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Mapping eHealth Education: Review of eHealth Content in Health and Medical Degrees at a Metropolitan Tertiary Institute in Australia

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Abstract

Background: With the increasing use of digital technology in society, there is a greater need for health professionals to engage in eHealth-enabled clinical practice. For this, higher education institutions need to suitably prepare graduates of health professional degrees with the capabilities required to practice in eHealth contexts.

Objective: This study aims to understand how eHealth is taught at a major Australian university and the challenges and suggestions for integrating eHealth into allied health, nursing, and medical university curricula.

Methods: Cross-disciplinary subject unit outlines (N=77) were reviewed for eHealth-related content, and interviews and focus groups were conducted with the corresponding subject unit coordinators (n=26). Content analysis was used to identify themes around challenges and opportunities for embedding eHealth in teaching.

Results: There was no evidence of a standardized approach to eHealth teaching across any of the health degrees at the university. Where eHealth content existed, it tended to focus on clinical applications rather than systems and policies, data analysis and knowledge creation, or system and technology implementation. Despite identifying numerous challenges to embedding eHealth in their subjects, unit coordinators expressed enthusiasm for eHealth teaching and were keen to adjust content and learning activities.

Conclusions: Explicit strategies are required to address how eHealth capabilities can be embedded across clinical health degrees. Unit coordinators require support, including access to relevant information, teaching resources, and curriculum mapping, which clearly articulates eHealth capabilities for students across their degrees. Degree-wide conversations and collaboration are required between professional bodes, clinical practice, and universities to overcome the practical and perceived challenges of integrating eHealth in health curricula.

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KEYWORDS

clinical competence; digital health; educational design; eHealth

Introduction

Health and medicine graduates in Australia and internationally are entering increasingly eHealth-enabled work contexts, and eHealth education has been identified as critical for implementing eHealth strategies at national and international levels [1,2]. eHealth refers to the use of information and communication technologies (ICTs) to support health and health care [3]. Such technologies can support clinical and administrative processes, facilitate access to services, and enable health consumers to monitor and manage their own health. Examples include electronic medical records; videoconferencing technology; and wearable devices, such as pedometers and mobile apps; and virtual reality. The introduction of the national My Health Record initiative [4] and the frequency with which people seek health information via web [5] or join web-based support communities [6] further highlight the need for tertiary education to adequately equip students to engage in eHealth-enabled practice. As such, students need a curriculum that enables them to critically analyze the available technologies, implement them in practice where appropriate, and evaluate their effectiveness in specific contexts.

The current literature consistently reports health providers' lack of confidence in, and knowledge of, using digital technologies as barriers to successful implementation and uptake of eHealth [7-9]. These barriers have also been identified in university students who report being confident in using the technology but not in using the technology for health and health care [10]. Qualitative studies have also highlighted that current tertiary education does not adequately prepare students for working with eHealth tools as clinicians [11,12]. Thus, an eHealth curriculum in higher education needs to focus on how to apply ICT skills in the health context, not just on teaching students how to operate digital tools.

Despite the well-evidenced need to prepare health and medical graduates to work in eHealth contexts, there is limited research exploring how eHealth is currently being taught to students in clinical health and medical degrees. In a pivotal study, Dattakumar et al [13] surveyed coordinators of Australian allied health, nursing, and medical degrees about eHealth education in their curriculum. The researchers found that despite 84% of participants reporting that eHealth was taught, their explanations of the content that was taught showed conflation of eHealth, e-Learning (ie, using the learning management system), and evidence-based practice. Where eHealth content was mentioned, focus was almost exclusively on electronic medical records, with limited content on other key areas of eHealth practice such as telehealth, integration of mobile apps and wearable devices, and data-driven practices. Dattakumar et al [13] concluded that eHealth education at the time was largely informal and inconsistent.

We are now seeing more concerted efforts toward establishing a structured eHealth curriculum that equips and empowers clinical health graduates to work effectively with digital technologies. For example, a recent study by Brunner et al [14] described a capabilities framework of skills and knowledge that is considered key for eHealth practice. The 4 learning domains are related to (1) digital technologies, systems, and policies; (2) clinical practice; (3) data analysis and knowledge creation; and (4) technology implementation and co-design. However, the extent to which these are currently embedded in clinical health curricula is unknown. This study aims to provide an updated and nuanced understanding of how eHealth is currently being taught in health and medicine. Specifically, it aims to determine the extent to which current eHealth teaching at an Australian university maps to the capabilities framework [14], how formally this is integrated into curricula, and teachers' perceived challenges and opportunities for embedding eHealth into health and medical curricula.

Methods

Design

This study used a mixed methods approach, including semistructured interviews and document review. eHealth teaching was mapped across 5 health degrees from a major metropolitan Australian university with approximately 60,000 students: physiotherapy, nursing, dentistry, oral health, and medicine. eHealth teaching refers to any learning outcomes, assessments, or learning activities (eg, discussions, demonstrations, and case studies) about the use of digital technologies in health care. Examples include applying exergaming in physical rehabilitation or discussing how electronic medical record data can be used to improve health services. The mapping process was conducted to understand the shared challenges in teaching eHealth capabilities across a range of health disciplines, with the understanding that each health discipline has a unique approach to teaching and different clinical knowledge and objectives for their graduates.

Document Review

Degree or course coordinators provided the researchers with access to all the subject or unit of study documents of core units for review (elective units were not reviewed). In total, 77 units of study outlines across the 5 health degrees (dentistry, oral health, medicine, nursing, and physiotherapy) were analyzed. The purpose of the document review was to investigate the extent to which eHealth was represented in the formal curriculum. The formal curriculum consisted of learning outcomes and assessments. The unit of study outline documents were reviewed for eHealth-related content. At a high level, this included any reference to ICT for health, and on a granular level, this included content on how eHealth skills and behaviors were taught or assessed. Any learning outcomes, assessments, or weekly schedules that mentioned technology, eHealth, telehealth, telemedicine, or examples of health technologies were recorded. The topic and topic frequency were recorded against the unit in which they appeared. Data extracted from the unit outlines were categorized as either formal (eHealth was part of the learning outcomes and formally assessed) or semiformal eHealth teaching (mentioned in the unit outline, usually as a lecture topic, but not formally assessed).

Interviews

A purposeful sample was used to recruit units of study coordinators across the 5 health degrees. A total of 26 coordinators of units within the 5 health degrees (dentistry and oral health, n=10; medicine, n=3; nursing, n=2; and physiotherapy, n=11) agreed to participate in a semistructured interview. Interview questions were chosen to prompt the unit of study coordinators to think about any informal eHealth teaching that was not captured in formal documentation and to understand barriers and enablers to embedding eHealth in their subjects. Participants were provided with a copy of their unit outline at the interview and asked to describe the learning activities that occurred each week in lectures, laboratories, and tutorial classes. Finally, participants were asked to describe the current challenges to embedding eHealth into their subjects and a *blue sky* question, "If resources were not an issue, how would you like to integrate eHealth into your units of study?"

The duration of an interview was, on average, 30 minutes. The interviews were audio recorded, transcribed, and deidentified before analyses. Content analysis of interview data was performed to identify examples of informal eHealth teaching [15]. Interviews underwent an initial reading so that the researchers could familiarize themselves with the content. Transcripts were coded on subsequent readings, and codes were aggregated into broad categories. Exemplar quotes were extracted from the transcripts and grouped under relevant categories. The criteria for formal and semiformal eHealth teaching were applied again, and the criteria for informal teaching were also applied. Informal teaching included, for example, discussions about eHealth, tutorial activities, or other learning activities that were not part of a summative assessment or subject or course learning outcome or described explicitly in any formal course documentation.

Ethics

Permission to conduct this study was granted by the Human Research Ethics Committee (protocol: 2016/811) of the University of Sydney.

Results

Overview

Of the 77 unit outlines reviewed, 30 (39%) included content that could be directly mapped to the eHealth capabilities framework [14]. Although all health degrees had some content related to eHealth in unit outlines, interviews with unit coordinators revealed that much of this content did not translate into specific learning activities that developed eHealth capabilities. As such, incidental eHealth references, which could not be sufficiently mapped to eHealth capabilities, were excluded from study results. Physiotherapy was the only degree in which the majority of its 15 units of study contained some eHealth content (9/15, 60%). Most of this content, however, was embedded within 2 units; the remaining 7 units only had brief mentions of eHealth.

In examining how the teaching content mapped to the 4 domains of the capability framework [14], there was a strong focus on eHealth tools in the *clinical practice and applications* domain (52/64, 81% of eHealth content). There was less focus on *digital technologies, systems, and policies* (10/64, 16%). There was even less content related to *eHealth data analysis and knowledge creation* (8/64, 13%) and *system and technology implementation* (2/64, 0.03%). Note that some activities addressed multiple domains.

Types of eHealth Content in Health Degree Curriculum

Formal

In total, 4 out of the 5 health degrees mapped—dentistry, medicine, nursing, and physiotherapy—had examples of formal eHealth content in the curriculum. Of these degrees, only a small subset of units had formal eHealth content: dentistry (2/8, 25%), medicine (2/47, 4%), nursing (2/32, 6%), and physiotherapy (5/32, 16%). All examples of formal eHealth content were in the form of unit objectives. Only one unit of study, in the physiotherapy degree, used the term *eHealth*; other degrees either used the term *technology* or did not explicitly refer to eHealth in any form. There were no instances where eHealth capabilities were formally assessed across any of the health degrees.

Semiformal

In total, 3 out of the 5 health degrees mapped—dentistry, nursing, and physiotherapy—had examples of semiformal eHealth content in their unit of study outlines. As was the case with formal eHealth content, this semiformal content was only present in a small number of units within each degree. A total of 6 nursing (6/32, 19%) and 5 dentistry (5/8, 63%) units of study had high-level statements relating to developing eHealth relevant knowledge and skills.

Informal

All degrees mapped had some examples of informal eHealth teaching; however, the extent of teaching and delivery approaches varied widely. Most degrees had some level of informal eHealth teaching related to ethical or professional use of technology, particularly social media. In more sophisticated examples of informal eHealth teaching, unit coordinators described concrete examples of tutorials where eHealth concepts were discussed. However, it was more common for informal eHealth teaching to be unstructured or implicit:

> *I think it's just we try and include, without thinking about eHealth specifically, we try and include stuff in there that's moving with the times if you like, is more of how I think of it.* [Physiotherapy 9]

Many coordinators reported a sense that students would pick up eHealth skills over time because of their high level of technology use in everyday life. Unit coordinators also tended to report a belief that informal eHealth teaching was being delivered to the students throughout their degree, but they were unable to give concrete examples of when and how this was happening. In medicine, this tended to occur during clinical placement, rather than in academic units:

> *Yeah, it [my experience with telehealth] was totally...circumstantial [because of my speciality], but I figured that that was cool. I actually didn't realise, you know, you hear about it and then okay, well this actually works pretty well.* [Medicine 1]

Challenges to Embedding eHealth Teaching

Perceived Relevance

The relevance of eHealth teaching was frequently cited as a challenge in implementing it in health curricula. Different aspects of relevance were highlighted by participants, including the relevance of teaching eHealth to already *tech-savvy learners* who potentially use digital tools every day, the relevance of learning about eHealth in isolation outside the clinical context, and a lack of perceived value for teaching students about eHealth tools without immediate practice application. For example, one participant stated:

> *The students didn't particularly like it [tutorial focused on health apps], it was kind of this just tute that stood out as this different thing [from other physiotherapy content] and it was just apps...we didn't get very good feedback.* [Physiotherapy 8]

Some participants also attributed their doubt about the relevance of eHealth, given the variable use of digital technologies across the health sector. A perceived lack of actual uptake of digital tools in clinical practice was considered a challenge when attempting to convey relevance to learners. For example:

> *Teaching hospitals, they're still using paper records, paper files, everything's done on paper...So until those go digital, it's pointless talking about having graduates who are IT ready.* [Oral health 3]

This disconnect between clinical practice and classroom experiences was a strong subtheme within perceived relevance, which is a challenge for eHealth teaching. Some interviewees felt that even when eHealth teaching was embedded in health units, the learnings did not align with what students encountered during clinical placements or when they entered practice.

