers of social media in health professional education, many cited a lack

of understanding of how to integrate use, lack of departmental support and technical skills, and uncertainty of departmental policies [41]. Social media-based research often lacks in methodological rigor [44]. However, there are numerous resources available regarding the responsible use of social media, and some medical schools are incorporating principles of use into the curriculum and promotion criteria for faculty [38,45-48].

A Call to Action

With unprecedented numbers of women entering medical and science careers, there has never been a more important or realistic opportunity to enhance the field's emphasis on retaining women in academic medicine. Twitter's ability to connect women faculty in academic medicine with others surviving and thriving in the field can facilitate and promote long-term success in a challenging career environment.

We suggest the following strategies for developing a supportive environment through the use of Twitter. First, promote a culture of Tweeting among academics. Medical schools should support the use of Twitter among faculty, such as including professional social media activity as one component of the faculty dossier. Profile pages of faculty at schools of medicine should publish Twitter handles, allow faculty to integrate Twitter feed on their profile pages, and encourage faculty Twitter engagement. Schools may also report journal article influence using metrics, such as the Altmetric, that measure the social media impact of research articles. When faculty publish articles, they should be encouraged to share through Twitter and discouraged from believing that it is shameless self-promotion. Second, facilitate connections. Faculty on Twitter should make a point of acknowledging participation as part of routine networking, education, and mentoring activities (eg, conferences, lectures). In academic presentations, faculty should include Twitter handles (not just email addresses) as contact information. As part of mentoring and leadership development activities, mentors and sponsors should be encouraged to use social media and to support their trainees in doing so responsibly. Training programs should include workshops on how to get the most out of Twitter, facilitated by faculty seasoned in its use.

Closing the sustained gender gap in hiring, promoting, and retaining women in academic medicine will certainly require a multi-faceted approach. As the authors of this piece have experienced, the use of Twitter as part of this approach can facilitate ties fundamental to the long-term success of women in medicine and science. We are encouraged by the growing flurry of tweets that have become the roar of many academic women in medicine and science advancing through their careers.

Conflicts of Interest

None declared.

References

1. Lautenberger D, Dandar V, Raezer C, Sloane R. Association of American Medical Colleges. The State of Women in Academic Medicine: The Pipeline and Pathways to Leadership, 2015-2016 URL: https://www.aamc.org/members/gwims/statistics/ [accessed 2018-05-29] [WebCite Cache ID 6zmg4f6J1]
2. Association of American Medical Colleges. 2017. Table A-1: Medical School Applications and Matriculants by School, State of Legal Residence, and Sex, 2017-2018 URL: https://www.aamc.org/download/321442/data/factstablea1.pdf [accessed 2017-06-25] [WebCite Cache ID 70Wj9rtQB]
3. Association of American Medical Colleges. 2017. US Medical School Faculty, 2016 URL: https://www.aamc.org/data/facultyroster/reports/475478/usmsf16.html [accessed 2017-09-04] [WebCite Cache ID 6zmgCwIAJ]
4. Kaminski D, Geisler C. Survival analysis of faculty retention in science and engineering by gender. Science 2012 Feb 17;335(6070):864-866 [FREE Full text] [doi: 10.1126/science.1214844] [Medline: 22344445]
5. Sexton KW, Hocking KM, Wise E, Osgood MJ, Cheung-Flynn J, Komalavilas P, et al. Women in academic surgery: the pipeline is busted. J Surg Educ 2012;69(1):84-90 [FREE Full text] [doi: 10.1016/j.jsurg.2011.07.008] [Medline: 22208838]
6. Barfield WL, Plank-Bazinet JL, Austin CJ. Advancement of Women in the Biomedical Workforce: Insights for Success. Acad Med 2016 Aug;91(8):1047-1049 [FREE Full text] [doi: 10.1097/ACM.0000000000001274] [Medline: 27306970]
7. Levine RB, Lin F, Kern DE, Wright SM, Carrese J. Stories from early-career women physicians who have left academic medicine: a qualitative study at a single institution. Acad Med 2011 Jun;86(6):752-758. [doi: 10.1097/ACM.0b013e318217e83b] [Medline: 21512363]
8. Sege R, Nykiel-Bub L, Selk S. Sex Differences in Institutional Support for Junior Biomedical Researchers. JAMA 2015 Sep 15;314(11):1175-1177. [doi: 10.1001/jama.2015.8517] [Medline: 26372589]
9. Mayer EN, Lenherr SM, Hanson HA, Jessop TC, Lowrance WT. Gender Differences in Publication Productivity Among Academic Urologists in the United States. Urology 2017 May;103:39-46 [FREE Full text] [doi: 10.1016/j.urology.2016.12.064] [Medline: 28232174]
10. Silver JK, Slocum CS, Bank AM, Bhatnagar S, Blauwet CA, Poorman JA, et al. Where Are the Women? The Underrepresentation of Women Physicians Among Recognition Award Recipients From Medical Specialty Societies. PM R 2017 Aug;9(8):804-815 [FREE Full text] [doi: 10.1016/j.pmrj.2017.06.001] [Medline: 28606837]
11. Rochon PA, Davidoff F, Levinson W. Women in Academic Medicine Leadership: Has Anything Changed in 25 Years? Acad Med 2016 Aug;91(8):1053-1056. [doi: 10.1097/ACM.0000000000001281] [Medline: 27306972]

12. American Association of Medical Colleges. 2010. Mission, Goals, and Priorities URL: https://www.aamc.org/members/osr/about/77852/mission_goals_priorities.html [accessed 2018-05-22] [WebCite Cache ID 70e1LO8gJ]
13. Association of American Medical Colleges. 2018. Early Career Women Faculty Leadership Development Seminar URL: https://www.aamc.org/members/leadership/catalog/323134/earlycareerwomenfacultyleadershipdevelopmentseminar.html [accessed 2018-05-22] [WebCite Cache ID 70e19anlY]
14. Valerio AM, Sawyer K. The Men Who Mentor Women URL: https://hbr.org/2016/12/the-men-who-mentor-women [accessed 2018-05-29] [WebCite Cache ID 6zmgYagir]
15. Varalli S. Seeing is Believing: The Importance of Visible Role Models in Gender Equality | The Art Of URL: https://www.theartof.com/articles/seeing-is-believing-the-importance-of-visible-role-models-in-gender-equality [accessed 2018-05-29] [WebCite Cache ID 6zmgiEaK9]
16. Kibbe MR, Pellegrini CA, Townsend CM, Helenowski IB, Patti MG. Characterization of Mentorship Programs in Departments of Surgery in the United States. JAMA Surg 2016 Dec 01;151(10):900-906. [doi: 10.1001/jamasurg.2016.1670] [Medline: 27383863]
17. Welch J, Sawtelle S, Cheng D, Perkins T, Ownbey M, MacNeill E, et al. Faculty Mentoring Practices in Academic Emergency Medicine. Acad Emerg Med 2017 Mar;24(3):362-370 [FREE Full text] [doi: 10.1111/acem.13136] [Medline: 27860044]
18. Rehm M, Notten A. Twitter as an informal learning space for teachers!? The role of social capital in Twitter conversations among teachers. Teaching and Teacher Education 2016 Nov;60:215-223 [FREE Full text] [doi: 10.1016/j.tate.2016.08.015]
19. Smith Risser H. Virtual induction: A novice teacher's use of Twitter to form an informal mentoring network. Teaching and Teacher Education 2013 Oct;35:25-33. [doi: 10.1016/j.tate.2013.05.001]
20. Hart M, Stetten NE, Islam S, Pizarro K. Twitter and Public Health (Part 1): How Individual Public Health Professionals Use Twitter for Professional Development. JMIR Public Health Surveill 2017 Sep 20;3(3):e60 [FREE Full text] [doi: 10.2196/publichealth.6795] [Medline: 28931499]
21. Visser RD, Evering LC, Barrett DE. #TwitterforTeachers: The Implications of Twitter as a Self-Directed Professional Development Tool for K–12 Teachers. Journal of Research on Technology in Education 2014 Aug 13;46(4):396-413. [doi: 10.1080/15391523.2014.925694]
22. Straus S, Sackett D. Mentorship in Academic Medicine. Malden, Massachusetts: John Wiley & Sons, Ltd; 2014:978-971.
23. Straus SE, Johnson MO, Marquez C, Feldman MD. Characteristics of successful and failed mentoring relationships: a qualitative study across two academic health centers. Acad Med 2013 Jan;88(1):82-89 [FREE Full text] [doi: 10.1097/ACM.0b013e31827647a0] [Medline: 23165266]
24. Sambunjak D, Straus SE, Marusic A. A systematic review of qualitative research on the meaning and characteristics of mentoring in academic medicine. J Gen Intern Med 2010 Jan;25(1):72-78 [FREE Full text] [doi: 10.1007/s11606-009-1165-8] [Medline: 19924490]
25. Zimmerman K. Stop Telling Millennial Women To Find A Mentor URL: https://www.forbes.com/sites/kaytiezimmerman/2017/04/09/stop-telling-millennial-women-to-find-a-mentor/ [accessed 2018-05-29] [WebCite Cache ID 6zmgwZfCq]
26. Rosati CM, Koniaris LG, Molena D, Blitzer D, Su KW, Tahboub M, et al. Characteristics of cardiothoracic surgeons practicing at the top-ranked US institutions. J Thorac Dis 2016 Nov;8(11):3232-3244 [FREE Full text] [doi: 10.21037/jtd.2016.11.72] [Medline: 28066603]
27. Reed P. Hashtags and retweets: using Twitter to aid Community, Communication and Casual (informal) learning. Research in Learning Technology 2013 Sep 12;21:2013. [doi: 10.3402/rlt.v21i0.19692]
28. Fox A, Bird T. #any use? What do we know about how teachers and doctors learn through social media use? Qwerty-Open and Interdisciplinary Journal of Technology, Culture and Education 2017;12(2):64-87 [FREE Full text]
29. Pitt SC. What does #NYerORCoverChallenge mean for men in cardiothoracic surgery? J Thorac Cardiovasc Surg 2017 Oct;154(4):1352-1353. [doi: 10.1016/j.jtcvs.2017.06.060] [Medline: 28781089]
30. Shillcutt SK, Silver JK. Social Media and Advancement of Women Physicians. N Engl J Med 2018 Dec 14;378(24):2342-2345. [doi: 10.1056/NEJMms1801980] [Medline: 29897857]
31. Trust T. Professional Learning Networks Designed for Teacher Learning. Journal of Digital Learning in Teacher Education 2012 Jun;28(4):133-138. [doi: 10.1080/21532974.2012.10784693]
32. Hughes KA. #ILookLikeASurgeon goes viral: How it happened. Bull Am Coll Surg 2015 Nov;100(11):10-16. [Medline: 26677529]
33. Logghe HJ, Rouse T, Beekley A, Aggarwal R. The Evolving Surgeon Image. AMA J Ethics 2018 May 01;20(5):492-500 [FREE Full text] [doi: 10.1001/journalofethics.2018.20.5.mhst1-1805] [Medline: 29763396]
34. Rory L, Nino P, Eleni B, Kamakshi R, Anoush M, Isobel F. Goals, Motivation for, and Outcomes of Personal Learning through Networks: Results of a Tweetstorm. Journal of Educational Technology & Society 2013;16(3):59-75 [FREE Full text]
35. Colwell J, Hutchison AC. Considering a Twitter-Based Professional Learning Network in Literacy Education. Literacy Research and Instruction 2017 Sep 21;57(1):5-25. [doi: 10.1080/19388071.2017.1370749]
36. Maloney S, Tunnecliff J, Morgan P, Gaida J, Keating J, Clearihan L, et al. Continuing Professional Development via Social Media or Conference Attendance: A Cost Analysis. JMIR Med Educ 2017 Mar 30;3(1):e5 [FREE Full text] [doi: 10.2196/mededu.6357] [Medline: 28360023]