As observed in the following quote, one participant questioned the limitations and appropriateness of eHealth-enabled practice for aspects of clinical care more traditionally delivered face to face and with hands-on methods. Such quotes clearly captured participants' attitudes toward eHealth methods:

> *...Our assessment has a lot more of a physical focus where you're actually watching the patient move and looking for the impairments and looking for the adaptive strategies and thinking about why they might be moving that way and what you can do about it. Technology's a little bit limited with that without going to really fancy stuff, which is more used for research rather than clinically anyway. You know, 3D motion capture...[Physiotherapy 9]*

Participants considered it a major challenge that they could not comprehensively showcase eHealth tools because of access to, and licensing restrictions for, commercial products commonly used in clinical practice. Being very systems focused, some participants expressed that the use of commercial eHealth products presented a challenge for teaching because products either changed too frequently or showcasing one over another could be viewed as staff endorsement of a product. Hence, some interviewees indicated that it was more appropriate to teach eHealth in the workplace rather than at university. One interviewee commented:

> *You learn it on your first job, when your practice manager, sits you down and says, "Look, this is our software and this is how we use it."* [Oral health 3]

Finally, there was a lack of alignment in terms of the core eHealth competencies participants considered essential to graduates. There were different priorities for eHealth competencies in different health specialties. For example, within physiotherapy, learning system data entry was not perceived as high a priority as learning the value of quality data and how it can be used to improve care. In contrast, within medicine, more emphasis was placed on the use of data systems, such as electronic medical records and informatics skills.

Students' Inexperience as Clinicians

Participants consistently emphasized that students first needed to develop their clinical reasoning before they could engage with eHealth, which was largely considered to be more advanced. Participants reported that students, even in the second year, still have misconceptions and do not understand their own practice well enough to be using eHealth technologies, such as videoconferencing, in their practice.

One participant stressed the importance of emphasizing eHealth in the context of patient safety. As exemplified in the following quote, this participant considered students' confidence and high level of digital literacy to be a challenge when matched with limited clinical skills:

> *The big thing is because our students are tech savvy, they're not afraid of technology which is really tricky for us...They won't think twice about touching a touch screen on a ventilator because they grew up with screens. To them a screen is not a scary thing. There's a whole patient safety aspect to the technology that we have to really look at.* [Nursing 1]

One participant expressed doubt related to students' confidence and capacity to express concerns when eHealth is being inappropriately used, which could be attributed to a lack of perceived experience in the clinical context. It also highlighted a disparity between poor use of digital technologies in clinical practice and examples of best practice of eHealth in classes, which can be challenging to overcome in eHealth teaching:

> *Talking in one of my last tute's...They were saying that doctors text results to their patients which is an unsecure source...You probably don't have the capacity to tell the GP you work for that he or she shouldn't be texting results through the phones.* [Nursing 2]

Educators' Inexperience With eHealth

A number of interviewees across each of the health disciplines indicated their own inexperience with eHealth as a challenge to embedding it. They raised questions about the quality of apps currently available and reported a limited understanding of the current research on high-quality, eHealth-enabled care. Others also emphasized that they felt students' experience with technology outstripped their own, which made it challenging to know how to approach teaching eHealth. One interviewee commented:

> *I think our students our very savvy...So I feel that academics, we're the ones that need the assistance, I don't think we necessarily need to teach our students that [eHealth] because I feel that they already know that, they're happy to research that, in fact that's the one thing they do like you know.* [Oral health 2]

Some participants suggested that they had experience teaching some areas of eHealth, such as telehealth, use of apps, or exergames (games that are used to promote exercise) as adjuncts to face-to-face care, but lacked tools to teach eHealth holistically in a manner that encompassed a breadth of technologies. In addition, one interviewee noted that it was just generally challenging to teach eHealth because digital technologies, their applications, and policies around their use were frequently changing.

Practical Challenges

Interviewees identified several practical challenges impacting eHealth teaching and curriculum. Crowded curriculum, limited resources, time and effort, and alignment of a curriculum with accreditation requirements were the issues that were raised. For example, one participant cited time within classes and the curriculum more broadly as limitations to embedding eHealth within classes:

> *...we cannot put much in these...our tutorials are one hour tutorials only...And in the one hour, because we know that the physio curriculum is constrained by accreditation requirements as well, so are there particular manual things that the students have to practise in that one hour?* [Physiotherapy 1]

However, all participants were supportive of exploring creative ways of integrating eHealth ideas within essential areas of curriculum focus, for example, integrating eHealth methods into a tutorial where learning outcomes are focused primarily on a clinical intervention, such as pain management or cardiopulmonary rehabilitation.

Limited resources include lack of access to appropriate tools or databases, which is explicitly linked to a lack of funding for hardware and software, such as licenses for apps, exergaming and virtual reality equipment, and simulated electronic medical records. Where access to these tools may be available, one participant stated that it was time consuming to interact with the tools to design meaningful learning activities:

> *I tried last year to set up dummy accounts for Fitbits and things and picked a couple of students to take one and have a go, and then we'd have a look at their data so they could see how they would access that data from the thing. It took me over half a day setting up because you have to set it all up through an e-mail account. I set up all these student Google Gmail accounts and then had to prime the Fitbit and then do whatever.* [Physiotherapy 5]

Suggestions for eHealth Teaching in the Future

Although embedding eHealth in the health curriculum posed a number of challenges, interviewees also saw many opportunities for integrating eHealth in the future. Participants were uncertain about the extent to which eHealth teaching should be embedded into existing units of study or taught in stand-alone units. Analyses suggested that, of the health degrees that currently had a higher frequency of eHealth topics, support for taking an embedded teaching approach, rather than stand-alone eHealth units, was more common. In degrees that had less eHealth teaching, participants acknowledged that future efforts need to focus on blending eHealth into the curriculum, rather than keeping it as a stand-alone area. It was also suggested that greater effort was needed to use digital technology to deliver the curriculum, rather than just teaching about the use of technology.

Interviewees suggested a range of methods for incorporating eHealth teaching into health curricula, including didactic content, course readings, and embedding eHealth scenarios into assessments (eg, rural case study). Other suggestions included more interactive and hands-on methods, including tutorials built around eHealth case studies and role plays, and live demonstrations of digital technologies by current practitioners.

In addition, interviewees identified a number of opportunities to embed eHealth in the curriculum in a way that could build practical eHealth skills. Examples included providing learners with opportunities to design and build eHealth tools, using current, in-the-market digital technologies such as apps or virtual reality products and exergames, and analyzing hospital data as a manager:

> *I suppose what we are missing...[is] using health data. As you've seen I talk about that in the presentation in terms of how if you're the manager of a hospital physio department you're making decisions about staffing, about prioritising services based on clinical data that's been collected in your hospital and summaries, and what have you. Whether I should get the students to go maybe set them a challenge or something to go and look at...I don't know...You can go into the Bureau of Health Information's webpage, and you can generate reports and things.* [Physiotherapy 5]

Discussion

Principal Findings

This mixed methods study reviewed the unit of study documentation and conducted interviews with unit coordinators to determine the extent to which current eHealth teaching at an Australian university maps onto the eHealth capabilities framework [14]. In addition, the study explored the types of learning activities (formal, semiformal, and informal) used, challenges that unit coordinators experience in embedding eHealth content in health curricula, and their suggestions for improving eHealth teaching in their units. Of the 4 eHealth domains in the capabilities framework [14], learning activities in dentistry, oral health, medicine, nursing, and physiotherapy tended to focus on clinical practice and applications. There were some examples of learning activities in digital technologies, systems, and policies and data analysis and knowledge creation, and there are very few learning activities in the system and technology implementation domain. Interestingly, only the medical and nursing curricula included activities related to system and technology implementation. This may reflect differences in the types of health services that medicine and nursing graduates work in (eg, hospitals where consideration of a system approach is more prominent) compared with physiotherapy and dentistry graduates. Most examples of eHealth learning were informal. Unit coordinators also identified perceived relevance, students' inexperience as clinicians, teachers' inexperience with eHealth, and practical challenges of a crowded curriculum and limited resourcing as hurdles for embedding eHealth into health curricula.

This study builds on the existing literature on eHealth curricula [13,16,17] by evaluating the formal, semiformal, and informal curricula of several health degrees. Although only 1 unit used the term *eHealth* in formal unit outlines, the term was included in some learning outcomes but not in any of the summative assessments. There were fewer semiformal eHealth learning activities across the degrees and individual units. Informal learning was present, but the approaches used varied greatly. The limited adoption of eHealth in clinical practice [18-20] seems to be reflected in the small number of formal and semiformal eHealth learning activities in the sample included in this study. When mapped against the eHealth capabilities framework [14], learning activities tended to focus on clinical practice and applications with far fewer examples of digital technologies, systems and policies, data analysis and knowledge creation, and system and technology implementation. Given that assessment drives learning [21], the findings of this study highlight the need for a deliberate assessment of learning outcomes that explicitly focus on eHealth capabilities, particularly around system and technology implementation.

Consistent with previous literature [22], the findings in this study showed that despite interest in including eHealth content in health curricula, unit coordinators have identified several challenges for doing so. These include perceived relevance (from the students' perspective), educators' inexperience with incorporating eHealth teaching into curricula, students' inexperience as clinicians, and disconnect between classroom experiences and clinical practice. Together, these challenges suggest an opportunity for degree-wide conversations about when and how to introduce students to eHealth. Both learning and teaching theory and research highlight the importance of perceived relevance in motivating students to engage with content. For example, the attention, relevance, confidence, and satisfaction model by Keller [23,24] states that relevance provides 1 of the 4 conditions (the others being attention, confidence, and satisfaction) under which motivation can occur in the learning context. Relevance refers to the extent to which learning addresses students' personal needs for learning it. Therefore, in the case of students in clinical health degrees, this personal learning need is likely the extent to which the information or skills they are being taught enables them to be a better practitioner. Therefore, effective eHealth education needs to be taught in a way that is perceived as relevant and core to the students' professional practice.

Given that some unit coordinators consider eHealth as part of an emerging best practice, conversations about curriculum should also include professional and accrediting bodies. This coordinated approach would enable subjects taught in earlier years of the curriculum to introduce eHealth concepts while continuing their focus on students' development as clinicians and then scaffold students into more advanced eHealth practice in later years. Discussions about best practices can also be used to inform future iterations of accreditation requirements, which can, in turn, help address concerns around crowded curricula.

The challenge of a crowded curriculum is not unique to eHealth. With accreditation and registration requirements, health and medicine curricula are at capacity with mandatory content, leading to challenges in integrating Aboriginal and Torres Strait Islander education [25] and more comprehensive patient safety education [26] into the medical curriculum.

The practical challenges of introducing more content into health and medical education are coupled with pedagogical considerations. For example, traditional health education uses a building block approach. The curriculum consists of foundational units of study where students learn specific content or skills, such as biology or research methods, in separate subjects. This knowledge is then brought together in more complex and applied scenarios in senior years through more profession-specific units or practicum experiences. Students who study in this context report a lack of understanding about how these foundational units fit into their professional development and can perceive the units as less relevant or integral to the *core* curriculum [27].

Unit coordinators also highlighted their own inexperience with eHealth as a potential barrier to including content in their curricula. Part of this could also be related to perceived relevance and current misconceptions about eHealth (conflating it with e-Learning or evidence-based practice), as documented in the literature [13]. Given the limited learning activities generally and inconsistent mapping to the eHealth capabilities framework, there is a need for targeted professional development and at-elbow support for teachers. This would also include understanding how eHealth is currently applied in clinical practice and designing learning activities to explicitly promote this relevance.

Despite these challenges, there was general enthusiasm and keenness for introducing eHealth. Unit coordinators suggested a range of interactive activities designed to promote eHealth capabilities and critical thinking. However, there was continued uncertainty regarding how best to deliver eHealth education more broadly. One approach is to embed eHealth teaching directly into units of study that are central to health curricula, which can ensure clear links between clinical learning and technological learning. Alternatively, stand-alone units that explore eHealth can be used. These enable deep dives into eHealth knowledge and have the potential to more easily align with comprehensive eHealth frameworks [14]. However, such units continue to silo eHealth education away from core health training, which limits the reach of the content to all health graduates.

Limitations

This study provides a foundation for understanding and improving the way eHealth is included in health curricula. One limitation, however, is the unequal representation of staff from across the 5 degrees. Owing to inconsistent administration or unit organization practices, it was difficult to identify the person responsible for every learning module or unit of study. Physiotherapy used defined units of study with clear core and elective units. Uptake of participants was also greater in physiotherapy; therefore, there were more participants from that degree than from nursing, oral health, dentistry, and medicine. Despite this, the themes that emerged from the content analysis of interviews were consistent, and no new ideas were introduced. This suggests data saturation.

Implications and Future Directions

Future research should consider mapping eHealth teaching in health degrees that may have different accreditation requirements, such as more generalized health and science degrees. Graduates from these degrees often go onto corporate roles in health and can be influential in health systems and technology management and implementation.

This study undertook a high-level mapping process to understand shared challenges in eHealth teaching across health degrees. Future researchers may wish to conduct degree-specific research to understand the unique challenges faced by eHealth educators in individual health degrees. The findings from this study suggest that there may be disciplinary differences in eHealth focus that may reflect differences in the types of workplaces and work that graduates from different health degrees enter. For example, medicine and nursing were the only degrees that currently included content relating to system and technology implementation. This may reflect the greater proportion of graduates entering hospitals and the emphasis on these skills in that setting. Further research exploring disciplinary differences in eHealth focus is also needed.

Conclusions

At present, there is limited inclusion of eHealth in health and medical curricula. This includes formal (learning outcomes and summative assessments), semiformal (documented in unit outlines but not formally assessed), and informal (not documented but explicitly taught in classes) learning activities. Where there was eHealth content, it tended to focus on clinical applications rather than systems and policies, data analysis and knowledge creation, or system and technology implementation. There is a need for more explicit strategies for embedding eHealth capabilities across health and medical degrees. We recommend degree-wide conversations and collaboration between professional bodes, clinical practice, and universities to overcome the practical and perceived challenges of integrating eHealth in health curricula. Overall, unit coordinators were supportive of including eHealth in their teaching and welcoming of opportunities to learn how to do so. Future research could build on this to develop and evaluate examples of best practices in eHealth curricula.

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Conflicts of Interest

None declared.

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Abbreviations

ICT: information and communication technology

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Viewpoint

Taking a Leap of Faith: A Study of Abruptly Transitioning an Undergraduate Medical Education Program to Distance-Learning Owing to the COVID-19 Pandemic

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Abstract

The COVID-19 pandemic has forced universities worldwide to immediately transition to distance-learning. Although numerous studies have investigated the effect of the COVID-19 pandemic on universities in the Middle East, none have reflected on the process through which medical education programs for health professions underwent this transition. This study aimed to elucidate the rapid transition to distance-learning of an undergraduate medical program at the College of Medicine, Mohammad Bin Rashid University of Medicine and Health Sciences (Dubai, United Arab Emirates), owing to the COVID-19 pandemic. An action research approach constituted the foundation of this collaborative effort that involved investigations, reflections, and improvements of practice, through ongoing cycles of planning, acting, observing, and reflecting. Efforts of transitioning to distance-learning were grouped into four interrelated aspects: supporting faculty members in delivering the program content, managing curriculum changes, engaging with the students to facilitate distance-learning experiences, and conducting web-based assessments. Challenges included the high perceived uncertainty, need for making ad hoc decisions, lack of experiential learning and testing of clinical skills, and blurring of work-life boundaries. Our preliminary findings show the successful generation of a strong existing digital base, future prospects for innovation, and a cohesive team that was key to agility, rapid decision-making, and program implementation.

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KEYWORDS

action research; change management; COVID-19; curriculum content; curriculum delivery; distance-learning; learning; medical education; pandemic; teaching

Introduction

The COVID-19 pandemic occurred in a globalized world. It has disrupted lives after its initial report by the World Health Organization (WHO) Country Office in the People's Republic of China on December 31, 2019, as "pneumonia of unknown etiology detected in Wuhan City, Hubei Province of China" [1]. Initially, on January 30, 2020, the WHO declared the disease a public health emergency of international concern. On March 10, 2020, the United Nations International Children's Emergency Fund sent an alert to protect students, and soon thereafter, on March, 11, 2020, the WHO declared COVID-19 a pandemic [2]. Countries made efforts to promote the use of personal protective equipment and impose restrictions on people's movement to safeguard the health of their citizens. Human activity in all sectors was debilitated, and the education sector was among those most severely affected. Two major interrelated threats presented to global medical education: continuity of quality education and the resultant impact on graduating physicians' future performance.

Toward the end of 2020, reflective studies on actions taken at educational institutions for health profession–related undergraduate and postgraduate programs have dominated the literature on medical education. Resource-rich academic environments highlighted social distancing, seclusion, and struggle with digital transformation as their largest challenges. Among resource-poor surroundings, the lack of e-learning capacity (including infrastructure, skills, learning, and development), internet affordability, connectivity, and electronic skills were the most prominent challenges [3,4].

Despite these challenges, many centers were quite innovative in overcoming deficiencies and circumventing challenges. In postgraduate and residency programs, fostering of a community of learning by using multiple educational tools enabled by proprietary platforms, including Microsoft Teams and Zoom, led the transition to distance-learning. This was a significant transition from the previous random but lesser reliable short communications within the medical resident community through social media platforms [5]. In particular, medical students on the verge of graduation were most affected, but leading institutions worldwide reoriented assessments with a web-based teaching-learning approach, complemented by open-book examinations, thus allaying students' career-related anxiety [6].

The most prominent and impactful changes have been the initial rapid adaptation to distance-learning owing to the short lead time, and the mitigation of educational strategies that were devised and implemented during the period of complete lockdown across countries worldwide. This could be referred to as the "first wave" academic response to the first wave of the pandemic. The timeframe extended from the abrupt onset of the pandemic, blending with a sustained initial period, and lasted several months.

Although numerous studies have investigated the effect of the COVID-19 pandemic on universities in the Middle East [7], none have reflected on the process through which medical education programs for health professions transitioned [4,8]. Accordingly, the purpose of this study is to trace the abrupt educational transition of a new medical institution in the early years of its evolution, growing and delivering an undergraduate medical curriculum, on the eve of a complete nationwide lockdown in the United Arab Emirates. An in-house, cross-functional team of researchers collaborated to control for this process and document the experience in a scientific manner. This team comprised representatives of the university's administrative workforce who handle the Quality Assurance and Institutional Effectiveness portfolio, faculty members, academic leaders, and medical education experts. In alignment with the recommendations of a scoping review of the literature on COVID-19 [9], this study elucidates a holistic multidisciplinary approach to mitigate the impacts of the COVID-19 pandemic, whose implications reach far beyond the biomedical risks, especially in medical education related to health professions. This study defines the elements of digital technology preparedness and of agile systems and identifies the initial challenges and tribulations and the subsequent triumphs of the transition to distance-learning. Finally, this study of a leap of faith in the education sector lays the foundation for a critical analysis of the challenges, gains, and lessons learned, which have allowed for consolidation and future risk-planning.

Methods

Context of the Study

As the most globalized country in the Middle East, the United Arab Emirates announced the first case of COVID-19 on January 29, 2020 [10]. As part of the proactive measures implemented to slow the spread of COVID-19, all educational activities in the United Arab Emirates were suspended temporarily on March 8, 2020, which was 3 days before the WHO declared COVID-19 a pandemic. Under directives of the Minister of Education, the College of Medicine (CoM) at the Mohammed Bin Rashid University of Medicine and Health Sciences (MBRU) transitioned all educational activities (including teaching, assessment, and administrative activities) completely on the internet and resumed activities in 2 weeks (as of March 22, 2020), with all employees (faculty and staff) working remotely.

The bachelor of medicine, bachelor of surgery (MBBS) program at the CoM is a 6-year undergraduate program that follows a spiral curriculum and is divided into three sequential phases: foundational basic sciences (Phase 1), preclinical (Phase 2), and clerkship (Phase 3). Phase 1 takes place over the first academic year and introduces students to basic concepts in medicine, while Phase 2 covers academic years 2 and 3 where teaching is centered around organ systems and is integrated with clinical medicine. Years 4-6 constitute Phase 3, where students undergo their clinical placements or rotations during the first 2 years and an internship in the final year.

Before the onset of the COVID-19 pandemic, the curriculum was delivered on site, in person, supplemented (where appropriate) with asynchronous assignments and activities on digital platforms. The institution has invested in several digital platforms. The first one is the "Desire-to-learn" platform, which is a learning management system (LMS) that constitutes the repository of course files, and was also actively used for forums and quizzes across all phases. A virtual microscopy–enabled website "PathXL" was actively employed for practical pathology teaching and skill-testing in Phase 2. Furthermore, the Aquifer web-based platform provided an opportunity to supplement clinical-focused problem-solving among students in Phase 3. Clinical teaching activities included simulated learning on mannikins, followed by direct patient contact in hospitals and clinics. Assessment of cognitive learning required students to be physically present at the examination center; however, it was conducted entirely on the internet, using an examination software. Objective structured practical examinations in preclinical courses were conducted on the laboratory bench and through a web-based virtual microscopy teaching and learning platform. Clinical skills were assessed in multiple formats, including case-based discussion, clinical evaluation exercise using Mini-CEX [11], and Objective Structured Clinical Examination (OSCE).

Educational activities were suspended 8 weeks into the 15-week second semester for students in preclinical years 1-3, almost at the end of midsemester in-course assessments. During this time, year 4 students were midway through the fourth of a total of 5 clinical rotations for the academic year. In the respective academic year, the enrollment numbers were as follows: 65 students in year 1, 60 in year 2, 38 in year 3, and 47 in year 4. In terms of instructors, a total of 25 clinical and nonclinical academic faculty members were teaching in the basic sciences domain, and 11 were teaching in clinical sciences domain (2 of whom taught on part-time basis). The faculty members were also coordinating and overseeing the on-site clinical rotations, while a small number of adjunct clinical faculty members, across all disciplines, were also engaged to varying degrees in the hospital setting.

The transition was characterized by a short, intense, latent period of approximately 15 days of reorganizing, regrouping, and reinforcing governance and the educational process and its delivery [12-15]. The university's learning and teaching, research, and community engagement, through action research strategies, was structured to effectively meet the challenges of delivering its educational mission. This was achieved through problem selection, analysis, action design, implementation, and evaluation by collaborative cross-disciplinary teams of stakeholders [16]. Action research, in this context, enabled concrete and practical problem-solving and deeper reflection processes through stakeholders' participation in research-based discourses [17-19]. Systems rapidly attempted to enable infrastructure and digital skills, which improved incrementally, as experience and troubleshooting became an integral part of the change. Thus, early intervention primed by a digitally enabled new medical institution pivoted the educational enterprise in a favorable direction. Throughout the period, leading to the conclusion of the academic year, the transition was regularly punctuated by policy guidance within the country's health and education regulatory framework.

This situation necessitated a rapid response and concerted effort from all university spheres to ensure continuity in university operations. Empowering faculty and staff to deliver distance education while reassuring and engaging students was vital in managing the transition and successfully completing the academic year. Constant communication within and among higher and middle management, frontline employees, and academic and nonacademic organizational units was identified as key to synchronizing the educational metamorphosis.

Action Research Approach

The classical model of action research proceeds in a series of steps that start with the general idea and involve extensive fact-checking from first-hand experience [20]. The iterative process of action research takes the form of a spiral of steps of planning, acting, and observing and reflecting [21,22]. This ongoing cycle of action research constituted the foundation of the rapid transition of the MBBS program to distance-learning. By virtue of design [20,23], the adopted action research approach was conducted by, with, and for people, rather than being directed toward people [24]. Accordingly, the university set up a COVID-19 taskforce that steered the transition and guided the operational aspects of education delivery in discussion with academic leadership.

Three months after the transition, to evaluate the experience from the perspective of the students and the faculty, the MBRU organizational unit that handles the Quality Assurance and Institutional Effectiveness portfolio (ie, the Strategy and Institutional Excellence department) assembled a data collection tool (throughout June 2021) that was contextualized to match the intricacies of the situation [15]. This tool was developed after thorough consideration of other similar tools assembled by other universities. It was first deployed at another college of the same university, during which it proved to be reliable and valid (as revealed through the Cronbach α test and principal component analysis) [13]. This tool was composed of 5 components that were measured with a 5-point Likert-type scale (1="strongly disagree," 2="disagree," 3="neutral," 4="agree," and 5="strongly agree"). The first 4 components correspond to clarity of the explanations concerning the transition, effectiveness of the utilized information technology (IT), support received and opportunity to voice one's opinion, and web-based material and resources. The final component assessed the perception of both groups of stakeholders of the transition experience (as a whole). In the context of our study, the tool proved to be internally consistent and externally valid [25].

Results

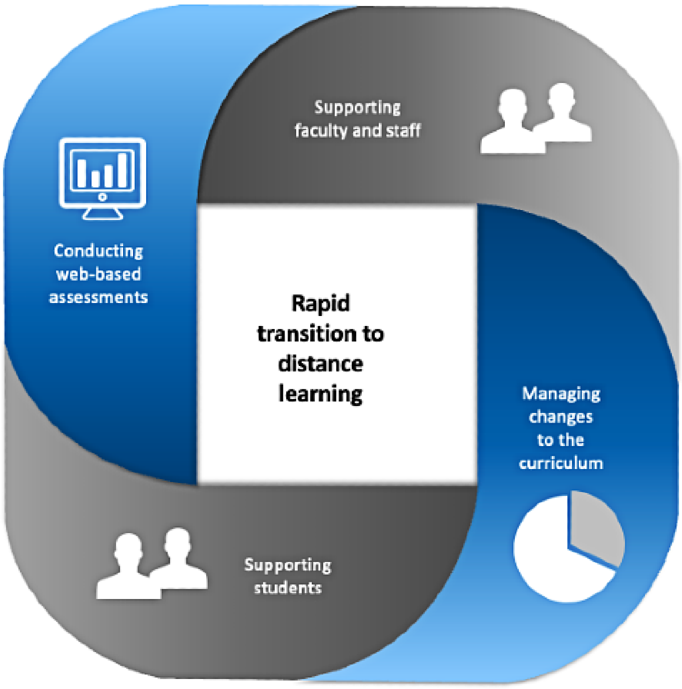
Planning Phase: Determining the Objective of the Transition and the Path and Means Toward Attaining It

The planning phase of the adopted action research approach was ultrarapid and constituted a narrow 2-week period, during which the objective of effectively transitioning to distance-learning was clarified, the path to the goal and the available means were determined, and a concrete strategy of action was developed. The strategic approach centered around ensuring the completion of the planned curriculum delivery and assessment for the academic year with reasonable modifications, upgrading digital resources, upskilling and supporting faculty, staff, and students, and ensuring safety by complying with health and education regulatory bodies. Procurement of additional digital resources and faculty and student onboarding were assigned top priority. The institution identified and invested in Microsoft Teams as the digital medium of choice for remote teaching. The acting phase involved the initiatives used to implement the action research strategy.