37. Kimmons R, Veletsianos G. Education scholars' evolving uses of twitter as a conference backchannel and social commentary platform. Br J Educ Technol 2016 Apr 12;47(3):445-464. [doi: 10.1111/bjet.12428]
38. Flickinger TE, O'Hagan T, Chisolm MS. Developing a Curriculum to Promote Professionalism for Medical Students Using Social Media: Pilot of a Workshop and Blog-Based Intervention. JMIR Med Educ 2015 Dec 01;1(2):e17 [FREE Full text] [doi: 10.2196/mededu.4886] [Medline: 27731846]
39. Duggan M. 2015. The Demographics of Social Media Users URL: http://www.pewinternet.org/2015/08/19/the-demographics-of-social-media-users/ [accessed 2017-09-04] [WebCite Cache ID 6zmXLZI1o]
40. Smith A, Anderson M. 2018. Social Media Use in 2018 URL: http://www.pewinternet.org/2018/03/01/social-media-use-in-2018/ [accessed 2018-05-29] [WebCite Cache ID 6zmfgP8jp]
41. D'Souza K, Henningham L, Zou R, Huang J, O'Sullivan E, Last J, et al. Attitudes of Health Professional Educators Toward the Use of Social Media as a Teaching Tool: Global Cross-Sectional Study. JMIR Med Educ 2017 Aug 04;3(2):e13 [FREE Full text] [doi: 10.2196/mededu.6429] [Medline: 28778841]
42. Wagner J, Cochran A, Jones C, Gusani N, Varghese T, Attai D. Professional Use of Social Media Among Surgeons: Results of a Multi-Institutional Study. J Surg Educ 2018;75(3):804-810 [FREE Full text] [doi: 10.1016/j.jsurg.2017.09.008] [Medline: 28964746]
43. Markham MJ, Gentile D, Graham DL. Social Media for Networking, Professional Development, and Patient Engagement URL: https://meetinglibrary.asco.org/record/139978/edbook [accessed 2018-05-29] [WebCite Cache ID 6zmgzfChf]
44. Alsobayel H. Use of Social Media for Professional Development by Health Care Professionals: A Cross-Sectional Web-Based Survey. JMIR Med Educ 2016 Sep 12;2(2):e15 [FREE Full text] [doi: 10.2196/mededu.6232] [Medline: 27731855]
45. American Society of Clinical Oncology. 2017. Ten Tips for Use of Social Media URL: http://www.asco.org/sites/www.asco.org/files/asco_socialmedia_card.pdf [accessed 2017-09-04] [WebCite Cache ID 6zmfmMziK]
46. Ferrada P, Suliburk JW, Bryczkowski SB, Selby LV, Lee EE, Torres M, et al. The surgeon and social media: Twitter as a tool for practicing surgeons. Bull Am Coll Surg 2016 Jun;101(6):19-24. [Medline: 27405181]
47. Kotsenas A, Aase L, Arce M, Timimi F, Dacy M, Young C, et al. The Social Media DNA of Mayo Clinic-and Health Care. J Am Coll Radiol 2018 Jan;15(1 Pt B):162-166 [FREE Full text] [doi: 10.1016/j.jacr.2017.09.026] [Medline: 29128500]
48. Cabrera D, Vartabedian BS, Spinner RJ, Jordan BL, Aase LA, Timimi FK. More Than Likes and Tweets: Creating Social Media Portfolios for Academic Promotion and Tenure. J Grad Med Educ 2017 Aug;9(4):421-425. [doi: 10.4300/JGME-D-17-00171.1] [Medline: 28824752]

Abbreviations

AAMC: Association of American Medical Colleges
EWIMS: Early Career Women in Medicine and Science
PLN: personal learning network
STEM: science, technology, engineering, and mathematics

Edited by G Eysenbach; submitted 29.05.18; peer-reviewed by J Suliburk, S Manca; comments to author 19.06.18; revised version received 03.07.18; accepted 05.07.18; published 23.07.18.

Please cite as:
Lewis JD, Fane KE, Ingraham AM, Khan A, Mills AM, Pitt SC, Ramo D, Wu RI, Pollart SM
Expanding Opportunities for Professional Development: Utilization of Twitter by Early Career Women in Academic Medicine and Science
JMIR Med Educ 2018;4(2):e11140
URL: http://mededu.jmir.org/2018/2/e11140/
doi:10.2196/11140
PMID:30037788

Original Paper

Enterprise Microblogging to Augment the Subinternship Clinical Learning Experience: A Proof-of-Concept Quality Improvement Study

Irsk Anderson[1], MD; Oliver Hulland[2], MD; Jeanne M Farnan[1], MD, MHPE; Wei Wei Lee[1], MD, MPH; Debra Milton[1], ACUME; Vineet M Arora[1], MD, MA

[1]Department of General Internal Medicine, Pritzker School of Medicine, University of Chicago, Chicago, IL, United States

[2]Department of Emergency Medicine, Yale School of Medicine, Yale University, New Haven, CT, United States

Corresponding Author:
Irsk Anderson, MD
Department of General Internal Medicine
Pritzker School of Medicine
University of Chicago
5841 S Maryland Avenue
MC3051, Room L324
Chicago, IL, 60637
United States
Phone: 1 773 702 6840
Fax: 1 773 834 3945
Email: ianderso@medicine.bsd.uchicago.edu

Abstract

Background: Although the Clerkship Directors in Internal Medicine (CDIM) has created a core subinternship curriculum, the traditional experiential subinternship may not expose students to all topics. Furthermore, academic institutions often use multiple clinical training sites for the student clerkship experience.

Objective: The objective of this study was to sustain a Web-based learning community across geographically disparate sites via enterprise microblogging to increase subintern exposure to the CDIM curriculum.

Methods: Internal medicine subinterns used Yammer, a Health Insurance Portability and Accountability Act (HIPAA)–secure enterprise microblogging platform, to post questions, images, and index conversations for searching. The subinterns were asked to submit 4 posts and participate in 4 discussions during their rotation. Faculty reinforced key points, answered questions, and monitored HIPAA compliance.

Results: In total, 56 medical students rotated on an internal medicine subinternship from July 2014 to June 2016. Of them, 84% returned the postrotation survey. Over the first 3 months, 100% of CDIM curriculum topics were covered. Compared with the pilot year, the scale-up year demonstrated a significant increase in the number of students with >10 posts (scale-up year 49% vs pilot year 19%; *P*=.03) and perceived educational experience (58% scale-up year vs 14% pilot year; *P*=.006). Few students (6%) noted privacy concerns, but fewer students in the scale-up year found Yammer to be a safe learning environment.

Conclusions: Supplementing the subinternship clinical experience with an enterprise microblogging platform increased subinternship exposure to required curricular topics and was well received. Future work should address concerns about safe learning environment.

(JMIR Med Educ 2018;4(2):e18) doi:10.2196/mededu.9810

KEYWORDS

social media; medical education; microblogging platform; distance learning

Introduction

The traditional internal medicine subinternship relies heavily on experiential learning to ensure adequate exposure to various presenting conditions [1]. Unfortunately, student exposure is limited by several factors, including differing patient populations by clinical site, duty hour restrictions, and seasonal variation in presenting illnesses. A review by the Clerkship Directors in Internal Medicine (CDIM) Subinternship Taskforce suggested that this pivotal transition, which bridges the gap between the undergraduate and graduate medical education, needs a formal curricular structure to ensure adequate and balanced exposure to disease processes [2]. Unfortunately, only 31% of internal medicine subinternship clerkship directors admitted to using a formal curriculum [3] despite the existence of standardized teaching tools [2]. In 2002, the CDIM created an Internal Medicine Subinternship Curriculum, whose second version was released on March 2018 [4,5].

Clerkship learning occurs through various means, and our prior work has demonstrated subintern exposure to the CDIM curriculum topics as follows: 19% from direct patient care, 39% from the discussion of a cointern's patient, 29% from cross-cover patient management, and 17% during conferences and dedicated teaching rounds [6]. Even more alarming, only 14% of students were exposed to ≥15 (of 17) CDIM training problems and >1 out of every 4 subinterns did not have exposure to 35% (6/17) of the training problems during their subinternship month [6].

As of 2016, over 95% of young adults aged 18-24 years had been using social media on a routine basis, with 85% using 6 or more sites regularly [7]. A recent survey on medical residents revealed multiple potential targets of education and further training, such as Web-based privacy, digital professionalism, and protecting patient health information (PHI) while using social media platforms [8]. Enterprise microblogging utilizes a company Web-based platform combining blogging and instant messaging for company workers to post, edit, and sort text and files privately online with specific coworkers in their organization [9,10]. We piloted the use of a Health Insurance Portability and Accountability Act (HIPAA)-compliant enterprise microblogging platform (Yammer) available at the University of Chicago. Muntz et al [11] have successfully implemented Yammer for distance learning during the third-year internal medicine clerkship with high satisfaction and participation rates and low levels of privacy concerns. Although prior work has demonstrated that social media can be used to positively augment a traditional curriculum with moderate to high levels of satisfaction [12-16], no published study to our knowledge has evaluated the use of an enterprise microblogging platform to enhance the clinical experience of subintern medical students. Building on this fact and considering the distributed nature of the subinternship, we hypothesized that employing an enterprise microblogging platform to build a Web-based learning community can augment traditional patient care and ensure a more robust exposure to patient pathology while promoting discussion and learning.

Methods

Study Participants

The study was conducted at the University of Chicago Pritzker School of Medicine. We included 5 core faculty and all internal medicine subinterns over 24 consecutive months. The 4-week long subinternships include general internal medicine, cardiology, or medical intensive care unit services. Rotations commenced at either our academic urban tertiary care hospital or a community hospital affiliate (Northshore Hospital) 29 miles away. The students were required to take an overnight call approximately every fourth day and admit up to 3 patients while carrying a total patient census of up to 6.

All fourth-year students participating in an internal medicine subinternship, whether at the University of Chicago or our affiliate, were strongly encouraged to participate for the duration of their subinternship. All students were provided with a consent script indicating that the surveys were anonymous and de-identified as well as the voluntary nature of the study. The experience consisted of several key components: (1) training on the secure social media platform; (2) student-initiated case discussion on the social media platform; and (3) faculty moderating student case discussions to reinforce concepts and identify teaching pearls.

Social Media Platform

We built a private Yammer discussion group called UC4 for all the internal medicine subinterns. To join UC4, an institution-specific email domain (eg, @uchicago.edu) and invitation are required. Yammer allows students in the private group to begin a conversation or thread around a specific topic, tag those conversations with supplementary files or images, and index the conversations in a searchable manner. Pilot testing of this software has proven the site's security and invitation-only functionality [10]. All connections to Yammer are secured via secure sockets layer or transport layer security. The project was granted institutional review board exemption based on research conducted in an established or commonly accepted educational setting that involves normal educational practices, such as research on regular and special education instructional strategies. The study was also approved by our HIPAA Compliance Office.

Student Requirements

Prior to the start of their subinternship, pilot-year students received an email from a faculty member (IA) describing the Yammer study details. During the scale-up year, all students participated in a face-to-face, 45-minute group training session prior to starting the fourth year and again individually prior to starting their subinternship month. All students were educated on how to de-identify all PHI shared in the discussion group and follow universal HIPAA guidelines for PHI protection. Students learned how to access and use Yammer on a desktop device (loading images and files) and how to download and use the mobile app. The students were encouraged to participate throughout their fourth year of medical school.

During their subinternship, the students were asked to submit 4 original cases for discussion and comment on 4 cases submitted by their peers on the platform. The cases could include

an actual patient case, teaching pearls learned, or cross-cover events they experienced (Multimedia Appendix 1).

Faculty Moderation

Faculty facilitators reinforced key educational points made during the discussion, clarified ambiguous areas, and monitored the process for appropriate sharing of PHI.