Acting Phase: Transitioning of the Undergraduate Medical Program at MBRU to Distance-Learning

The acting phase of the adopted action research approach was centered around 4 interrelated aspects (Figure 1).

Figure 1. Four interrelated aspects of the transition from on-site learning to distance learning (ie, acting phase of the adopted action research approach) that needed to be juggled simultaneously.



Supporting the Faculty in Curriculum Delivery Through Distance-Learning

Prior to the onset of the COVID-19 pandemic, faculty development was a year-round activity targeted to identifying areas of development and conducted both by colleges and the Institute for Excellence in Health Professions Education (ieHPE). The ieHPE is the first of its kind in the Middle East, moving beyond traditional departmental and disciplinary compartmentalization to create new knowledge, enable capacity-building, and promote knowledge translation. It involves education and capacity-building, research and scholarship, and community outreach and engagement. During the transition, the CoM, with support from the ieHPE and the Smart Services and Projects (SSP) units, developed and implemented a series of initiatives to support faculty members in effectively delivering distance education. The SSP is the MBRU arm that handles all the needed IT support, serving MBRU students, faculty, academic and administrative support staff, and alumni. The SSP is composed of several units that collaborate to provide comprehensive IT services (eg, operating the LMS and all digital education and assessment tools and overseeing the university-wide evaluation system and the intranet) as well as customer service (eg, IT Help Desk and IT project management and delivery) to the MBRU community at large. There was a sharp focus on remote digital upskilling with short intense teaching and learning modules and a 24/7 Microsoft Teams–anchored community-of-learners helpline. The initiatives that were meant to support the faculty throughout the transition consisted of the following activities.

Raising Faculty Awareness of Available Resources to Support Distance-Learning

An immediate needs assessment survey was assembled to gauge faculty members' familiarity with web-based teaching, expectations, requirements, and level of assistance required. The ieHPE subsequently organized sessions that explained the paradigm of web-based education and contrasted it to traditional classroom-teaching. The different modalities to be used, such as synchronous web-based delivery of didactic sessions and prerecording didactic sessions by creating screencasts, and podcasts were also advocated. The SSP shared with faculty members the available resources that could support such pedagogical modification.

Faculty Learning and Development

The staff at the ieHPE organized for and delivered hands-on workshops and "drop-in" sessions for faculty members to consult for the optimal learning and teaching configurations depending on the nature of the teaching session, as well as modifying teaching approaches to suit distance-learning. Specific hands-on training was provided using Microsoft Teams and Live Lecture Capture. Any hardware updates and modifications needed by the faculty members were also provided by the SSP team. Additional support and training were provided to faculty members to maximize engagement with learners on the internet, including creating live asynchronous classroom and discussion forums.

Supporting the Mental Health of the Faculty and Staff

Numerous measures were implemented to ensure that all MBRU employees (faculty and staff) are supported in terms of their mental health. Initially, all employees had access to the university counselor and were encouraged to reach out to the counselor's office to schedule an appointment when required. In addition, the counselor offered weekly web-based group relaxation sessions, which were open to all employees. Furthermore, stand-up meetings continued as usual to maintain cohesion and interaction among colleagues (which also indirectly played a protective role in the employees' mental health). Finally, committee chairpersons and Phase Directors supervised all employees and provided enhanced support throughout the experience.

Managing Changes to the Curriculum

Under the auspices of the Office of the Dean of the CoM and with the assistance of the Curriculum Committee, the academic calendar was immediately adjusted, and schedules were revised. This included preponing the spring break by 2 weeks to create space for preparation. Together with the accompanying modifications of roles and responsibilities, these calendar changes were instantly communicated to instructors. Implementation was regularly monitored by Phase Directors and course coordinators. Simultaneously, weekly meetings were scheduled with the dean of the CoM to discuss progress at the college level and with the respective academic committees' chairpersons to share updates and directives from the Ministries of Public Health and of Higher Education. As part of the implementation phase, a gap analysis was performed to ascertain the impact of reverting to web-based learning on the curriculum outcomes of the respective phases. This included measuring course learning objectives achieved and comparing them to those of the respective courses in accordance with the programs and study guides. All objectives set for Phase 1 (which aims at introducing students to basic concepts in medicine) were met, while 1 course (ie, "Foundations of Clinical Medicine-IV") in Phase 2 was significantly affected since it is designed to foster learning of experiential clinical skills at the university's simulation center. The impact was most significant on the Phase 3 curriculum since students could not complete the last 2 clinical rotations; however, all didactic teaching was carried out on the internet. Concerted efforts were made to compensate for the lost clinical experience through case study–based Aquifer sessions and web-based case-based discussions. Longitudinal COVID-19 rounds, led by clinicians in the hospital, were also conducted every week. This initiative was an innovative educational approach, where a group of students (on a rotating basis) would address a particular aspect of COVID-19 and its updates (eg, socioeconomic factors or medication) and collate them as an all-encapsulating infographic. During the session, the assigned team facilitated discussions were centered around the infographic. Considering the gaps, it was decided to introduce a 3-week "enhanced induction" at the beginning of the following academic year, which was intended to address the identified deficiencies for all students in Phase 3.

Supporting Students During Web-Based Learning

Communication With the Students

The Student Services and Registration (SSR) organizational unit was instrumental in communicating and updating students throughout this period. This included highlighting changes to the schedule, sharing of ministerial directives, changes in examination modalities, and the implementation of the "pass" or "fail" option. Course coordinators were tasked with sharing course-specific changes and weekly planning schedules.

Students' Connectivity and Readiness

The SSR surveyed students to determine their ability to fully participate in web-based activities by requesting the specifications of the devices that the students would use to connect on the internet, as well as the stability and bandwidth of their internet connection. Access to Microsoft Teams and training was also provided during subsequent usage. Continuous IT support was also made available to all students.

Students' Connectedness and Engagement

Student engagement prior to the pandemic was monitored through an established in-class attendance record, academic advisor meetings with digital records and follow-up, and meetings with Phase Directors and assessment chairs.

During the transition, all learning material was shared on the LMS, well in advance of the web-based sessions. Simultaneously, students received weekly updates from course coordinators with regard to the course schedules and presentation modes. Individual instructors posted expectations as well as formative assessments for sessions on the LMS.

Student engagement was further monitored through real-time logging on to the synchronous web-based sessions as well as extracting data of their engagement with learning material on the LMS. Course reports were compiled weekly, and those students who did not engage adequately were directly contacted and encouraged to improve their participation. The SSR also followed up with these students to determine any underlying reasons for their insufficient engagement (eg, connectivity issues or personal hurdles). Appropriate action was then taken. Academic advisors were also vigilant in engaging their advisees for early identification of challenges and providing prompt support to mitigate adverse outcomes.

Students' Health, Well-being, and Mental Health Support

Prior to the pandemic, several agencies supported the students' academic and nonacademic needs including but not limited to academic advisors, Office of the Assistant Dean of Student Happiness and Wellbeing, the SSR, and the student counselor. Each of them had independent and interdependent functions. On-campus life was steered by leadership of the student council and a host of extracurricular activities through student clubs.

Owing to the anticipated burden of deviating from the known traditional on-campus to complete off-campus remote teaching and learning on the internet, and the uncertainty of the psychosocial effects of the pandemic on faculty and students, it was also important to look after the health and well-being of all the community members, especially the students. The SSR, together with the students' council, scheduled various web-based extracurricular activities to support and maintain a sense of community among the student body. Furthermore, the student counselor developed a series of relaxation sessions and sessions aimed at equipping faculty and students with internal resources and coping mechanisms to deal with anxiety and stress.

A peer-mentoring program was also implemented. Since students in Phase 3 could not return to their clinical placements, part of their schedule was freed up, and volunteers were recruited to tutor students, particularly those in Phase 1. This served as a support system to the freshman students and provided senior students with a sense of purpose.

Toward the end of the academic year, it was decided to provide students with an extended study break before the final examination to provide them sufficient time to consolidate learning material and prepare for examinations.

Conducting Web-Based Assessments

The university had initially invested in a proprietary web-based examination platform (ie, ExamSoft) at the launch of the MBBS program, which was used for student assessment on campus before the onset of the pandemic. On the same platform, end-semester and end-year examinations and other forms of student assessment were delivered remotely during May-July 2020. The transition to web-based examination was therefore smooth as a remote proctoring tool was added to the existing digital platform to ensure academic integrity. This was deduced from the large proportion of class learning objectives met; student performance (assessment and progression), which did not differ from previous iterations; and student and instructors' satisfaction with the rapid transition to distance-learning in the end-of-course surveys [15]. However, the main challenge was ensuring proper identification of examination takers and avoiding unauthorized student access to material during examinations. Accordingly, an additional capability of remote proctoring was added to the examination platform to ensure the integrity of the assessment conducted remotely. Moreover, modified electronic versions of the OSCE generated in-house and video case-based evaluations were effective as the best fit for purpose in a remote setting.

Observing and Reflecting Phase: Challenges and Triumphs

Disruption of education was not an isolated phenomenon during the pandemic, and its acuteness was most palpable at the onset of the forced transition. Despite extensive efforts made at all levels, uncertainties created by educational directives that were in turn dictated by rising infections caused varying communication delays across the board. Overall, effects on mitigating the fear of infection and coping with isolation had to be balanced with the need for continuity in education. As expected, despite close monitoring and support, vulnerable individuals and borderline performers were most impacted more through academic stress than measurable on performance.

Nonetheless, several short- and long-term gains have been made. The digital efficiency enabled curriculum delivery and administrative meetings to achieve heightened focus, brevity, and timeliness. Recordings afforded flexibility, archiving, and efficient use of time, and live sessions provided impetus for innovative web-based activities. As 1 year of living with the COVID-19 pandemic has been completed, interesting and beneficial changes have persisted. In the context of our institution, these abiding changes include a digital revolution, personalized certifications in digital teaching, hybrid teaching, and adaptation of the lessons learnt from the electronic version of the OSCE to undertake electronic multiple mini-interviews for new admissions to programs. In terms of the stakeholders' perception of the experience, both groups appeared quite satisfied. The total average of satisfaction among stakeholders was 76.4% [25].

Discussion

Principal Findings

The COVID-19 pandemic created a window of opportunity for action research in medical education. Similar to any other action research study [18,19], the outcome of transitioning the MBBS program to distance-learning at the CoM was not defined a priori and resulted from the involved stakeholders' capacities, interests, and actions. It was immediately apparent that the stakeholders and their work would metamorphose, but what form it would take could not have been predicted. MBRU values of respect, integrity, connectivity, giving, and excellence [26] enabled the entire process by focusing on its core and acted as the stakeholders' compass throughout the journey. Leveraging the internal resources, including but not limited to the existing IT infrastructure and support team (ie, the SSP), and the internal expertise in medical education related to health professions (ie, ieHPE) were also fundamental to the transition. As such, the changing public needs owing to the COVID-19 pandemic were addressed by deploying an action research approach to restructure the university and its relationships and fostering the key positive elements of MBRU.

The United Nations Educational, Scientific and Cultural Organization defines an "educational emergency" as a crisis that is created by conflicts or disasters that have destabilized, disorganized, or destroyed the education system and requires an integrated process of crisis and postcrisis support, recognizing the importance of ensuring education continuity after disasters, and taking the lead in promoting education as part of an emergency response and for long-term recovery [27]. The impact of the COVID-19 pandemic on education was an unexpected bio-disaster. Adaptation to the changed circumstances and mitigation of its impact required known and yet unknown resources to devise solutions. Through the process adapted in this study, it was evident that 4 interrelated aspects of the transition needed to be closely followed up: managing the supporting faculty members in delivering the curriculum, managing curriculum changes, engaging with the students to facilitate the distance-learning experience, and conducting web-based assessments. This study bridges a gap in the literature by elucidating a process through which a medical university in the Middle East leveraged its internal resources to abruptly transition an MBBS program to distance-learning.

The first educational responder was China, where the pandemic originated, which did not benefit from reviewing coping strategies with to this specific threat. In contrast, other countries had a 3-month lag period before being affected by COVID-19. In an insightful case study from Peking University, an educationist reflected that 5 high-impact principles of web-based education served them well, including "(1) high relevance between online instructional design and student learning, (2) effective delivery on online instructional information, (3) adequate support provided by faculty and teaching assistants to students, (4) high-quality participation to improve the breadth and depth of student's learning, and (5) contingency plan to deal with unexpected incidents of online education platforms" [28]. At MBRU, the navigation of the curriculum retained the intended design and delivery as those of prepandemic electronic platforms for teaching and assessments. This required escalating efforts toward stabilizing capacity through rapid, expedited faculty development on additional electronic tools to facilitate continuity in teaching and keep it engaging. Investment in the identified Microsoft Teams platform and student orientation provided sustainability.

Part of the previous reluctance across the medical professions toward remote learning is the perception of the inability to effectively deliver practical learning. Nonetheless, institutions surmounted such obstacles, where, for example, teaching of anatomy at universities in Australia and New Zealand balanced the loss of "hands-on" experience and pedagogy with "six critical elements" that include "community care, clear communications, clarified expectations, constructive alignment, a community of practice, ability to compromise, and adapt and continuity planning" [29]. The use of a blended pedagogical framework through a social media application–integrated "interactome" strategy proved useful during the pandemic when teaching anatomy at MBRU [12]. Interestingly, the usage of MUELE, the official e-learning platform used at Makerere University, was much lower at their College of Medicine compared to other colleges at the same university [3]. In the transition reported in this study, there was minimum interruption in the first 3 years in learning, teaching, and assessments. There was only 1 cohort in the first clerkship year, and the challenge to replace clinical on-site clinical rotations with virtual, real-time interactive sessions was a compromise at best.

Virtual learning during the COVID-19 pandemic helped reimagine and blend the well-established practices of telehealth, which had previously been limited to provide health access to remote areas, by rendering it the central focus in educational processes [30]. Virtual learning drew students' attention to the rapidly advancing innovations in delivering home health care and the expanding inventory of handheld devices and apps that help monitor chronic ailments.

Student support was completely redefined during the acute transition to coping with isolation and learning simultaneously. High levels of anxiety and stress and the resurgence of pre-existing mental disorders identified through structured interviews were expected [31]. Addressing them through counseling and psychoeducational interventions was necessary. In our short journey, this was not left to chance, with active interaction maintained with students and at multiple levels from university leadership, academics, advisers, and counselor services. All educational functionaries also searched for new skills to deliver their respective roles in working from home with unexpected distractions from people and competition for space.

Community engagement is a vital activity of universities and students' engagement is critical. This engagement becomes even more critical for medical students when a health disaster strikes. It becomes supplementary to curricular learning, as pandemics constitute live exposure to learning emergency medicine and public health responses [32]. An interesting case study of higher education regarding the public health response to disruption during the Christchurch earthquake of 2010 provides interesting insights in to the dynamic way service-learning made curricula responsive and engaging, turning an educational disruption into a pedagogical opportunity [33].

Limitations

Through an action research approach, this study provides thorough reflections on a particular experience that is relevant to stakeholders of other health profession–related educational programs. By virtue of this study's design, the generalizability of its findings is limited to institutions that are characteristically and contextually analogous to MBRU. Moreover, since the focus of this study was on the inductive process adapted by the institution to effectively respond to a crisis, it was purely descriptive. Follow-up studies are required to focus on a single institution to capture the perceptions of several stakeholders and to strive to systematically integrate quantitative and qualitative data through a mixed-methods analysis.

Conclusions

This university-wide action research approach highlights the experience of a first responder in an educational crisis with a recently established undergraduate medical program of a young university at the outset of the COVID-19 outbreak and nationwide lockdown. Seminal triumphs of this study included building on a strong existing digital base, prospects for innovation, and a modest and cohesive team that was key to agility, rapid decision-making, and implementation. Challenges included the uncertainty of endpoints, rapid decision-making, clinical skill–learning and –testing, and blurring of work-life boundaries. This educational "leap of faith" was not based on flamboyance; instead, it relied on the strength of its purpose, a sound digital infrastructure, and focused reorientation and delivery of the curriculum. Experiences of newly devised innovations and adaptations toward multiple formats of remote assessments will help integrate the "new normal" with the "old normal" academic journey narrative. A year on, digital upscaling and upskilling and hybrid educational experiences have persisted.

Conflicts of Interest

None declared.

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Abbreviations

CoM: College of Medicine
ieHPE: Institute for Excellence in Health Professions Education
IT: information technology
LMS: learning management system
MBBS: bachelor of medicine, bachelor of surgery
MBRU: Mohammed Bin Rashid University of Medicine and Health Sciences
OSCE: Objective Structured Clinical Examination
SSP: Smart Services and Projects
SSR: Student Services and Registration
WHO: World Health Organization

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Viewpoint

Web-Based Medical Examinations During the COVID-19 Era: Reconsidering Learning as the Main Goal of Examination

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Abstract

Like other aspects of the health care system, medical education has been greatly affected by the COVID-19 pandemic. To follow the requirements of lockdown and virtual education, the performance of students has been evaluated via web-based examinations. Although this shift to web-based examinations was inevitable, other mental, educational, and technical aspects should be considered to ensure the efficiency and accuracy of this type of evaluation in this era. The easiest way to address the new challenges is to administer traditional questions via a web-based platform. However, more factors should be accounted for when designing web-based examinations during the COVID-19 era. This article presents an approach in which the opportunity created by the pandemic is used as a basis to reconsider learning as the main goal of web-based examinations. The approach suggests using open-book examinations, using questions that require high cognitive domains, using real clinical scenarios, developing more comprehensive examination blueprints, using advanced platforms for web-based questions, and providing feedback in web-based examinations to ensure that the examinees have acquired the minimum competency levels defined in the course objectives.

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KEYWORDS

COVID-19; online exam; e-learning; medical education; medical student; online learning; online platform; cheating; web-based examination

Background

Currently, we are living in the COVID-19 era [1], during which almost every aspect of life, from communications to people's lifestyles, has changed [2,3]. Originating in China, the SARS-CoV-2 virus spread worldwide quickly, affected billions of people, and led to several infection control policies, such as wearing masks, social distancing, and lockdowns [4-6]. Iran is one of the countries that was greatly affected by this pandemic. The first cases of COVID-19 were reported on February 19, 2020, and to date, approximately 2.8 million confirmed cases and 78,000 deaths have been reported in Iran. Medical education, including undergraduate and postgraduate education, was not immune to the effects of this virus [7]. A sudden shift to e-learning and web-based courses was a direct result of COVID-19 [8]. For undergraduate students, almost all courses are presented virtually, and for postgraduate students, a blended learning approach is used to reduce the exposure of students, interns, and residents to the disease. Traditional written examinations also underwent a transformation in response to this pandemic, considering the high risk of infection in indoor testing sites [9,10]. The easiest way to face the new challenges was to administer traditional questions via a web-based platform. However, more factors should be accounted for in designing web-based examinations during the COVID-19 era. This article aims to address some of the major aspects that should be considered in this regard and to suggest a valid and reliable method for organizing medical students' examinations in the COVID-19 era.

COVID-19 and Web-Based Examinations

Resorting to web-based examinations during the COVID-19 pandemic was inevitable. It should be noted that COVID-19 itself affects medical students, medical educators, and medical universities more than lockdowns and social distancing. Other aspects of COVID-19 that must be taken into account during the pandemic can be categorized into mental aspects, educational aspects, and technical aspects.

Mental Aspects

Stress and burnout are among the factors that may affect medical students during this pandemic [11]. Studies conducted before the COVID-19 pandemic showed that stress levels were high among medical students [12]. The COVID-19 pandemic has now worsened the stress levels of medical students and workers throughout the entire health care community [13,14]. In our experience in Medical University of Isfahan (MUI) teaching hospitals, some of the main causes of stress during this pandemic were the shortage of personal protective equipment in the early weeks; the poor state of intern and resident on-call rooms, which increased the risk of infection; and the fear of infecting family members.

Regarding burnout, previous studies have shown a higher prevalence of burnout in medical students than in the general population [15]. Currently, during the COVID-19 pandemic, burnout syndrome has become more prevalent in health care providers and medical students [14,16].

Educational Aspects

The difference in the types of education that medical students, interns, and residents receive also increases the need to change the way examinations are conducted. The sudden shift to e-learning has created challenges in medical education [17]. Challenges include decreased numbers of educational opportunities, decreased numbers of patients (except for patients with COVID-19), increased numbers of shifts, and in some cases, the requirement to work in COVID-19 wards. As a result of the second and third waves of this pandemic in Isfahan, the primary teaching hospital of MUI became a COVID-19 center, and all operation rooms or outpatient clinics were closed, thus decreasing educational opportunities for interns and residents.

Technical Aspects

Web-based examinations also have unique problems. Studies show that web-based testing environments negatively affect student performance on examinations because of differences in student comfort and technical problems, such as internet connection disruptions and server failure [18]. This problem occurred in our first experiences of web-based examinations at MUI. Server error messages appeared during the examinations due to the lack of server resources and negatively affected the students' performance by causing them stress or wasting examination time.

The ability to control the environment of unproctored web-based examinations is also questionable [19]; for instance, cheating is a commonly reported challenge in web-based assessments [20]. Kennedy et al [21] reported that 57% of students and 64% of faculty members believed that it is easier to cheat on web-based examinations than on traditional examinations. In another study, Jensen and Thomas [22] showed that approximately 22% of participants in web-based examinations used search engines to find the correct answer. This was also the case in MUI examinations. Our first web-based examination results showed a significant increase in examination grades. Further investigations revealed that using messaging platforms such as WhatsApp to share the answers is one of the most common ways of cheating among students. Some other common ways of web-based cheating are using electronic books and typed handouts and searching for keywords.

In response to all these emerging problems, most solutions are limited to technical aspects and preventing students from cheating. Some educators reduced the examination time or used more difficult questions to address this problem. Using webcams and screen sharing to control students is another solution. This method, however, has certain limitations, such as the limits concerning the number of examination participants and the need for high-speed internet connections for all students [23]. Meanwhile, technology can be employed to prevent cheating. For example, PageFocus is a JavaScript code that detects when participants abandon test pages by switching to another window or browser tab [24]. However, the inclusive use of smartphones and messaging applications undermines this method. Sharing answers on social media platforms can thwart the strategies employed by educators, such as decreasing the duration of examinations. Generally, using a second device can neutralize strategies such as screen sharing and PageFocus.

Learning as the Main Goal of Examinations

Although all these problems related to web-based examinations in the COVID-19 era seem concerning at first look, this leads us to take a step back and reconsider the aims of an examination. One of the main goals of an examination is to improve learning; however, learning through examination can only occur when the examination involves more than participating in the examination, answering the questions, and waiting for the results.

The COVID-19 era and web-based examinations are providing an excellent opportunity to consider learning as the main goal of examination. By accepting the existing limitations in educating and assessing students and preventing cheating in this era, some measures can be taken to transform the examination sessions into learning sessions to ensure that students have achieved the minimum competency levels required for passing their courses. For this transformation, the following approach is suggested.

Suggestions

Use Open-Book Examinations

The reason for suggesting open-book examinations is that it may encourage students to use their books or search for the answers on evidence-based medicine databases. Moreover, a systematic review showed decreased anxiety levels among students in open-book examinations, which makes them more favorable, especially in this era [25]. Evidence-based medicine is a result of the internet revolution, and it emerged because of the rapid expansion of knowledge in the age of information; its primary goal is to educate clinicians on how to use published articles for optimizing clinical care [26]. To use evidence-based medicine, physicians must possess the ability to search for and find correct information on the internet and in medical databases [26]; therefore, open-book examinations are an excellent way to familiarize medical students with evidence-based medicine [27].

Use Questions That Require High Cognitive Domains

To encourage students to use their books and other evidence-based medicine sources during examinations, it is essential to revise the examination questions.

According to Bloom's theory, cognition has multiple domains [28]. Open-book examinations enable examiners to ask questions that require higher cognitive domains [29], because the students cannot find the test answers easily in references or on the internet with a simple keyword search. Using questions that require high cognitive domains forces the students to read the related contents thoroughly and ensures that students answering the questions have read the selected contents at least once and have understood them.

Using clinical scenarios is a good way to develop questions for open-book examinations because these scenarios require high cognitive domain levels. Open-book examinations are, in fact, similar to clinical practice in certain aspects. In real practice, general practitioners must have the ability to use evidence-based medicine in their decision-making; therefore, they should know how to search, where to search, and what to search for. Using real clinical scenarios in web-based examinations is an excellent method to train medical students in using evidence-based medicine by searching in evidence-based medicine resources [30].