Data Collection

We implemented Yammer in 2014-2015 (pilot year) through a smaller pilot starting late summer. In 2015-2016 (scale-up year), we incorporated Yammer into the required Subinternship Preparatory Course and scaled up to include all internal medicine subinterns. The students completed an anonymous, electronic survey (Google Forms for pilot year and E*Value for scale-up year; Multimedia Appendix 2) on the Yammer experience after completing their subinternship. The survey specifically targeted the frequency of posting and ease of use, perceptions of learning, overall satisfaction, and privacy concerns. Study authors (IA, OH, and VMA) analyzed the discussion threads for the frequency of posting and mapped cases to the CDIM Subinternship Curriculum. We compared results from both the pilot and scale-up years to assess implementation success and sustainability. Two-sample tests of proportions were used to compare perceptions between the pilot and scale-up years. Statistical tests were performed using Stata 14.0 software (College Station, TX).

Results

All 56 fourth-year medical students who rotated on an eligible medicine subinternship during 2014-2016 (n=21 in the pilot year and n=35 in the scale-up year) were included. On average, 41% (23/56) of the subinterns rotated at our affiliate hospital, while 59% (33/56) rotated at the academic hospital; >90% of the students were able to meet the threshold of 4 original posts and commenting on 4 discussions. Within the first 3 months of the pilot year, 100% (17/17) of the CDIM Subinternship Curriculum Topics (“training problems”) had been discussed on the Yammer forum.

Of all the medical students, 84% returned the postsurvey over 2 years (14/21, 67%, in pilot vs 33/35, 94%, in scale-up; *P*=.006). In both years, 87% (41/47) of the students found Yammer easy to use. Usage was high and sustained: 89% (50/56) posted at least once, 82% (46/56) posted 4 or more times, and 38% (21/56) posted ≥10 times. Posting rates were significantly higher in the scale-up year (17/35, 49%) than in the pilot year (4/21, 19%) for ≥10 posts (*P*=.03; Figure 1).

At least half of the students in both years agreed that Yammer broadened their exposure to both familiar (7/14, 50%, pilot vs 18/33, 55%, scale-up) and unfamiliar (9/14, 64%, pilot vs 20/33, 58%, scale-up) topics (Figure 2). Compared with the pilot year, significantly more students in the scale-up year reported that it was a useful way to share pearls and teaching points (9/14, 64%, pilot vs 30/33, 91%, scale-up; *P*=.02; Figure 2) and rated the educational experience as higher (2/14, 14%, pilot vs 19/33, 58%, scale-up; *P*=.006; Figure 2). More students were satisfied in the scale-up year than in the pilot year (4/14, 29%, pilot vs 19/33, 58%, scale-up; *P*=.07; Figure 2), although the numbers did not reach statistical significance.

A minority of students expressed privacy concerns (1/14, 7%, pilot vs 2/33, 6%, scale-up). Although the numbers were not statistically significant, fewer students felt that Yammer provided a “safe space,” or safe learning environment, in the scale-up year (13/33, 39%) than in the pilot year (9/14, 64%; *P*=.12).

Figure 1. Frequency of posts on Yammer: pilot year versus scale-up year. Asterisk indicates *P*=.03.

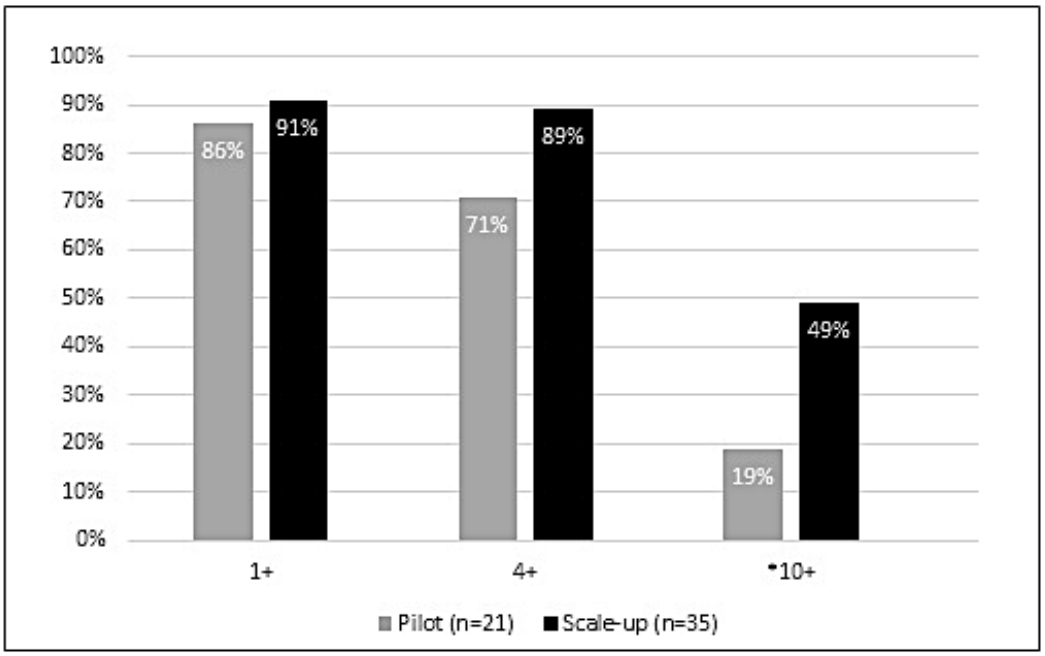
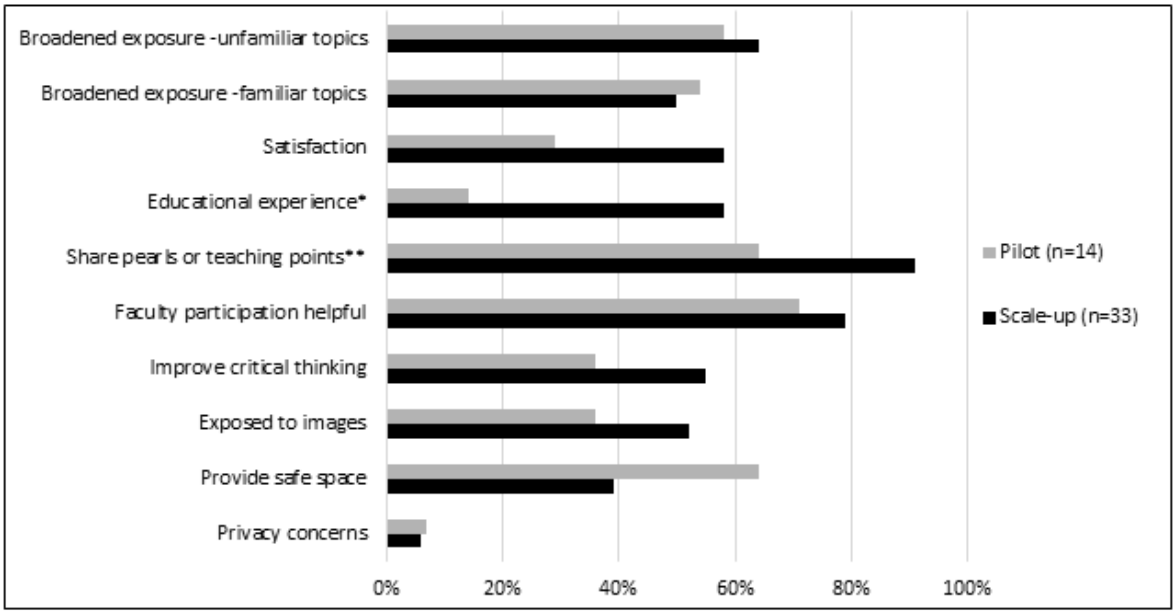


Figure 2. Student perceptions of Yammer: pilot year versus scale-up year. Asterisk indicates *P*=.006; double asterisk indicates *P*=.02.



Constructed response feedback from the students and faculty highlighted additional issues for exploration and feedback. The students commented the following: "liked the little pearls and discussing cases," "many students will really enjoy this forum," "more enjoyable part of my Sub-I," "not enough participants," "forced effort," and "burdensome." Faculty commented the following: "I was impressed with the effort the students put into the cases as well as how engaged the responses were. I particularly enjoyed the quality or safety topics," "many cases generated fruitful discussions, which spurred self-directed and case-directed learning by students," and "the students were fast to post the most up-to-date clinical trials or guidelines and initiated thoughtful discussions of the findings and relevance to personalized patient care."

Discussion

Principal Results

To the best of our knowledge, this is the first study to evaluate the implementation of an enterprise microblogging platform for the subinternship across geographically disparate sites. Compared with the pilot year, the scale-up year showed an increased frequency of posting and improved student perceptions of educational value. All 17 of the CDIM Subinternship Curriculum topics were discussed within the first 3 months of the pilot year, far higher than our prior experience with personal patient care, cross-cover patient care and conference exposures [6]. Despite these positive outcomes, there are some concerns surrounding the platform's ability to provide a safe learning environment among colleagues.

Our findings highlight the importance of sustaining new technologies in medical education to provide benefits to learners. There are several reasons why the scale-up year may have been better received than the pilot year. First, a known "cost of building it" exists as the site did not have any background content during its pilot year, whereas the scale-up year had the entire catalog of the pilot-year postings (including images, documents, and links) for students to review. Second, the scale-up year benefited from a timely in-person Yammer orientation during our annual Subinternship Preparatory Course in June, 1 month prior to the start of the first subinternships, as well as a once-a-month refresher orientation prior to the start of each monthly rotation. Last, during the scale-up year orientations, faculty (IA) noted constructive feedback from pilot-year students, such as frustration with long-winded cases without resolution; preference for brief, high-yield pearls and images; and benefits of robust participation with hopes of embedding these lessons into the scale-up year experience.

Use of such technologies involves a certain degree of skepticism. For example, not all students considered Yammer a safe learning environment even though it was a private group. There may be a fear of judgement on their perceived knowledge or skills based on their post content or lack of clarity on who has access to the site. Future work should explore how to better address student concerns to overcome this challenge, particularly for private platforms. Anonymous posting is one option, although that may affect conversation tracking and monitoring of individual student participation. Using student peer social media champions as platform facilitators is another possibility.

Limitations and Future Directions

Our study was conducted using only one mobile technology platform (Yammer), with students from one medical school rotating in one specialty, the internal medicine subinternship. These limitations may affect the generalizability of our findings. The survey response rate in the pilot year was lower than optimal. Other factors affecting participation include prior use of and comfort with social media, competing responsibilities during the internal medicine subinternship, overall low numbers of subinterns in any given month (maximum 6), and the asynchronous nature of the platform.

Using Kirkpatrick's training evaluation model (reaction, learning, behavior, and results), we assessed students' reactions, but future work should address the three other factors [17]. We

hope that students are learning with Yammer, but this may require building direct e-learning of Alliance for Academic Internal Medicine (AAIM) Subintern Curriculum 2.0 content and assessing uptake and retention through internal testing or tracking USMLE (United States Medical Licensing Examination) Step 2 scores. Yammer monitors individual student use, but any long-term change to social media use (behavior) would likely have to be assessed through self-reporting. Finally, the ultimate result would be improved quality of patient care; this could be assessed through simulation or directly observed patient care.

We propose the following four strategies to scale up mobile technology and distance learning: (1) engaging a student champion, or peer educator, with social media savvy to improve student satisfaction and participation; (2) adding incentives, possibly gift cards, as posting rates and peer-nominated "best posts" have been shown to improve learner participation [18]; (3) expanding the study to all fourth-year or even all third-year medical students (eg, we have partnered with our third-year medical school internal medicine clerkship directors to utilize Yammer to create a patient advocacy blog and plan to work with our colleagues in the infectious disease field to create a unique mobile learning experience surrounding antibiotic stewardship); and (4) making the initiative multi-institutional. We have partnered with three academic centers to create an e-learning internal medicine subinternship curriculum geared toward the CDIM training cases. This curriculum is hosted on a Web-based platform for distance learning and collaboration. Our goal is to broaden exposure to the Association of American Medical Colleges Core Entrustable Professional Activities and ensure early exposure to American Council for Graduate Medical Education Competencies, a priority of the AAIM CDIM Subinternship Task Force and Association of Program Directors in Internal Medicine collaboration [19,20].

Conclusions

Supplementing the required clinical experiences in an internal medicine subinternship with an enterprise microblogging platform was feasible, and the majority of students found it easy to use. Overall, Yammer was a well-received addition to the traditional subinternship experience and facilitated distance learning across multiple clinical sites.

Acknowledgments

The authors would like to thank Diane Altkorn, MD, and Todd Stern, MD, at the Department of Medicine, The University of Chicago Medical Center. Without their hard work and guidance, this study would not have been possible. We also acknowledge the assistance of Drs Paul Bergl, Martin Muntz, and Amber Bird, copresenters at social media in medical education national workshops. This study was funded by the University of Chicago Pritzker School of Medicine, Academy of Distinguished Medical Educators. Additional grant funding (VMA, JMF, and IA) is supported by the American Medical Association–Accelerating Change in Medical Education. Neither funding body had a role in the study design, conduction, data analysis, or writing of the manuscript.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Sample screenshots of the interactive microblogging platform.

[PDF File (Adobe PDF File), 325KB - mededu_v4i2e18_app1.pdf]

Multimedia Appendix 2

Survey instrument.

[PDF File (Adobe PDF File), 140KB - mededu_v4i2e18_app2.pdf]

References

1. Green EH, Fagan MJ, Reddy S, Sidlow R, Mechaber AJ, CDIM Subinternship Task Force. Advances in the Internal medicine subinternship. Am J Med 2002 Dec 15;113(9):769-773. [Medline: 12517373]
2. Clerkship Directors in Internal Medicine Subinternship Task Force, Aiyer M, Appel J, Fischer M, Fitz M, Vu TR, et al. The role of the internal medicine subinternship director in the 21st century. Am J Med 2008 Aug;121(8):733-737. [doi: 10.1016/j.amjmed.2008.04.025] [Medline: 18691488]
3. Aiyer MK, Vu TR, Ledford C, Fischer M, Durning SJ. The subinternship curriculum in internal medicine: a national survey of clerkship directors. Teach Learn Med 2008;20(2):151-156. [doi: 10.1080/10401330801991683] [Medline: 18444202]
4. Alliance for Academic Internal Medicine. CDIM internal medicine subinternship curriculum URL: http://www.im.org/p/cm/ld/fid=373 [accessed 2018-08-01] [WebCite Cache ID 71MdsmTgV]
5. Alliance for Academic Internal Medicine. CDIM internal medicine subinternship curriculum URL: http://www.im.org/page/subi [accessed 2018-08-02] [WebCite Cache ID 71Mdx5RXt]

6. Anderson I, Farnan JM, Altkorn D. Assessing the adequacy of clinical exposure during the sub-internship. In: Academy of Distinguished Medical Educators Medical Education Day Plenary Session April 13; Chicago, Illinois. 2007 Presented at: Academy of Distinguished Medical Educators Medical Education Day Plenary Session; April 13, 2007; Chicago, IL.
7. Villanti AC, Johnson AL, Ilakkuvan V, Jacobs MA, Graham AL, Rath JM. Social Media Use and Access to Digital Technology in US Young Adults in 2016. J Med Internet Res 2017 Jun 07;19(6):e196 [FREE Full text] [doi: 10.2196/jmir.7303] [Medline: 28592394]
8. Lefebvre C, Mesner J, Stopyra J, O'Neill J, Husain I, Geer C, et al. Social Media in Professional Medicine: New Resident Perceptions and Practices. J Med Internet Res 2016 Dec 09;18(6):e119 [FREE Full text] [doi: 10.2196/jmir.5612] [Medline: 27283846]
9. Nations D. Lifewire. 2018 06. URL: https://www.lifewire.com/what-is-microblogging-3486200 [WebCite Cache ID 71hd1DLqi]
10. Leonardi PM, Huysman M, Steinfield C. Enterprise Social Media: Definition, History, and Prospects for the Study of Social Technologies in Organizations. J Comput-Mediat Comm 2013 Oct 18;19(1):1-19. [doi: 10.1111/jcc4.12029]
11. Muntz M. Teaching and Learning in Medicine (online). In: Abstracts from the proceedings of the. 2013 Presented at: 2013 CDIM National Meeting; October 5, 2013; New Orleans, LA URL: https://tinyurl.com/y8kpu2z4 [WebCite Cache ID 71hdNzixS]
12. Bahner DP, Adkins E, Patel N, Donley C, Nagel R, Kman NE. How we use social media to supplement a novel curriculum in medical education. Med Teach 2012;34(6):439-444. [doi: 10.3109/0142159X.2012.668245] [Medline: 22449268]
13. Bergl P, Muntz M. Using social media to enhance health professional education. Clin Teach 2016 Dec;13(6):399-404. [doi: 10.1111/tct.12594] [Medline: 27870329]
14. Cartledge P, Miller M, Phillips B. The use of social-networking sites in medical education. Med Teach 2013 Oct;35(10):847-857. [doi: 10.3109/0142159X.2013.804909] [Medline: 23841681]
15. Reames BN, Sheetz KH, Englesbe MJ, Waits SA. Evaluating the Use of Twitter to Enhance the Educational Experience of a Medical School Surgery Clerkship. J Surg Educ 2016;73(1):73-78. [doi: 10.1016/j.jsurg.2015.08.005] [Medline: 26417905]
16. Galiatsatos P, Porto-Carreiro F, Hayashi J, Zakaria S, Christmas C. The use of social media to supplement resident medical education - the SMART-ME initiative. Med Educ Online 2016;21:29332 [FREE Full text] [Medline: 26750511]
17. Moreau KA. Has the new Kirkpatrick generation built a better hammer for our evaluation toolbox? Med Teach 2017 Sep;39(9):999-1001. [doi: 10.1080/0142159X.2017.1337874] [Medline: 28649887]
18. Pisano J, Pettit N, Bartlett A, Bhagat P, Han Z, Liao C, et al. Social media as a tool for antimicrobial stewardship. Am J Infect Control 2016 Nov 01;44(11):1231-1236. [doi: 10.1016/j.ajic.2016.07.005] [Medline: 27810065]
19. Vu TR, Angus SV, Aronowitz PB, Harrell HE, Levine MA, Carbo A, CDIM-APDIM Committee on Transitions to Internship (CACTI) Group. The Internal Medicine Subinternship--Now More Important than Ever: A Joint CDIM-APDIM Position Paper. J Gen Intern Med 2015 Sep;30(9):1369-1375 [FREE Full text] [doi: 10.1007/s11606-015-3261-2] [Medline: 26173515]
20. Reddy ST, Chao J, Carter JL, Drucker R, Katz NT, Nesbit R, et al. Alliance for clinical education perspective paper: recommendations for redesigning the “final year” of medical school. Teach Learn Med 2014;26(4):420-427. [doi: 10.1080/10401334.2014.945027] [Medline: 25318040]

Abbreviations

AAIM: Alliance for Academic Internal Medicine
CDIM: Clerkship Directors in Internal Medicine
HIPAA: Health Insurance Portability and Accountability Act
PHI: patient health information
USMLE: United States Medical Licensing Examination

Edited by G Eysenbach; submitted 11.01.18; peer-reviewed by A Olszewski, R Booth, D Hansen, S Oser; comments to author 21.03.18; revised version received 01.05.18; accepted 18.06.18; published 21.08.18.

Please cite as:
Anderson I, Hulland O, Farnan JM, Lee WW, Milton D, Arora VM
Enterprise Microblogging to Augment the Subinternship Clinical Learning Experience: A Proof-of-Concept Quality Improvement Study
JMIR Med Educ 2018;4(2):e18
URL: http://mededu.jmir.org/2018/2/e18/
doi:10.2196/mededu.9810
PMID:30131315

Original Paper

How Self-Directed e-Learning Contributes to Training for Medical Licentiate Practitioners in Zambia: Evaluation of the Pilot Phase of a Mixed-Methods Study

Sandra Barteit[1], MA; Albrecht Jahn[1], Prof Dr; Annel Bowa[2]; Sigrid Lüders[3], MD; Gregory Malunga[2], MSc; Clemence Marimo[4], MD; Sigrid Wolter[3], Dr rer net; Florian Neuhann[1], MD

[1]Heidelberg Institute of Global Health, Heidelberg University, Heidelberg, Germany

[2]Chainama College of Health Sciences, Lusaka, Zambia

[3]SolidarMed, Lusaka, Zambia

[4]School of Medicine, University of Zambia, Lusaka, Zambia

Corresponding Author:
Sandra Barteit, MA
Heidelberg Institute of Global Health
Heidelberg University
Im Neuenheimer Feld 130.3
Heidelberg, 69120
Germany
Phone: 49 62215634030
Email: barteit@uni-heidelberg.de

Abstract

Background: Zambia faces a severe shortage of health workers, particularly in rural areas. To tackle this shortage, the Medical Licentiate program was initiated at Chainama College of Health Sciences in the capital, Lusaka, in 2002. The objective of the program was to alleviate the shortage of human resources in curative care. On-the-job training is conducted in decentralized teaching hospitals throughout Zambia. However, the program faces significant challenges such as shortages of senior medical instructors and learning materials.

Objective: Our aim was to address these challenges by introducing a self-directed, e-learning platform with an offline tablet as part of a collaborative blended-learning intervention to supplement local teaching and training.

Methods: The pilot phase of the e-learning platform was evaluated using a mixed-methods approach with a convergent parallel design. Various methods were employed to test the data's adequacy and potential for generating valid results. Methods included questionnaires according to the technology acceptance model and information system success model by DeLone and McLean, semistructured interviews, learner diaries, pretesting, the collection of usage data, exam results, demographics, and informal feedback. Outcome measures included usage, adoption, efficiency, acceptance, user-friendliness, and gained knowledge and skills.

Results: In total, 52 students and 17 medical instructors participated in the pilot evaluation. The questionnaire results showed a high acceptance of the technology (>80%) and high agreement (>75%) with the e-learning platform. Semistructured interview results showed an overall appreciation of the e-learning intervention, but the need for more e-learning materials. Respondents identified a need for multimedia materials that transfer skills such as medical procedure visualization and interactive exercises to practice procedural knowledge. The learning diaries identified the lack of specific learning materials and potential shortcomings of existing learning materials. However, students were satisfied with the current e-learning content. The majority of students used the e-learning platform offline on their tablets; online e-learning was underutilized.

Conclusions: The pilot phase of the tablet-based e-learning platform to support the self-directed learning intervention was well received and appreciated by students and medical instructors of Chainama College of Health Sciences. E-learning for knowledge acquisition appears to be adequate and feasible for this low-resource educational environment. Our evaluation results guide the further development of the full implementation of the e-learning platform in this educational setting. E-learning materials should reflect curriculum requirements, and additional multimedia and interactive content is needed, as well as improved integration and active participation from medical instructors in the e-learning processes.

(JMIR Med Educ 2018;4(2):e10222) doi:10.2196/10222

KEYWORDS

evaluation; medical e-learning; intervention; sustainability; effectiveness; adoption; health care workers; rural health; sub-Saharan Africa

Introduction

Zambia's severe lack of health workers is leaving basic population health needs unmet [1], which is further aggravated by an overabundance of medical doctors in urban areas [2]. Consequently, rural health clinics are often understaffed and managed by health workers who lack the medical qualifications to manage their patient population adequately [2,3]. A human resource upscale of 140% is necessary to reduce the current deficiency, which may be further intensified by population growth that may double the health worker shortage by 2035 [2]. More health worker training is needed "with measures to mitigate attrition and to increase productivity" [4]. As part of Zambia's national response to the health worker deficiency, especially in rural areas, the Medical Licentiate (ML) program was established at Chainama College of Health Sciences (CCHS), in 2002 [5]. Initially, the program was targeted at in-service clinical officers to upgrade their medical skills in order to perform various essential operations and manage Level 1 health care facilities. Graduated MLs are placed primarily in district hospitals on the periphery of Zambia with a focus on internal medicine, pediatrics, surgery, gynecology, and obstetrics. The ML program has proven valuable to date, particularly for high retention [6] and equal distribution of MLs throughout rural Zambia [4,5]. An essential part of the ML training includes clinical rotations, which currently lack adequate onsite senior supervision, mentorship, and learning resources. Medical instructors, the majority of which are physicians, are often faced with a double burden, since their appointment to the ML program is in addition to their daily clinical duties. Furthermore, appointed medical instructors have no didactic training for this program. Learning materials are scarce in the rural training sites, although technologies for medical education are widely available even in low-resource countries [7].