Create More Comprehensive Examination Blueprints

We use examinations to ensure that medical students have a minimum competency in the subject of the examination. To achieve this goal, especially when the education system is less than perfect, it is necessary to develop more comprehensive examination blueprints. By using a comprehensive blueprint in coordination with open-book examinations, the instructor ensures that all the students recall, review, read, and understand the course topics and subtopics. A common guideline for cognitive domains of questions is 50-40-10, which means that 50% of questions require the knowledge domain, 40% require the application domain, and 10% require problem-solving skills [31,32]. However, as mentioned above, questions that require high cognitive skills such as problem-solving must be given more weight in these circumstances. The type of examination (formative or summative) and examinee (student, intern, or resident) can also change these percentages to ensure that an examinee who passes the examination has a minimum competency according to the course objectives [33].

Use Advanced Platforms for Web-Based Examinations

Using advanced platforms to administer web-based examinations makes it difficult for students to cheat and encourages them to refer to their books to find the answers [29]. Showing only one question at a time on screen, sorting the questions and choices randomly for multiple-choice questions, and prohibiting students from revisiting a question can help the instructors encourage students to use references instead of cheating [34-36]. Reducing stress is an additional goal of using advanced platforms. Internet connection disruptions and server failure are major causes of stress during web-based examinations. The web-based examination platform must be capable of handling these disruptions; it should save the students' previous answers and their remaining examination time to curb the negative effects of disruptions on the performance of the examinees.

Provide Feedback

Learning in an examination session occurs when the examination requires students to do more than merely participate, answer questions, and wait for their grades. Providing feedback is an essential component to turn an examination session into a learning session. The question-response-feedback approach is one of the easiest ways to create a learning session in web-based examinations [37]. This type of feedback is divided into three categories: indication of a correct or incorrect response, statement of the correct response, and elaborative corrective feedback that includes an explanation of the question and responses. Moreover, the feedback could be provided after each question (immediate) or at the end of the test (delayed). Previous studies show that providing feedback with examination question rationales is a better approach than simply providing the correct answer or simply indicating whether the student was correct or not [37-39]. Moreover, a study shows that delayed feedback in examinations is more beneficial than immediate feedback [37]. In conclusion, using delayed elaborative feedback in web-based examinations is suggested for such examinations in this era.

Conclusion

There is no doubt that medical education, especially in the clinical setting, is being affected by the COVID-19 pandemic. Therefore, there is a need for new education and examination policies to adapt to this situation. Learning is one of the goals of examination that both instructors and students often neglect. The COVID-19 pandemic era is an excellent opportunity to consider learning as the main goal of exams and use methods to transform an exam session into a learning session and ensure that the students who pass the exam have a minimum competency.

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Conflicts of Interest

None declared.

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Abbreviations

MUI: Medical University of Isfahan

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Original Paper

The Association Between Gaming Practices and Scholastic Performance Among Medical Students in India: Case-Control Study

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Abstract

Background: Gaming is a billion-dollar industry that is expanding at a compound annual growth rate of 9% to 14.3%, with the biggest market in Southeast Asian countries. The availability of low-cost smartphones and the ease at which the internet can be accessed have made gaming popular among youth, who enjoy it as a leisure activity. According to the World Health Organization, excessive indulgence in gaming can lead to gaming disorder. Medical students indulging in excessive gaming can succumb to gaming disorder, which can affect their scholastic performance.

Objective: This study aimed to assess the association between gaming practices and scholastic performance among medical students.

Methods: This study used a case-control design, where 448 medical undergraduate students (first year to prefinal) were preliminarily surveyed using universal sampling on their gaming practices in the last 6 months. Out of this sample, the 91 participants who admitted to gaming in the past 6 months were recruited as cases, while participants who never engaged in gaming in the last 6 months were recruited as controls. Both the cases and controls were matched for age and gender in a 1:1 ratio. The internal assessment scores (based on 2 midterms completed in the last 6 months) of cases and controls were compared. The Snedecor F test was used to determine the association between the number of hours spent gaming and internal assessment scores (%), while the Student *t* test was used to determine significant differences between the internal assessment scores of cases and controls. Odds ratios were calculated to identify the risk of poor scholastic performance among cases compared to the controls. The prevalence of gaming disorder among cases was assessed using the Gaming Addiction Scale (GAS).

Results: The frequency of gaming (in hours) was not associated with mean internal assessment scores (P=.13). Male cases reported significantly lower internal assessment scores compared to male controls (P=.005 vs P=.01), whereas no significant differences were observed between the internal assessment scores of female cases and controls (P=.89 vs P=.59). A negative correlation was observed between GAS scores and internal assessment scores (r=–0.02). The prevalence of gaming disorder using the GAS was observed to be 6.3% (28/448) in the study population and 31% (28/91) among cases. The risk of low scores (<50%) among gamers was observed to be 1.9 (95% CI 1.04-3.44, P=.03) times higher in the first midterm and 1.80 (95% CI 0.97-3.36, P=.06) times higher in the second midterm compared to nongamers.

Conclusions: The findings suggest that excessive gaming adversely affects the scholastic performance of male participants more than female participants. Awareness about gaming disorder needs to be created among students, parents, and teachers. Treatment services should be made available to medical students with gaming disorders.

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KEYWORDS

gaming; gaming disorder; medical students; gaming addiction; scholastic performance; academic performance; addiction; smartphones; mobile phones; youth; medical education

Introduction

In 2019, the global gaming market was valued at US $151.55 billion, growing at a compound annual growth rate of 9% to 14.3% and expected to reach US $256.97 billion by 2025, with the largest market in the Asia Pacific region. Of all the available gaming platforms (PC, PlayStation, Xbox), smartphones remain the most utilized gaming platform at present, earning US $64.4 billion in 2019 [1]. India also has a rapidly growing gaming market, with an annual growth rate of 14.3% valued at US $890 million currently [2]. This growth is driven by the rising younger population, higher disposable incomes, the introduction of new gaming genres, and the increasing number of smartphone and tablet users [2].

Although considered a harmless leisure activity, excessive indulgence in gaming can lead to possible internet gaming disorder [3]. In the 11th Revision of the International Classification of Diseases, the World Health Organization recognized excessive gaming as a disorder “characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences” [4].

Recent studies have documented significant impairment of physical, psychological, social, and work-related problems such as insomnia, increased irritability and aggression, depressive and/or anxiety symptoms, poor academic performance, and neglect of interpersonal relationships with excessive and problematic gaming [5-7].

The medical curriculum is vast and requires extensive reading and dedication. In such circumstances, indulgence in excessive gaming among students can lead to gaming disorder, which can affect their scholastic performance. This study aimed to shed light on whether gaming practices among medical students affect their scholastic performance. Hence, this study was conducted with the following objectives:

1. To study the amount and nature of gaming practices among medical students;
2. To assess the prevalence of gaming disorder among medical students;
3. To study the association between gaming practices and scholastic performance among medical students.

Methods

The study attempted to demonstrate the association between gaming practices and the scholastic performance of medical students.

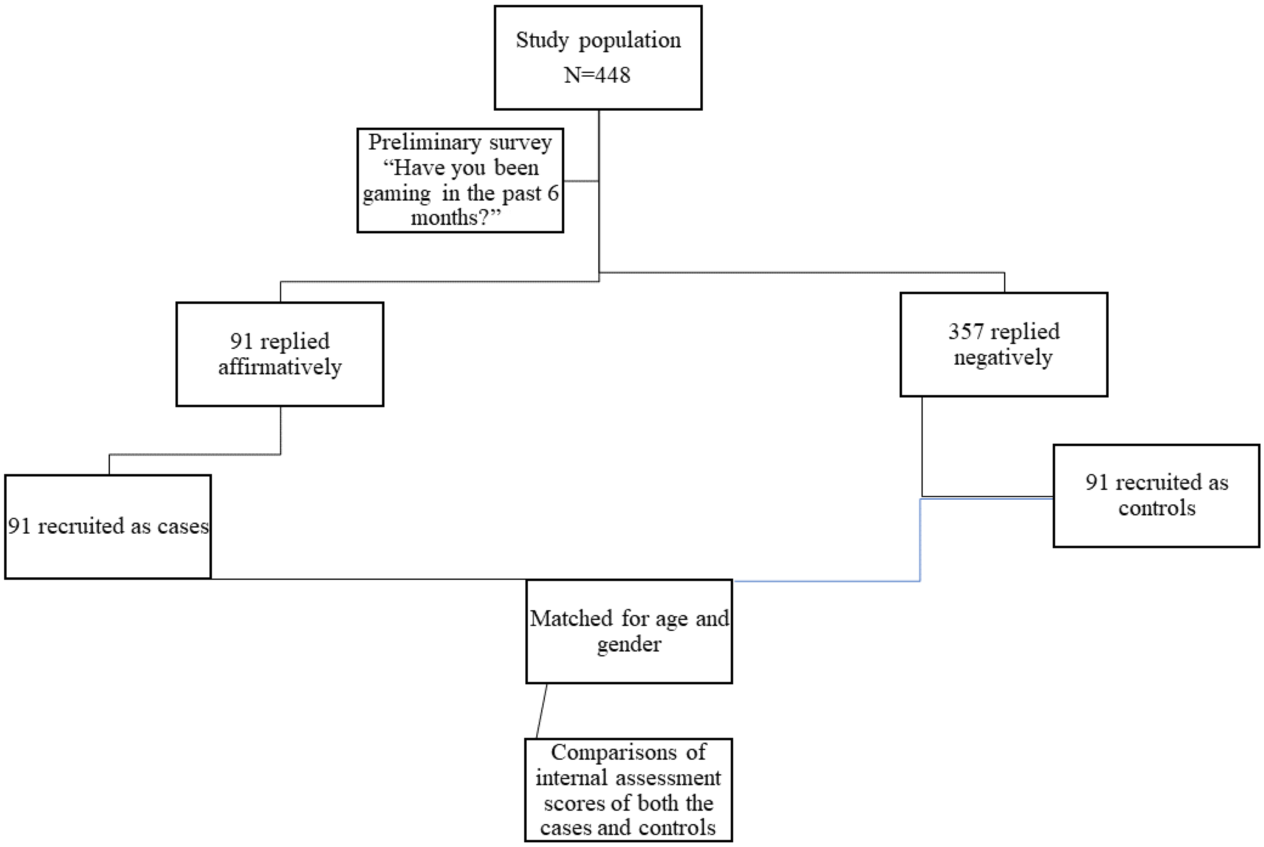
Study Design and Ethical Clearance

The study used a case-control design and was conducted during the period of October and November 2019 in a medical college in the Trichy District of Tamil Nadu, India. Ethical clearance was obtained from the Institutional Ethical Committee of Trichy SRM Medical College (1007/TSRMMCH&RC/ME-1/2019-IEC no:039). Informed written consent was obtained from all the participants. If the enrolled participants were not interviewed on a specified date, they were interviewed subsequently at a time and place of their convenience. The purpose of the study was explained in detail and assured that the data collected would be used only for scientific purposes. Ethical principles such as respect for the person and confidentiality of their data were strictly adhered to.

Recruitment of Cases and Controls

A total of 448 undergraduate medical students in their first to prefinal year were included as participants using the universal sampling technique (Figure 1). The study preliminarily surveyed the entire study population of 448 students using personal interviews. All 448 participants were asked only 1 question: “Have you been gaming in the last 6 months?” From this preliminary sample of 448 surveyed students, 91 students replied affirmatively and were recruited as cases in the study. Following this, the investigator used purposive sampling to select 91 controls from the remaining 357 students who had never indulged in gaming in the last 6 months, and matched both cases and controls for age and gender. The controls selected were matched for age and sex using a 1:1 ratio. The frequency of gaming hours per week was assessed among the cases. The internal assessment scores of the two midterm examinations held in the last 6 months were accessed from the students’ records kept by the institution after obtaining written permission from the students and the Institutional Ethical Committee. The internal assessment scores of cases and controls were then compared and recorded in percentages.

Figure 1. Recruitment of cases and controls.



To assess the prevalence of gaming disorder, the Gaming Addiction Scale (GAS) by Lemmens et al [8] was used. The GAS is a pretested, prevalidated scale with a Cronbach alpha of .82 to .87 [8]. It has 7 items: salience, tolerance, mood modification, relapse, withdrawal, conflict, and problems. Each item has three questions with a score range of 0 to 5 with all the components scored on a Likert scale: 1=never, 2=rarely, 3=sometimes, 4=often, and 5=very often. The investigators used the monothetic format in the study, that is, a score of >3 for all items being indicative of gaming addiction. Lemmens himself hypothesized that the monothetic format would lead to a better estimate of the prevalence of addiction than the polythetic format [8]. Therefore, the investigators used the GAS according to protocol, but for the convenience of analysis, the investigators summed up the total score of all 7 items, and classified participants with a score of ≥63 as having a gaming disorder.

Statistical Analysis

The data entry and analysis were done using SPSS software (version 21, IBM Corp). Descriptive statistics were used for analyzing sociodemographic details, frequency, and type of gaming. The Snedecor F test and the Student *t* test were used to determine the association between the hours spent gaming and scholastic performance, and gaming and internal assessment scores, respectively. Odds ratios were used to calculate the risk of low internal assessment scores among cases and controls. The correlation coefficient (*r*) was used to determine the correlation between the GAS scores and internal assessment scores.