In Africa, the number of households with a personal computer has significantly increased as reported by the International Telecommunications Union [8]. E-learning for medical education offers significant potential for knowledge acquisition [9], particularly for health care training, monitoring, diagnostics, and new analysis methodologies [8]. The advantages of e-learning have been widely discussed [10-13] and could potentially address the bottlenecks faced by low-resource countries scaling up health worker numbers. E-learning is flexible and can provide self-directed, local, and personalized training, and it can easily be scaled to provide access to current educational materials even in the most remote areas.

Thus, Heidelberg Institute of Public Health in partnership with the Swiss nongovernmental organization, SolidarMed, and CCHS implemented a medical e-learning platform to strengthen the ML program. A 2-week fact-finding mission was conducted in November 2015, followed by an e-learning platform piloted from January-July 2016. For cost-effectiveness, we focused on open-source software and low-cost qualitative hardware. Initial e-learning materials included lecture notes taken from a previous e-learning project in Malawi and then adapted to the Zambian context [14]. The content was targeted at ML students only. There was no content specifically for medical instructors as they were instead to make use of the e-learning platform as a teaching method. During the pilot phase, additional e-learning materials were developed and made available per the ML curriculum, including medical books, treatment guidelines and procedures, virtual patients (interactive patient cases), and lecture notes. ML students in their final study year were given tablets preloaded with e-learning content for offline usage (see Multimedia Appendix 1 for a full list of e-learning materials). Furthermore, a local Web server was implemented on campus, and local information and communications technology (ICT) support was trained in e-learning administration and support. The objective of the pilot phase was to test the feasibility of a blended learning approach for this educational environment since blended learning has shown to be effective in strengthening educational interventions in health care in similar settings [9,10]. In this paper, we introduce the pilot evaluation methods in detail, discuss results, reflect on shortcomings, and propose recommendations based on our findings. The adequacy of the mixed method approach we employed was also evaluated as a secondary objective of the pilot phase.

Methods

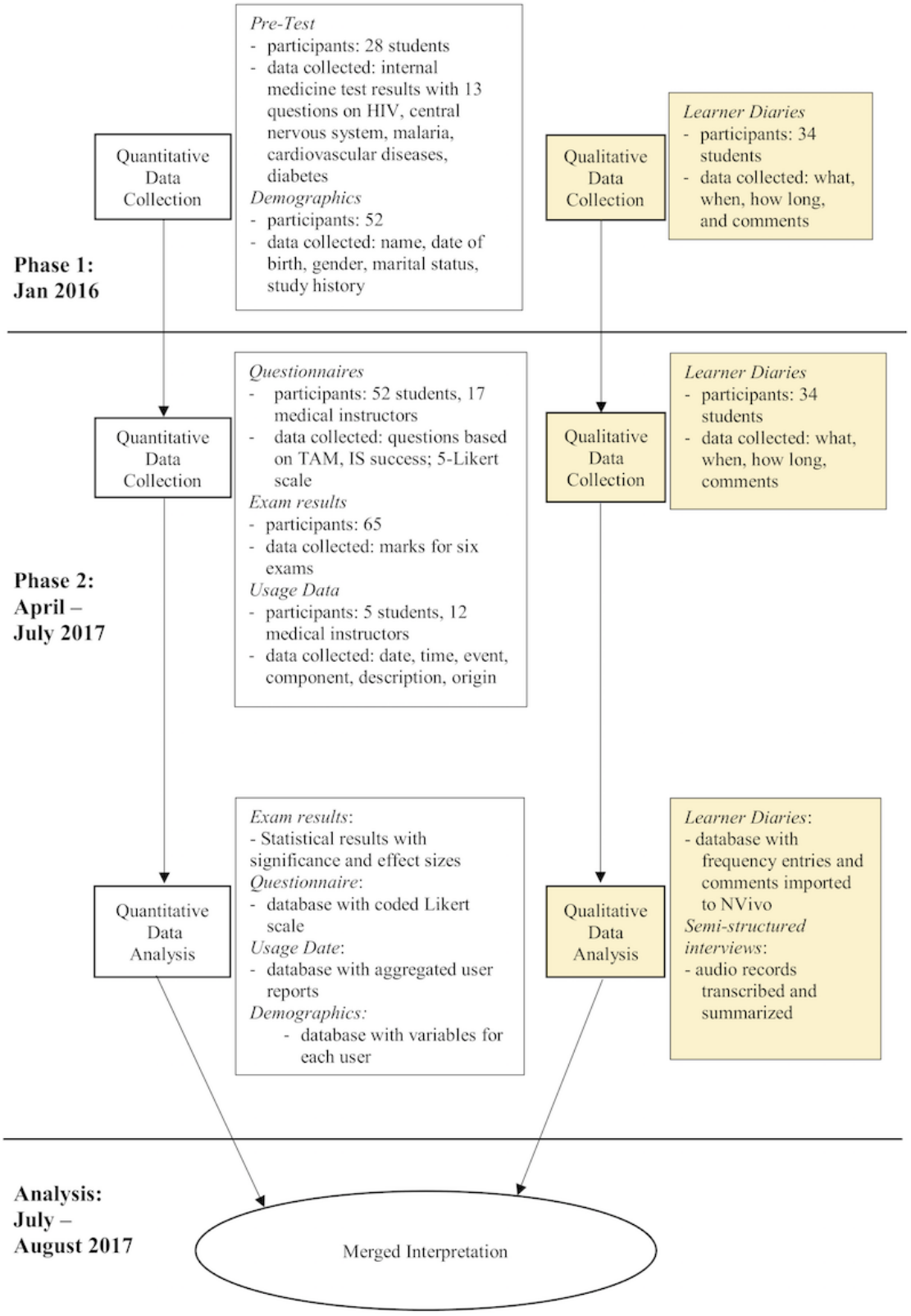
Overview

The e-learning evaluation followed a mixed-methods approach by employing a convergent design [12,13] (see Figure 1) to obtain data from various perspectives and gain a comprehensive understanding of the following study questions [12]:

1. How adequate is the employed technology?
2. How do students use the e-learning platform?
3. How does e-learning enable and support learning and teaching?
4. How useful are e-learning materials?
5. What challenges in e-learning are encountered?

Data collection followed a purposive, nonrandom sampling procedure since all CCHS students and instructors involved with the e-learning platform were included. The Consolidated Criteria for Reporting Qualitative Research guided the qualitative data collection [14]. The quantitative data collection followed guidelines for "Assessing Rigour in Quantitative Health Sciences Research" [13]. Results were validated by merging and comparing both sets of data [12].

Figure 1. Convergent mixed-methods design of the evaluation of the Medical Licentiate (ML) e-learning intervention. IS: Information System Success Model; TAM: Technology Acceptance Model.



Qualitative data included (1) learner diaries given to students to provide feedback on e-learning materials and usage, (2) six semistructured student interviews using 12 guiding questions with a purposive selection including 3 females and 3 males, ages ≤30, ≥31-45, >45 years (see Multimedia Appendix 2), and (3) informal feedback from student statements and the status quo of tablets (ie, condition of tablets, installed apps, specific

tablet configuration) during general tablet maintenance at the end of the study year in July 2016.

Quantitative data included the following:

1. Knowledge assessment by pretest and posttest (see Multimedia Appendix 3) with multiple-choice and short-answer questions on internal medicine.
2. Two questionnaires (see Multimedia Appendices 4 and 5) using a 5-point Likert scale based on the Technology Acceptance Model (TAM), which assesses students' acceptance and use of technology based on perceived usefulness and ease-of-use, and the Information System (IS) Success Model [15-17], which assesses the success of the information system's components [18] based on six interrelated and interdependent dimensions: the student questionnaire with 60 statements (36 from IS and 24 from TAM), and the medical instructors' questionnaire with 32 statements (15 from IS and 17 from TAM).
3. Usage data of the e-learning platform based on inbuilt Moodle statistics.
4. Demographics of ML students and medical instructors comprising both cohorts' dates of birth, gender, and years of medical practice.
5. Exam results of ML students' end-of-year exam.

Ethics

The Biomedical Research Ethics Committee of the University of Zambia approved this study's protocol, as well as the ethical committee of the University Hospital Heidelberg, Germany. All participating students agreed before taking part in this study that the user data (frequency of use) would be tracked and analyzed. All approached and selected interview participants were informed about the scope and purpose of the interviews and their right to withdraw. All participants gave written consent. All students and instructors in the study were treated with an ethic of respect. All data gathered in the survey were anonymized before the analyses.

Data Analysis

Quantitative Data

Pretests for knowledge assessment were marked by medical instructors specialized in internal medicine. Questionnaire results were aggregated in MS Excel and analyzed according to ordinal data with the mean as the best measure of central tendency. Usage data were exported in an MS Excel format and analyzed according to the login frequency of individual users. Demographic data were descriptively analyzed in MS Excel with graphs for visualization. Exam results were checked for correlation (one-way analysis of variance) with questionnaire results and correlation with the frequency of participation in learner diaries.

Qualitative Data

Contents of the learner diaries were transcribed in MS Excel and analyzed according to word frequency and number of entries. Interviews were transcribed with word-processing software and further analyzed with computer-assisted qualitative data analysis software (NVivo) based on grounded theory. The coding followed the qualitative data analysis process is described in the Coding Manual for Qualitative Researchers [19]. Data were coded by hypothesis coding [19] and conducted in two coding cycles. Informal feedback was sought to complement data and widen insights if deemed necessary by the researchers.

Results

Summary

Overall, the pilot phase of the e-learning platform comprised the following results:

1. E-learning server set up locally on CCHS campus.
2. Tablets fit collegiate requirements of ML students.
3. Establishment of ICT support infrastructure for e-learning.
4. ICT training for e-learning administration and support.
5. Support materials created and provided for e-learning usage proved supportive.
6. ML students found the e-learning platform useful for their needs.
7. A general acceptance of e-learning platform by medical instructors.
8. Positive feedback to e-learning platform from students and medical instructors.

Results are presented concisely according to the respective evaluation method and then according to the study questions.

Demographics

In total, 14 females and 38 males (52/65 students) participated in the study, except for the final exam in which all 65 students participated. The ML students are a heterogeneous group with the youngest student aged 27 and the eldest aged 54 years (see Figure 2). Student distribution reflected clinical experience ranging from novice to quite experienced adult learners (see Figure 3): 85% (44/52) had more than 10 years of clinical experience, 8% (4/52) more than 25 years, and 15% (8/52) fewer than 5 years of continuous medical practice (see Figure 3). Medical instructors (2 female, 14 male) were also heterogeneous with ages ranging from 36-56 years. Most of the medical instructors (14/16, 88%) had more than 10 years of experience in professional medical practice.

Exam Results

All ML students in their last study year had a final exam (65/65). For all 65 ML students who participated in the exam, results were checked for correlation (one-way analysis of variance) with questionnaire results covering all factors of the IS success model (ie, information quality, service quality, system quality, user satisfaction, system use, net benefits) and TAM. Figures 4 and 5 present the results for medical instructors based on the IS success and TAM models. Figure 6 shows the results for ML students by IS success model and TAM. A correlation was also checked for self-reported usage in the learner diaries. No correlations were found.

Figure 2. Age of Medical Licentiate (ML) students depicted in six age groups.

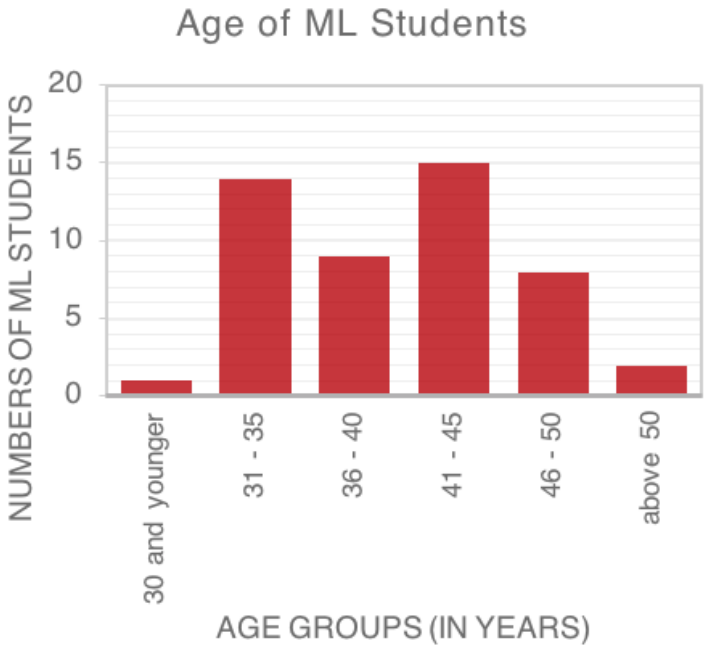


Figure 3. Uninterrupted years of medical practice of Medical Licentiate (ML) students.

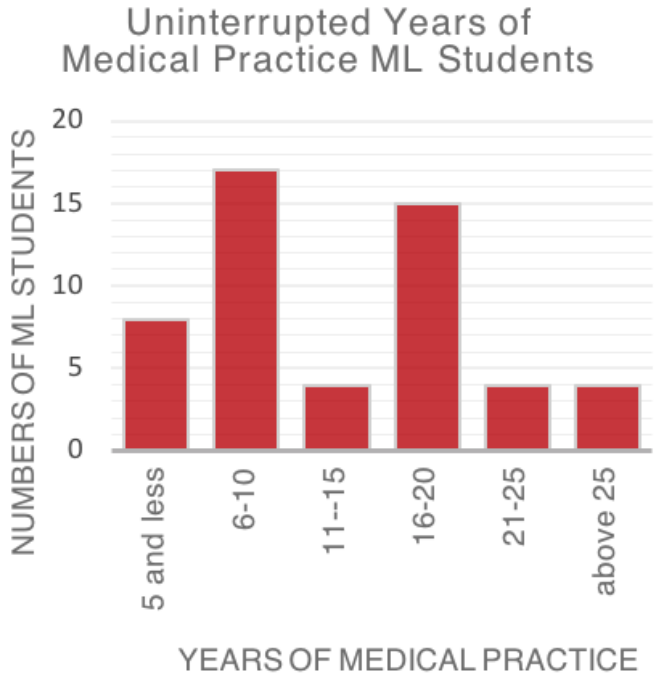


Figure 4. Questionnaire results of medical instructors based on the Information System (IS) Success Model. CCHS: Chainama College of Health Sciences; ML: Medical Licentiate.

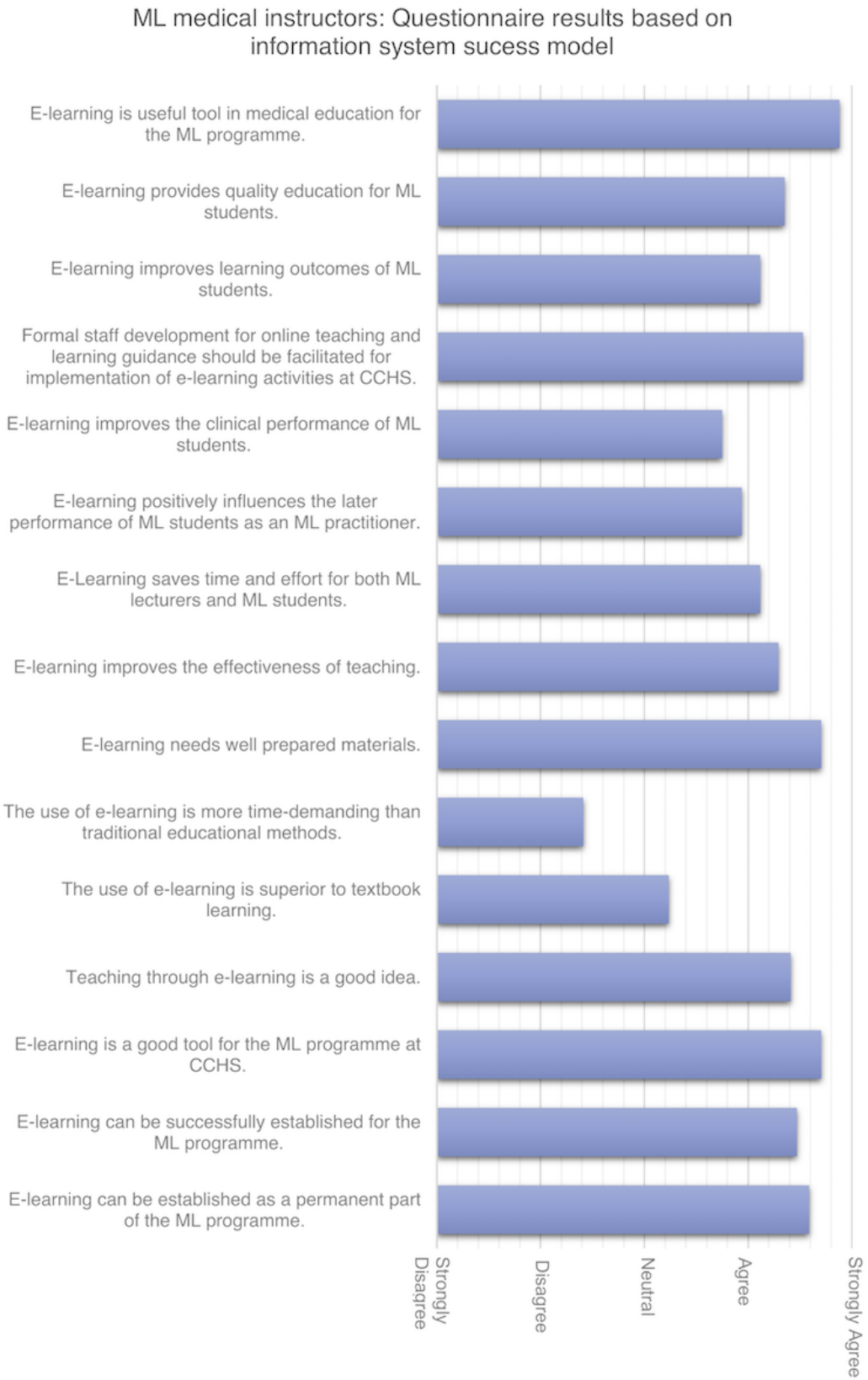


Figure 5. Questionnaire results of medical instructors based on Technology Acceptance Model (TAM). ML: Medical Licentiate.

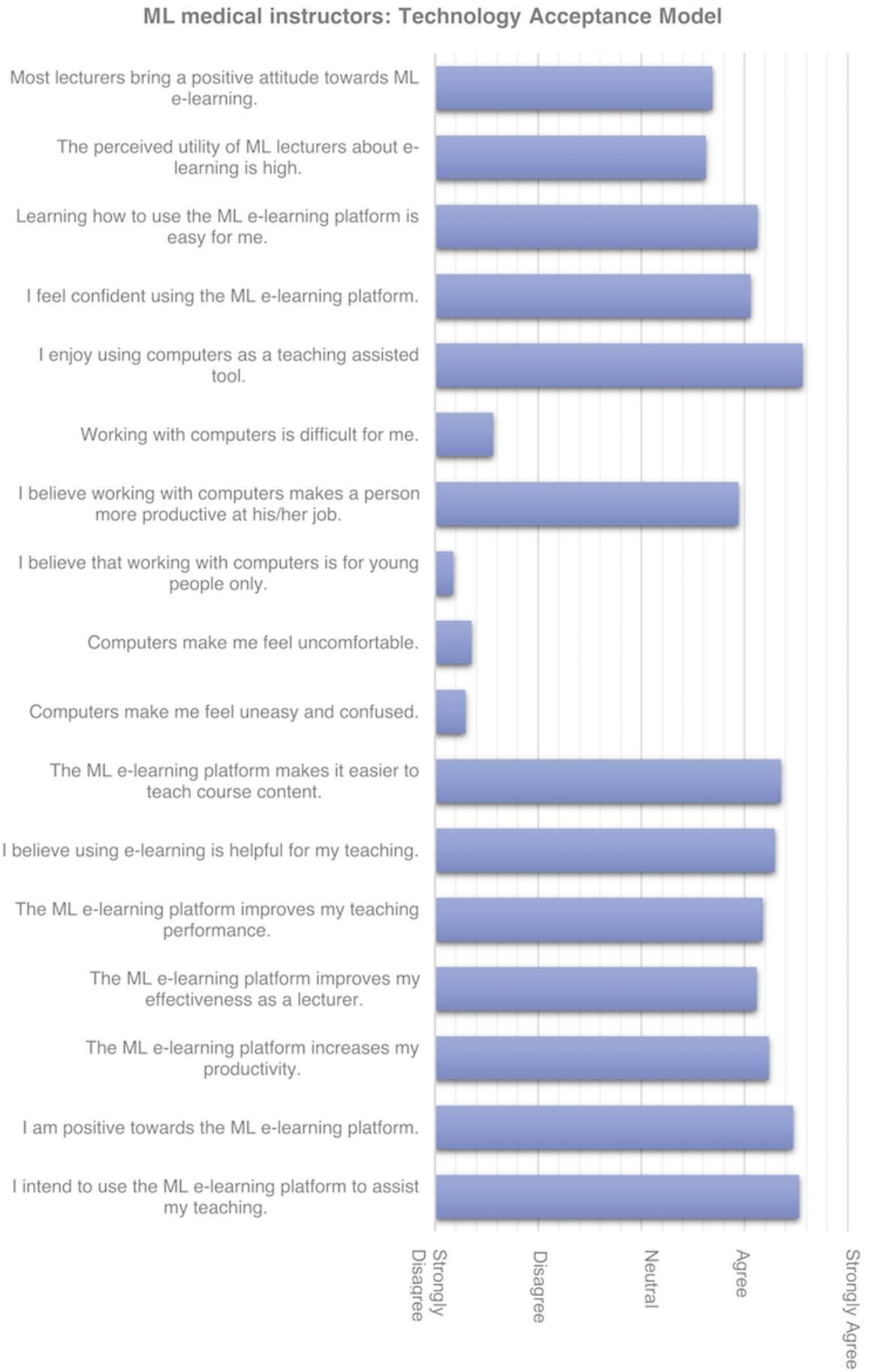
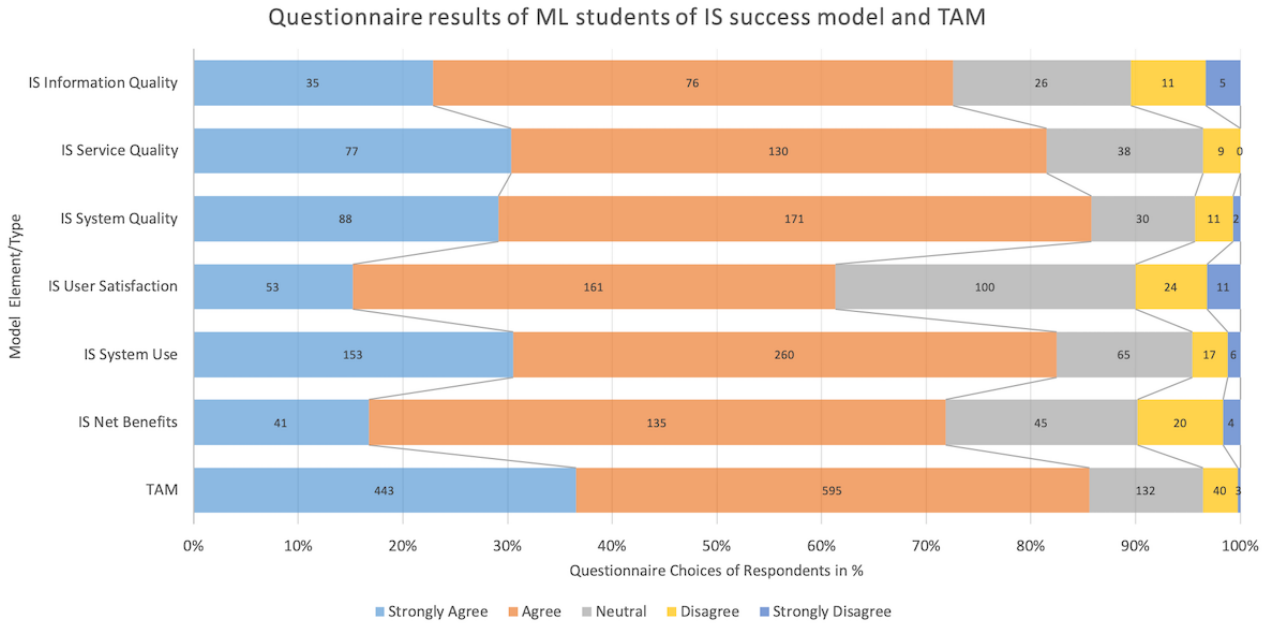


Figure 6. Questionnaire results of Medical Licentiate (ML) students by model type (Information System [IS] Success Model and Technology Acceptance Model [TAM]).