Results

Of the 448 students who were preliminarily surveyed, 91 were allocated as cases and 91 as controls**.** Out of the 91 cases, 49 (53.8%) were female and 42 (46.2%) were male. The majority of cases (80/91, 87.9%) were aged 19 to 23 years. In terms of gaming platform, 87 (95.6%) used a mobile phone, 3 (3.4%) used a personal computer or laptop, and 1 (1.0%) used Xbox (Table 1).

Table 1. Age distribution and gaming characteristics of cases (n=91).

Characteristic	Female, n (%)	Male, n (%)	Total, n (%)	*P* value
Age (years)				.57
≤18	7 (7.6)	3 (3.3)	10 (11.1)	
19-23	42 (46)	38 (41.7)	80 (87.9)	
≥24	0 (0)	1 (1.1)	1 (1.0)	
Gaming platform used				.75
Mobile phone	48 (52.7)	39 (42.8)	87 (95.6)	
Mobile phone/PC	1 (1.1)	2 (2.1)	3 (3.4)	
Xbox	0 (0)	1 (1.1)	1 (1.0)	
Hours per week spent gaming				.47
≤10.0	12 (13.1)	16 (17.5)	28 (30.8)	
10.1-25.0	28 (30.7)	22 (24.1)	50 (55.0)	
25.1-40.0	5 (5.4)	2 (2.1)	7 (7.6)	
40.1-55.0	3 (3.2)	0 (0)	3 (3.2)	
≥55.1	1 (1.1)	2 (2.1)	3 (3.2)	
Gaming Addiction Scale score				.97
<63.0	34 (37.3)	29 (31.8)	63 (69.2)	
≥63.0	15 (16.4)	13 (14.2)	28 (30.7)	

The frequency of playing games was assessed for a typical working day in hours and then calculated for a 7-day week. In this study, more than half of the cases (50/91, 55.0%) spent 10-25 hours per week gaming, 28 (30.8%) cases spent less than 10 hours per week, and 6 (6.4%) cases spent more than 40 hours per week (Table 1). There was no significant difference observed in the internal assessment scores of those who played games for more hours than those who played for fewer hours (*P*=.13).

Mean scores among cases were 5.2% lower compared to the controls (mean score 48.7 vs 53.9, *P*=.01) in the first internal assessment and 4.1% lower (mean score 50.2 vs 54.3, *P*=.01) in the second internal assessment.

Male cases showed a significantly lower mean score of 9.5% on the first Internal assessment (*P*=.005) and 8.4% on the second internal assessment (*P*=.01) compared to male controls. Female cases observed 0.6% lower scores on both internal assessments than female controls (*P*=.89 and *P*=.59), as shown in Figure 2 and Table 2.

Figure 2. Comparison of mean internal assessment scores across various groups (n=91).

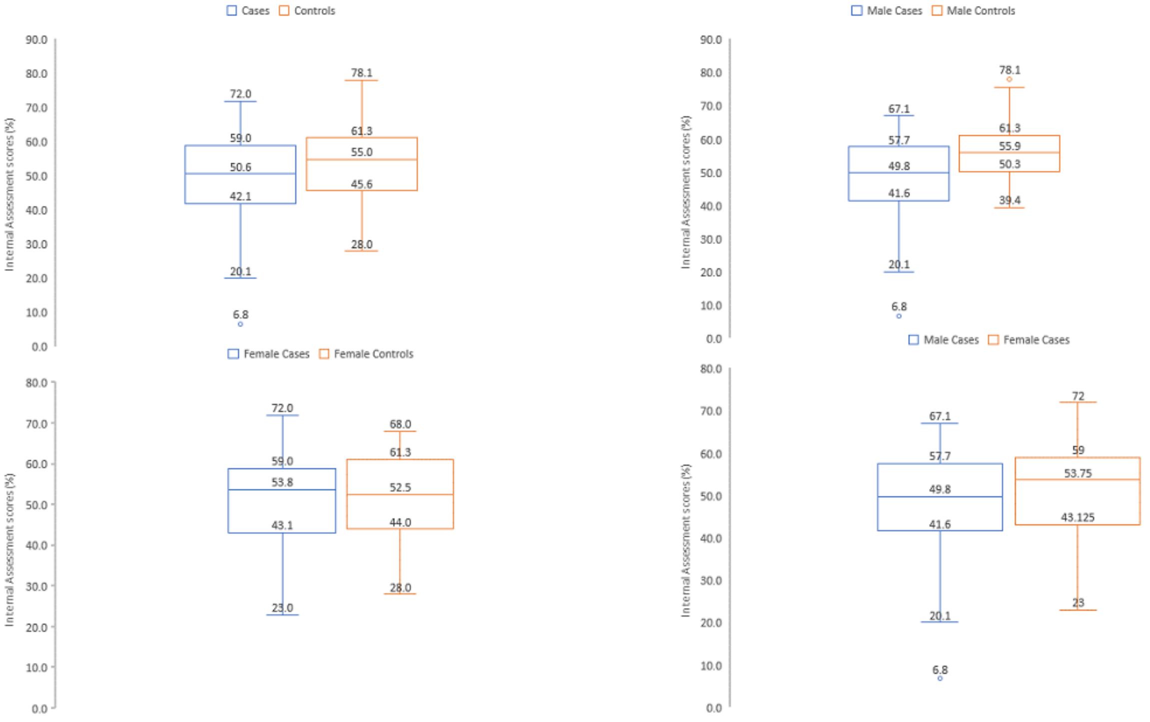


Table 2. Comparison of mean international assessment scores between various groups.

Group	First internal assessment scores		Second internal assessment scores	
	Mean (SD)	*P* value	Mean (SD)	*P* value
Group 1		.01[a]		.01[a]
Cases	48.7 (15.0)		50.2 (13.9)	
Controls	53.9 (12.1)		54.3 (11.5)	
Group 2		.05		.83
Male cases	45.6 (15.5)		50.2 (14.9)	
Female cases	50.1 (14.0)		50.2 (13.2)	
Group 3		.005[a]		.01[a]
Male cases	45.9 (13.6)		49.3 (14.7)	
Male controls	55.4 (12.1)		57.7 (10.6)	
Group 4		.89		.59
Female cases	52.2 (13.9)		50.8 (13.3)	
Female controls	52.8 (12.2)		51.4 (11.5)	

[a]Significant values.

The 7 items of the GAS were analyzed for the 91 cases. A salience score of ≥3 was observed in 30 (33%) participants, 24 (26.4%) had a tolerance score of ≥3, 34 (37.4%) had a mood modification score of ≥3, 20 (22%) had a relapse score of ≥3, 26 (28.6%) a withdrawal score of ≥3, 22 (24.2%) had a conflict score of ≥3, and 56 (61.5%) had a problem score of ≥3 (Multimedia Appendix 1).

Of the 448 students who were surveyed, 28 cases had a GAS score of ≥63. Thus, the prevalence of gaming disorder in this study was 6.3% among the study population and 31% (28/91) among cases.

There was a significant difference observed between mean GAS scores among male and female cases (males: mean 69.5, SD 6.4, n=13 vs females: mean 78.5, SD 9.2, n=15; *P*=.008). The GAS scores of female cases were 9 percentage points higher than male cases.

There was a negative correlation observed between the GAS and mean internal assessment scores for the cases (*r*=–0.02). Further, it was observed that the odds of scoring less than 50% were 1.9 (95% CI 1.04-3.44, *P*=.03) times more among cases than controls. A similar result was observed during the second internal assessment, where the odds of scoring less than 50%

were 1.8 (95% CI 0.97-3.36, P=.06) times higher among cases than controls.

Discussion

Principal Findings

To the best of our knowledge, this study is the first to use a case-control design to examine the association between gaming and scholastic performance in medical students. Since the availability of literature on internet gaming among medical students is sparse, it is difficult to draw meaningful comparisons.

This study observed that smartphones were the most commonly used gaming platform by medical students. The study observed no significant association between the frequency of gaming and internal assessment scores. Gamers (cases) showed a significantly lower score than nongamers (controls). Male gamers showed significantly lower scores compared to male nongamers, whereas the difference between scores of female gamers and nongamers was not statistically significant. The study found a negative correlation between GAS scores and internal assessment scores. Further, there was a higher risk of lower scores among those who played games compared to those who did not.

Time Spent Gaming and Internal Assessment Scores

There was no significant differences observed in the internal assessment scores and the number of hours spent gaming. This finding differs from a study by Ip et al [9], where frequent gamers (both males and females) scored less than nonfrequent gamers in examinations, with the average grades of nongamers being 9.4% higher than those of frequent gamers. A study conducted by Dumrique and Castillo [10] observed no significant relationships between the number of hours of playing and the social behavior of the respondents. The reason for this difference may be because they included assessments from the whole academic year, whereas we have included only assessments from the last 6 months. In addition, the scale of measurements differs between those studies and our study.

Internal Assessment Scores and Gaming Among Males and Females

In this study, the mean scores of the first and second midterms of those who played games were 5.2% and 4.1% lower than those who did not play games, respectively. Male nongamers had 9.5% and 8.4% higher scores than male gamers for the first and second assessments, respectively. This is somewhat similar to the finding of Ip et al [9], where the examination grades of infrequent male gamers were on average 7.2% higher compared to regular male gamers. In our study, we observed no significant difference in internal assessment scores between female gamers and female nongamers. We also observed that female gamers had higher internal assessment scores compared to male gamers despite having higher GAS scores. This indicates that although there is a greater incidence of gaming disorder among females, this is not associated with poor scholastic performance. This is similar to the findings of Ip et al [9] on gaming frequency and academic performance, where female students performed better than male students in all disciplines even though they were gaming. Contrary to our finding was Dumrique and Castillo's [10] observation that the academic performance of students was not affected even if they played online games. This difference is because their participants had better self-control, played games preferably during the weekends, and socialized more. This finding is useful in the context of gaming as a leisure activity that is not done in excess.

Prevalence of Gaming Disorder Using Various Scales

In this study, gaming addiction, as assessed by the GAS, was found to be prevalent in 6.2% of the study population and 31% of those who played games. The prevalence of gaming disorder using different scales in various prior studies ranged from 2.0% to 22.7% [8,11-23]. This variation may be due to differences in study populations and measurement scales used.

In terms of specific studies, Lemmens et al [8] found the prevalence of the gaming addiction to be 2.3% using the monothetic format and 9.3% using the polythetic format [8]. Mentzoni et al [24], who used the GAS, observed the prevalence of problematic users (score of ≥4 out of 7 on the GAS) to be 4.1%. Wang et al [21] in Hong Kong identified 15.6% of study participants as having a gaming addiction. In a study conducted in Germany by Festl et al [25], 3.7% of the respondents were considered to be problematic gamers.

Correlation of the GAS With Internal Assessment Scores

We found a negative correlation between GAS scores and mean internal assessment scores—greater gaming disorder scores were associated with lower internal assessment scores, emphasizing the fact that gaming negatively affects scholastic performance. A review by Mihara and Higuchi [26] showed that many studies reported lower grades and career attainment in students indulging in excessive gaming.

Our novel study quantifies the risk of poor scholastic scores associated with excessive gaming, with gamers at higher risk than nongamers (odds ratio 1.9, 95% CI 1.04-3.44). This finding is useful in the context of restricting gaming as a leisure activity than indulging in it excessively. This observation also helps in the early identification and treatment of students who are gaming excessively to prevent poor academic performance.

Limitations

The study comes with the inherent limitations of the case-control design. The retrospective nature of the study can be used to establish an association between gaming and scholastic performance, but cannot establish causation. Additionally, it should be noted that cases and controls were matched only for age and gender since matching for other potential confounders would have led to overmatching and fewer control participants. Further, the findings of this study pertain to a single educational setting, which could limit its generalizability.

Conclusion

We conclude that gaming adversely affects scholastic performance among male students compared to female students. Awareness needs to be created among medical students about the negative effects of gaming, which can have a detrimental effect on their scholastic performance. Students, parents, teachers, and institutions should be advised on the early detection of gaming disorder. Treatment services should be made available to those with gaming disorder in medical institutions. The study also opens new avenues for further exploration in different educational settings using a cohort study design to examine the long-term impact of gaming on the scholastic performance of students.

Conflicts of Interest

None declared.

Multimedia Appendix 1
Scoring of items using the Gaming Addiction Scale for cases.
[DOCX File , 18 KB - mededu_v7i3e22235_app1.docx]

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Abbreviations

GAS: Gaming Addiction Scale

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Original Paper

Digital Learning in Speech-Language Pathology, Phoniatrics, and Otolaryngology: Interdisciplinary and Exploratory Analysis of Content, Organizing Structures, and Formats

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Abstract

Background: The digital revolution is rapidly transforming health care and clinical teaching and learning. Relative to other medical fields, the interdisciplinary fields of speech-language pathology (SLP), phoniatrics, and otolaryngology have been slower to take up digital tools for therapeutic, teaching, and learning purposes—a process that was recently expedited by the COVID-19 pandemic. Although many current teaching and learning tools have restricted or institution-only access, there are many openly accessible tools that have gone largely unexplored. To find, use, and evaluate such resources, it is important to be familiar with the structures, concepts, and formats of existing digital tools.