Usage Data

In total, 12 medical instructors and 5 students logged into the online e-learning platform, on five unique dates from January-March 2016. Online usage of the e-learning platform proved too infrequent for inclusion in the mixed-methods analysis and results were discarded.

Learner Diaries

Of 52 learner diaries, only 34 were collected (see Multimedia Appendix 6). On average, the diaries contained 27 entries from January-May 2017 (range 2-85 entries) (see Figure 7). The most frequently used comment notes were “good information,” “excellent notes,” “good notes,” “well understood,” “well summarized,” “good,” “excellent,” and “helpful information.” The rating regarding the content was positive overall: “good information,” “excellent notes,” “good notes,” “well understood,” “well summarized,” “good,” “excellent,” and “helpful information.”

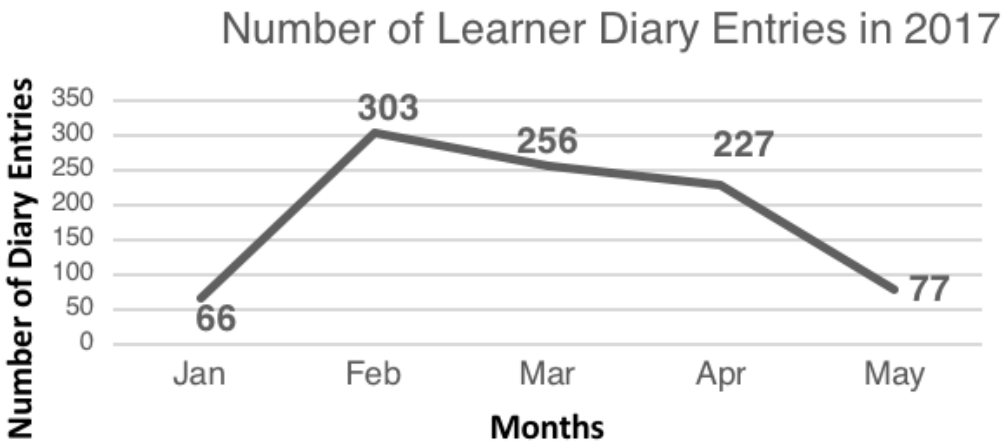
Pretests and Posttests

Students answered almost all the questions on the pretest correctly. Hence, the pretest did not provide a nuanced result useful for assessing differences in knowledge once the course was completed, so the posttest was omitted (see Multimedia Appendix 3 for pretests).

Questionnaires

In total, 52 students and 16 medical instructors completed the questionnaire (see Figure 6). The correlation was tested for the following variables for both groups: age, gender, and years of medical practice. We found that the older the students were, the higher their satisfaction with the e-learning intervention (P=.02). Male students were more satisfied with information quality (P=.03), and showed higher user satisfaction (P=.01), system use (P<.001), and technology acceptance (P<.001). Years of medical practice did not correlate with questionnaire results.

Figure 7. Number of learner diary entries per month during the pilot phase January-May 2017.



Student Interviews

In total, 6 semistructured interviews were held in a secluded office on the CCHS campus in Lusaka. The interview results are included in the following merged interpretation of the results.

Adequacy of Employed Technology

Overall, the ML e-learning platform was received as beneficial by students, supporting their clinical performance and fitting in well with their clinical duties: "very informative…as when on call, as [the tablet] is easy to carry during ward rounds," "was reading during evening call in labor ward," and "reference during ward rounds, was asked a question by consultant – had to make reference, was very helpful." There was general agreement that studying through e-learning is a good idea and fits well with the learning style of ML students. A student mentioned, "I don't have to go home to read textbooks" and another said the tablet "is handy" and useful "for consultation."

The acceptance of e-learning as a new learning technology was high (over 80% of respondents, both ML students and medical instructors). Students were slightly less positive about the information system (over 75% of respondents were positive). Student feedback also confirmed this since they perceived the tablets and e-learning platform as a positive development in the ML program, and the e-learning platform was a status symbol characterizing program development. From both ML students and medical instructors, the questionnaire received the lowest ratings in the categories of information quality, user satisfaction, and net benefits. Students highly rated user satisfaction and net benefits. For most students, using and accessing materials on the tablet was relatively easy. Students stated that the effort to learn how to use the e-learning platform was acceptable, and they perceived it as user-friendly with a suitable user-interface and having appealing features. Students commented that it was "convenient" and "very good to access information." Most students thought their fellow students brought a positive attitude towards the ML e-learning platform. ML students and medical instructors rated perceived utility as adequate, but the scope of the ML e-learning was regarded as inadequate.

Most medical instructors stated that they enjoyed using computers to assist with teaching and disagreed that computers made them feel uncomfortable, uneasy, or confused. Medical instructors agreed that computers were not only for young people. The majority of medical instructors intended to use the e-learning platform to assist their teaching. They were positive about the e-learning platform and considered it to be helpful by increasing their productivity and enhancing their teaching performance. Learning how to use the ML e-learning platform was easy for most medical instructors, as one mentioned that it was "not an effort." Confidence about using the e-learning platform was rated as reasonable by most medical instructors. Computers were not perceived to increase job productivity for teaching nor daily medical practice. Medical instructors using e-learning rated their positive attitude as higher towards the e-learning platform than they rated their medical instructor colleagues.

Usage of e-Learning Platform

Most students reported having accessed the platform frequently, usually on a daily basis. A few students reported difficulties using the platform because of technical problems. One student mentioned having "had little opportunities to effectively use the facility since faulty settings prevented downloading of contents onto the tablet." A few students indicated that they did not use the e-learning platform frequently during their practical rotations since they had not found adequate materials for the practical rotations yet. Two interviewees reported that they used the tablet less during electives since subjects such as anesthesia were not yet available on the ML e-learning platform. In the student questionnaires, dependency on the ML e-learning platform was rated low for ML studies and medical practice. Tablet maintenance at the end of the study year showed that many students had downloaded additional apps such as Medscape, an offline handbook for pediatrics, and an offline dictionary for diseases.

Medical instructors evaluated the perceived utility of the online e-learning platform as neutral. The usage data of the ML e-learning platform showed a low involvement. The 12 medical instructors signed in on the online e-learning platform for less than 30 minutes on five dates across January, February, and March 2016.

Usefulness of Learning Materials

Questionnaire results showed that the ML e-learning platform provided relevant information for ML medical practice. However, the quantity and quality of learning materials were rated as inadequate. One student stated, "books clear, not PowerPoint." Another stated that "the number of textbooks incorporated was too low for the course" and that "other course contents from the learning curriculum are missing." Students preferred to have more multimedia-supported content such as "more videos on procedures," for example, surgery, obstetrics, and gynecology. Available presentations recorded with audio were perceived as "nice videos, well elaborated." Interviewees requested a quick reference guide or manual, for example, for malnutrition in pediatrics or emergency treatment. Also, it was perceived by ML students to be helpful if more exam-relevant materials were available. Suggestions were made to improve tablet navigation for some e-learning content.

Medical instructors disclosed a high level of agreement that e-learning is a useful and valuable tool that could be established as a core component of the ML program. E-learning was not perceived by medical instructors to be more time-demanding than traditional teaching and learning methods.

Enabling Medical Learning With the e-Learning Platform

Students perceived the e-learning platform as supportive for improving their medical performance. They found it useful for their studies and fostered clinical thinking. The enhancement of learning performance was rated as satisfactory, and the net benefits as good since e-learning saved students time when they searched for relevant learning materials. E-learning materials complemented face-to-face teaching sessions and led to group discussions. An ML student reported having "found new

information from previous notes given in class, very educative, had group discussion within my group and compared." One interviewee suggested students share learning materials on the e-learning platform among each other. Some students requested a discussion board with medical instructors giving feedback to students' questions and comments.

Medical instructors reported that they had a positive attitude towards the ML e-learning platform to provide quality education leading to improved learning outcomes for students. However, this agreement was lower for e-learning positively influencing a student's performance as an ML practitioner. Medical instructors were mostly neutral about e-learning being better than textbook learning, whereas there was a general agreement that e-learning could improve teaching effectiveness.

Challenges With the e-Learning Platform

Students found the lack of a SIM card slot in the tablet as a limiting factor: "if it [tablet] has a SIM card," "need for tablet with SIM card provision for Internet connectivity," and "it would be more wonderful if the tablet had provisions to put a SIM card for network rather than depending on WiFi". Mobile data was perceived as a crucial feature, especially in rural practical sites with limited Internet access: "with challenges in accessing Internet, the tablets have no provision for SIM card and there is no Internet in school," "only that limited places have Internet services," "no access to WiFi," "Internet was off," and "no WiFi."

Another challenge was the level of technical support for the e-learning platform and the tablets, which students perceived as insufficient. Students reported that support has "not helped" and at times there was "no feedback from IT."

In general, access and usage of the online e-learning platform received the lowest ratings from students. A few students rated their skills as inadequate to make full use of the ML e-learning platform and said it, "needs orientation and practice" and that at times they "needed to consult someone," since currently there is "no coaching." Provided tutorials do support students, but additional and more detailed materials were requested. Questionnaire results underlined the need for e-learning training and the need for formal staff development. Medical instructors mentioned "some [medical lecturers] need orientation," and another admitted "I've had a few challenges."

Discussion

Principal Results

The pilot phase of the e-learning platform continued over 6 months and proved that the e-learning platform and the offline tablet-based component are feasible tools for teaching and learning within this low-resource environment.

Initially, only a small number of interactive and multimedia learning materials were available on the e-learning platform. Most of the e-learning materials consisted of lecture notes that were primarily used as presentations within a class and not intended as comprehensive e-learning materials. Thus, these materials were not ideal learning materials for students. The rating of the category of information quality was low, possibly due to the predominance of lecture notes on the e-learning platform. User satisfaction and net benefits were also rated comparatively low, showing that the e-learning platform was not sufficiently meeting the students' needs. Increasing the quantity and quality of e-learning materials and adapting available materials might address these shortcomings. The demand for more e-learning materials was reflected in the usage of various other medical tablet apps, such as Medscape and medical dictionaries downloaded on the tablets. Furthermore, students felt that the tablet was not as useful as it could be since it did not have a SIM card slot that would allow for mobile data usage, and there was a need for comprehensive training. A SIM card would enable students to access online materials even in rural areas of Zambia. When we decided on tablets for the pilot phase, we seriously considered associated costs, for example, students paying for the tablet. Therefore, we selected a comparatively inexpensive device that did not provide a SIM card slot. Although usage and materials of the online e-learning platform show a clear need for improvement, ML students regarded the tablets and the e-learning platform as a privilege and a development in the ML program.

Older students were more satisfied with the e-learning intervention than younger students. It is possible that they had not been exposed to as much technology throughout their lives as the younger students and thus perceived it as extraordinary to include this technology in their educational environment.

Medical instructors perceived the e-learning platform as quite favorable for the ML program. However, the intended high use of the online e-learning platform was not met by the actual usage, which was low, since only a few medical instructors logged in. Similar findings were shared in another study in India [20], in which e-learning users reported positive feedback, but utilization was low. Some medical instructors in this study stated that they had never used the platform. Therefore, the evaluation of medical instructor use can show only general trends. Involving medical instructors more actively in e-learning is a significant challenge since medical instructors are scarce even within the ML program. A substantial investment by medical instructors and the college is necessary to develop more e-learning materials. A potential enabling factor could be making e-learning more useful to medical instructors and increasing the effectiveness of the e-learning platform, such as introducing an electronic student evaluation.

The evaluation methods were part of the pilot. The mixed method approach was chosen to provide a more comprehensive understanding of the evaluation results [21,22]. To our knowledge, this is one of the first studies to provide a self-directed, offline e-learning approach for a low-resource setting evaluated with a mixed-methods approach. Most e-learning interventions provide an online setup accessed with personal computers. However, our search did yield publications that reported offline approaches with personal computers in low- and lower-middle-income settings [23-26]. The reported methods resulted in varying levels of insights and also unveiled methods that needed adaption to yield evaluation results, such as the knowledge assessment with the student pretest that proved too easy, thus producing no knowledge nuances. The online usage data showed to be insufficient since only a few students

and medical instructors logged in on the online platform. The e-learning platform was predominantly accessed offline. Thus, online data were scarce. Lessons learned from the pretests, and the usage data for the next evaluation phase include increasing the level of difficulty of the knowledge assessment pretest and collecting the usage data of the offline Moodle app on the tablet.

The learner diaries did produce helpful feedback on the usage, quality, and usefulness of learning materials. This finding underlines the students' perception that the e-learning platform was a valuable improvement. However, their perception of the quality of the learning materials was not revealed. It is possible that learner diaries might offer further insight if selection criteria were structured, that is, including the time of access, the type and specialty of e-learning materials, learning duration, and a scaled rating. However, only a few students filled their learner diary diligently, and some diaries were lost. Overall, the pilot phase of the evaluation methods and results were able to highlight needs and point out further improvement needed for the e-learning platform. Although the results were not able to quantitatively provide insights into knowledge and skills improvement, the e-learning intervention was received as quite positive and may be a factor that increases attraction to the ML program.

Conclusion

The result of the pilot phase of this e-learning intervention confirms its feasibility within this low-resource environment. Evaluation findings show that the technological framework was useful and supportive for students and was well received and accepted by students and medical instructors. The applied mixed method approach to evaluating this e-learning intervention proved adequate to produce valuable results about the quality of teaching materials, usefulness, usage of the e-learning platform, adequacy of technology and challenges, although, methods like the pre-posttest, learner diaries, and usage data need adaptation to capture meaningful data.

Overall, the e-learning platform has the potential to strengthen ML training in the long-term. However, it is crucial to have a reliable IT infrastructure in place and committed stakeholders, especially engaged medical instructors, to integrate medical education e-learning sustainably and comprehensively in low-resource settings.

Acknowledgments

The authors would like to thank all the ML students and ML staff who participated in the pilot phase of the evaluation, as well as the CCHS administration for support and collaboration. Also, the authors would like to thank SolidarMed, which has supported the ML training program since 2009, for their willingness to collaborate, which provided the base for this partnership project. Furthermore, we wish to acknowledge Julia Challinor for editorial support.

Also, we acknowledge financial support by Deutsche Forschungsgemeinschaft within the funding program, Open Access Publishing, by the Baden-Württemberg Ministry of Science, Research, and the Arts and by Ruprecht-Karls-Universität Heidelberg.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Available e-learning contents during pilot phase

[PDF File (Adobe PDF File), 51KB - mededu_v4i2e10222_app1.pdf]

Multimedia Appendix 2

Semistructured interviews: Guiding questions.

[PDF File (Adobe PDF File), 25KB - mededu_v4i2e10222_app2.pdf]

Multimedia Appendix 3

Knowledge assessment: Pretest.

[PDF File (Adobe PDF File), 29KB - mededu_v4i2e10222_app3.pdf]

Multimedia Appendix 4

Questionnaire for students.

[PDF File (Adobe PDF File), 36KB - mededu_v4i2e10222_app4.pdf]

Multimedia Appendix 5

Questionnaire for medical instructors.

[PDF File (Adobe PDF File), 25KB - mededu_v4i2e10222_app5.pdf]

Multimedia Appendix 6

Exemplary diary entry of Medical Licentiate (ML) student.

[PDF File (Adobe PDF File), 114KB - mededu_v4i2e10222_app6.pdf]

References

1. Tjoa A, Kapihya M, Libetwa M, Lee J, Pattinson C, McCarthy E, et al. Doubling the number of health graduates in Zambia: estimating feasibility and costs. Hum Resour Health 2010 Sep 22;8:22 [FREE Full text] [doi: 10.1186/1478-4491-8-22] [Medline: 20860827]
2. Ministry of Health Zambia. Zambia National Health Strategic Plan 2017 – 2021. Zambia: Ministry of Health, Republic of Zambia; 2017.
3. Stekelenburg J, Kyanamina S, Mukelabai M, Wolffers I, van Roosmalen J. Waiting too long: low use of maternal health services in Kalabo, Zambia. Trop Med Int Health 2004 Mar;9(3):390-398. [Medline: 14996369]
4. Ferrinho P, Siziya S, Goma F, Dussault G. The human resource for health situation in Zambia: deficit and maldistribution. Hum Resour Health 2011 Dec 19;9:30 [FREE Full text] [doi: 10.1186/1478-4491-9-30] [Medline: 22182366]
5. Gajewski J, Mweemba C, Cheelo M, McCauley T, Kachimba J, Borgstein E, et al. Non-physician clinicians in rural Africa: lessons from the Medical Licentiate programme in Zambia. Hum Resour Health 2017 Dec 22;15(1):53 [FREE Full text] [doi: 10.1186/s12960-017-0233-0] [Medline: 28830528]
6. Graf U, Bowa A, Thieme K, Häggblom A. Strengthening Zambia's health workforce: the Medical Licentiate training programme. In: Geneva Health Forum. 2014 Presented at: Geneva Health Forum; 2014; Geneva.
7. Nicholson P. A history of e-learning. In: Computers and Education. Dodrecht, Netherlands: Springer; 2007:11.
8. Mack H, Golnik K, Murray N, Filipe H. Models for implementing continuing professional development programs in low-resource countries. MedEdPublish 2017;6(1). [doi: 10.15694/mep.2017.000018]
9. Dawson A, Walker R, Campbell J, Egede L. Effective Strategies for Global Health Training Programs A Systematic Review of Training Outcomes in Low and Middle Income Countries. Glob J Health Sci 2016 Mar 31;8(11):278. [doi: 10.5539/gjhs.v8n11p278]
10. Childs S, Blenkinsopp E, Hall A, Walton G. Effective e-learning for health professionals and students--barriers and their solutions. A systematic review of the literature--findings from the HeXL project. Health Info Libr J 2005 Dec;22 Suppl 2:20-32 [FREE Full text] [doi: 10.1111/j.1470-3327.2005.00614.x] [Medline: 16279973]
11. World Health Organization. Global strategy on human resources for health: workforce 2030. Geneva: World Health Organization; 2016.
12. Asongu S, Le Roux S. Enhancing ICT for inclusive human development in Sub-Saharan Africa. Technological Forecasting and Social Change 2017 May;118:44-54 [FREE Full text] [doi: 10.1016/j.techfore.2017.01.026]
13. Al-Shorbaji N, Rifat A, Car J, Majeed A, Wheeler E. eLearning for undergraduate health professional education: A systematic review informing a radical transformation of health workforce development. Geneva: World Health Organization; 2015.
14. Barteit S, Hoepffner P, Huwendiek S, Karamagi A, Munthali C, Theurer A, et al. Self-directed e-learning at a tertiary hospital in Malawi--a qualitative evaluation and lessons learnt. GMS Z Med Ausbild 2015;32(1) [FREE Full text] [doi: 10.3205/zma000949] [Medline: 25699110]
15. Park S. An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioral Intention to Use e-Learning. Journal of Educational Technology & Society 2009;12(3):162 [FREE Full text]
16. Davis F. A Technology Acceptance Model for Empirically Testing New End-User Information Systems. Boston, MA: Massachusetts Institute of Technology; 1985.
17. Roca J, Chiu C, Martínez F. Understanding e-learning continuance intention: An extension of the Technology Acceptance Model. International Journal of Human-Computer Studies 2006 Aug;64(8):683-696. [doi: 10.1016/j.ijhcs.2006.01.003]
18. Delone WH, McLean ER. The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. Journal of Management Information Systems 2014 Dec 23;19(4):9-30. [doi: 10.1080/07421222.2003.11045748]
19. Saldaña J. The coding manual for qualitative researchers. London, UK: SAGE Publications; 2015.
20. Patil RN, Almale BD, Patil M, Gujrathi A, Dhakne-Palwe S, Patil AR, et al. Attitudes and Perceptions of Medical Undergraduates Towards Mobile Learning (M-learning). J Clin Diagn Res 2016 Oct;10(10):JC06-JC10 [FREE Full text] [doi: 10.7860/JCDR/2016/20214.8682] [Medline: 27891356]
21. Curry L, Nunez-Smith M. Mixed Methods in Health Sciences Research: A Practical Primer. London, UK: SAGE Publications; 2014:A.
22. Creswell J. A concise introduction to mixed methods research. London, UK: SAGE Publications; 2014.
23. de Sena DP, Fabricio D, Lopes M, da Silva VD. Computer-assisted teaching of skin flap surgery: validation of a mobile platform software for medical students. PLoS One 2013;8(7):e65833 [FREE Full text] [doi: 10.1371/journal.pone.0065833] [Medline: 23935818]

24. Farokhi M, Zarifsanaiey N, Haghighi F, Mehrabi M. E-learning or in-person approaches in continuous medical education: A comparative study. IIOAB J 2016;7(2):472-476 [FREE Full text]
25. Kaliyadan F, Manoj J, Dharmaratnam A, Sreekanth G. Self-learning digital modules in dermatology: a pilot study. J Eur Acad Dermatol Venereol 2010 Jun;24(6):655-660. [doi: 10.1111/j.1468-3083.2009.03478.x] [Medline: 19906046]
26. Khoshbaten M, Soleimanpour H, Ala A, Shams VS, Ebrahimian K, Safari S, et al. Which Form of Medical Training is the Best in Improving Interns' knowledge Related to Advanced Cardiac Life Support Drugs Pharmacology? An Educational Analytical Intervention Study Between Electronic Learning and Lecture-Based Education. Anesth Pain Med 2014 Feb;4(1):e15546 [FREE Full text] [doi: 10.5812/aapm.15546] [Medline: 24719802]

Abbreviations

CCHS: Chainama College of Health Sciences
ICT: information and communications technology
IS: Information System Success Model
ML: Medical Licentiate
TAM: Technology Acceptance Model

Edited by G Eysenbach; submitted 26.02.18; peer-reviewed by F Aminpour, K Goniewicz; comments to author 02.08.18; revised version received 14.08.18; accepted 14.09.18; published 27.11.18.

Please cite as:
Barteit S, Jahn A, Bowa A, Lüders S, Malunga G, Marimo C, Wolter S, Neuhann F
How Self-Directed e-Learning Contributes to Training for Medical Licentiate Practitioners in Zambia: Evaluation of the Pilot Phase of a Mixed-Methods Study
JMIR Med Educ 2018;4(2):e10222
URL: http://mededu.jmir.org/2018/2/e10222/
doi:10.2196/10222
PMID:30482744

Publisher:
JMIR Publications
130 Queens Quay East.
Toronto, ON, M5A 3Y5
Phone: (+1) 416-583-2040
Email: support@jmir.org