Objective: This descriptive study aims to investigate digital learning tools and resources in SLP, phoniatrics, and otolaryngology. Differences in content, learning goals, and digital formats between academic-level learners and clinical-professional learners are explored.

Methods: A systematic search of generic and academic search engines (eg, Google and PubMed); the App Store; Google Play Store; and websites of established SLP, phoniatrics, and otolaryngology organizations was conducted. By using specific search terms and detailed inclusion and exclusion criteria, relevant digital resources were identified. These were organized and analyzed according to learner groups, content matter, learning goals and architectures, and digital formats.

Results: Within- and between-learner group differences among 125 identified tools were investigated. In terms of content, the largest proportion of tools for academic-level learners pertained to anatomy and physiology (60/214, 28%), and that for clinical-professional learners pertained to diagnostic evaluation (47/185, 25.4%). Between groups, the largest differences were observed for anatomy and physiology (academic-level learners: 60/86, 70%; clinical-professional learners: 26/86, 30%) and professional issues (8/28, 29% vs 20/28, 71%). With regard to learning goals, most tools for academic-level learners targeted the performance of procedural skills (50/98, 51%), and those for clinical-professional learners targeted receptive information acquisition (44/62, 71%). Academic-level learners had more tools for supporting higher-level learning goals than clinical-professional learners, specifically tools for performing procedural skills (50/66, 76% vs 16/66, 24%) and strategic skills (8/10, 80% vs 2/10, 20%). Visual formats (eg, pictures or diagrams) were dominant across both learner groups. The greatest between-group differences were observed for interactive formats (45/66, 68% vs 21/66, 32%).

Conclusions: This investigation provides initial insights into openly accessible tools across SLP, phoniatrics, and otolaryngology and their organizing structures. Digital tools in these fields addressed diverse content, although the tools for academic-level learners were greater in number, targeted higher-level learning goals, and had more interactive formats than those for clinical-professional learners. The crucial next steps include investigating the actual use of such tools in practice and students' and professionals' attitudes to better improve upon such tools and incorporate them into current and future learning milieus.

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KEYWORDS

digital learning; e-learning; speech-language pathology; phoniatrics; otolaryngology; communication disorders; mobile phone

Introduction

Background

The digital age has introduced tremendous changes and emerging opportunities in teaching and learning, especially in the health care environment. Buzzwords such as *eHealth, digital health*, mobile health (*mHealth*), *e-learning, digital learning*, and *m-learning* are increasingly enriching the medical language and have infused clinical teaching and practice with new vocabulary and concepts. The terms *eHealth* or *digital health* have often been used to refer to a broad spectrum of information communication technology applications in which information can be processed or exchanged electronically and can be used to support patient treatment and care; *mHealth* refers to these processes and apps on mobile devices such as tablets, smartphones, or smartwatches [1,2]. On the other hand, *e-learning* or *digital learning* are broad terms that can be used to describe a wide range of methods in which digital media, internet, and information and communication technologies are used for teaching and learning purposes to optimize knowledge creation and reproduction, interpersonal exchange, or collaborative work; the term *m-learning* thus refers to the implementation of these processes on mobile devices [3-6]. However, because of rapid changes in technology and didactic approaches, definitions often become obsolete faster than they can be created [7]. The emergence and continuous renewal of such concepts and digital possibilities not only demonstrate the enormous scope and potential for development of digital solutions but also highlight how the knowledge and skills required by current and future clinicians are gradually expanding to include technical skills.

Given the (1) increasing number of portable devices and technologies, (2) increasing accessibility to information, and (3) new generations of learners who process information in a manner that is different from prior generations, "...the issue is not whether we adopt these new technologies but whether we make the most of the opportunities they provide" [8]. Moreover, given the growing aging population and well-reported shortage of health care workers worldwide, digital solutions offer potential avenues for increasing equitable health care accessibility [9-13]. Digital skills will likely become a prerequisite for future health professionals, who will play a major role in educating patients on digital health literacy and optimizing digital patient-centered care [14,15]. It is recognized worldwide that current and future health professionals must be equipped for learning and medical practice in an increasingly digitalized health care system [16,17]. In essence, "[w]e have to prepare students for jobs that have not yet been created, technologies that have not yet been invented and problems that we don't yet know will arise" [18]. Such a sentiment is especially relevant in light of the COVID-19 pandemic, which has pushed the discussion of digital learning and digital health care solutions and alternatives to the forefront [19-23].

In the interdisciplinary fields of speech-language pathology (SLP), phoniatrics, and otolaryngology, digital possibilities offer great potential. Professionals in these fields collaboratively treat disorders and disabilities affecting speech, language, voice, hearing, and the ability to communicate. The importance and benefit of interdisciplinary education within these fields cannot be understated; in fact, interdisciplinary education will play a significant role in *future-proofing* health professional curricula moving forward [24-27]. Moreover, digital tools can contribute to enhancing such collaborative opportunities and are already beginning to engage other, traditionally more technical fields (eg, informatics and engineering) [25,28]. Given the World Health Organization's estimate of over one billion people worldwide living with a disability that often affects their functional communication, it is crucial that current and future professionals in these fields are well prepared to advance their knowledge, skills, and coordinated patient care through new digital solutions [29]. Thus, it can be useful to investigate current digital resources collectively across these fields.

Literature has shown that research and outcomes for digital solutions in these fields are only just beginning to emerge relative to other medical fields [30,31]. That is not to say, however, that tools and applications do not already exist. Augmentative and alternative communication devices (eg, speech-generating tablets) and mathematical-linguistic language modeling are just some examples of digital support technologies that are already well established in the field [32,33]. There is also an increasing number of emerging digital applications to assist with diagnostic evaluations and therapeutic exercises; however, knowledge of these tools and their quality appears to be uncertain [34,35]. Given that students and professionals who treat communication disorders have overall reported positive attitudes toward eHealth and a desire for more digital learning opportunities, it is crucial that digital tools are more critically assessed and deliberately integrated into clinical education and professional development [35-37]. To begin this process, it can be helpful to first investigate existing digital e-learning tools. Although it currently appears that many digital learning tools are institution-specific or have restricted access, there is a notable plethora of digital learning resources relevant to the abovementioned interdisciplinary fields with easier accessibility or freely available. These have largely been unexplored in the literature and have yet to be assessed for quality. However, the current range of digital tools is broad and heterogeneous, making it difficult to fully comprehend their purpose or use [37,38].

Objectives

To effectively find, use, evaluate, and incorporate such resources and tools into learning and teaching scenarios, it is important to be familiar with the structures, concepts, and formats of existing digital learning resources. This study seeks to (1) investigate the current scope of digital tools and resources with free or good accessibility across the interdisciplinary fields of SLP, phoniatrics, and otolaryngology and (2) specifically explore potential differences between resources available for academic-level learners versus clinical-professional learners in terms of content, learning goal, or format. Importantly, this initial study does not aim to investigate the quality of the tools, although this is a necessary next step. It is worth mentioning that given the fast-paced nature of technological development, the number and scope of digital tools and resources at any given time are changing. This investigation was based on a search conducted and updated in the autumn of 2020.

Methods

Electronic Search and Inclusion and Exclusion Criteria

A systematic search of Google; Google Scholar; EbscoHost (including PubMed and Medline); Livivo; the App Store, Google Play Store; and established SLP, phoniatrics, and otolaryngology foundation websites was conducted. The foundations and regulating bodies whose websites were searched included the American Speech-Language-Hearing Association, Union of the European Phoniatricians, the International Federation of Oto-Rhino-Laryngological Societies, the European Federation of Oto-Rhino-Laryngology Societies, and the American Academy of Otolaryngology-Head and Neck Surgery. The keywords used were *e-learning* OR *digital learning* AND either *speech pathology*, *speech-language pathology*, *phoniatrics*, *ENT medicine*, and *otolaryngology*.

Inclusion criteria included were as follows:

- The presented information should be relevant for students and professionals in the interdisciplinary fields of SLP, phoniatrics, and otolaryngology.
- The resource should either be openly accessible or have good accessibility (eg, could require account creation but no institution-specific restricted access).
- There is evidence of clinician or physician involvement in resource development.
- The resource should be in the English or German language.

Exclusion criteria included tools or resources used solely for clinical purposes (eg, therapy apps) or specifically for patient use and blogs. Although there is evidence that professional blogs serve as a significant source of information and exchange for practicing professionals and even students, it was not within the scope of this study to identify the full range of professional blogs [39].

Organizing Structures

Overview

To construct a more comprehensible organization for a broad range of available resources, digital tools were specifically analyzed according to (1) learner groups, (2) content areas, (3) learning goals and architectures, and (4) formats.

These organizing structures have commonly been referred to in multimedia learning theories and their applications in other fields [40-43]. Each of these organizing structures is defined in more detail.

Learner Groups

In health professional education, there are several ways to differentiate among learner groups. These include, among others, distinctions between preclinical and clinical learners, trainees and attendees, academic introductory and advanced learners, or student clinicians and working professionals [44-46]. These distinctions can vary depending on the specific institution, context, profession, or educational system in a country. With these differences in mind, for the purposes of this study, we have broadly differentiated between the following learner groups, as described below.

Academic-Level Learners

This includes those who have introductory and advanced theoretical knowledge with initial clinical experience. Digital resources and tools were allocated to the academic-level learner group when content consisted of introductory information (eg, basic introductions to anatomy and physiology, pathologies, or treatment approaches) or when the content of the resource was explicitly referred to as appropriate for academic-level learners.

Clinical-Professional Learners

This includes residents, clinical fellows, and working professionals whose focus is on the clinical integration of knowledge and skills. Residents, clinical fellows, and working professionals were also deliberately grouped together because they shared many overlapping digital resources. Resources and tools that addressed the advanced integration of diagnostic or treatment strategies or that explicitly identified the content as appropriate for clinical fellows, residents, or professionals were allocated to the clinical-professional learner group.

This study also aims to investigate whether there were differences in digital tools and resources available between these two broad learner groups in terms of content, learning goals, and formats.

Content Areas

For the following investigation, digital tools, and resources were grouped into the following broad categories, as these were the observed prominent reoccurring content areas, which are also common to all the interdisciplinary fields involved with communication disorders: anatomy and physiology, diagnostic evaluation, pathology, treatment, professional issues, and other (eg, networking).

Learning Goals and Architectures

According to the cognitive theory of multimedia learning by Mayer [47], e-learning goals can be primarily divided into *inform* versus *perform* goals. *Informing* goals focus on the transmission of information and may not specify any expectations for the acquisition of new skills, whereas goals focused on *performing* do specify new skills to be attained and can be further divided into performing *procedural tasks* and *strategic tasks*. Procedural tasks encourage response strengthening and thus promote near transfer, whereas strategic tasks encourage knowledge instruction, which promotes the far transfer and, ideally, the application of knowledge to other contexts [40]. These learning goals are closely aligned with e-learning architectures, which include *receptive*, *directive*, and *guided discovery*. These architectures provide a broad framework for understanding the nature and purpose of learning interactions. Specifically, *inform* learning goals are *receptive* (low behavioral engagement), the learning goal of *performing procedural skills* is *directive* (medium behavioral engagement), and the learning goal of *performing strategic skills* promotes *guided discovery* (high behavioral engagement).

Formats

Content formats of digital learning resources and tools refer to the specific configuration by which information is displayed. Content formats can vary according to sensory modality, level of interaction, level of virtuality, level of mediality, and flexibility of synchronous or asynchronous use [48]. These dimensions are not always clearly defined, as they can also be affected by the specific way in which a digital tool or resource is implemented or used for learning purposes (eg, a simulation could be used synchronously or asynchronously or may have varying levels of interactivity depending on the specific exercise performed or the learning goal targeted). For the purposes of this study, formats have been organized into (1) verbal, (2) visual, and (3) interactive presentation forms, as suggested by Arnold et al [41]. Verbal formats include audio- and text-based information or activities such as websites, e-books, or podcasts. Examples of visual formats include static pictures or diagrams, videos, 3D models or manipulatives, portals, or apps that integrate multiple verbal or visual formats. Examples of interactive formats include simulations, social networking channels, web-based courses, serious games, 3D worlds, or dynamic apps that include interactive elements. Notably, the distinctions among these categories are somewhat fluid and overlapping (eg, a website could have visual and verbal elements and even contain interactive case scenarios). Although it is not within the scope of this investigation to review all existing digital formats, relevant formats for the digital tools and resources identified in this study are discussed in greater depth in the *Results* and *Discussion* section.

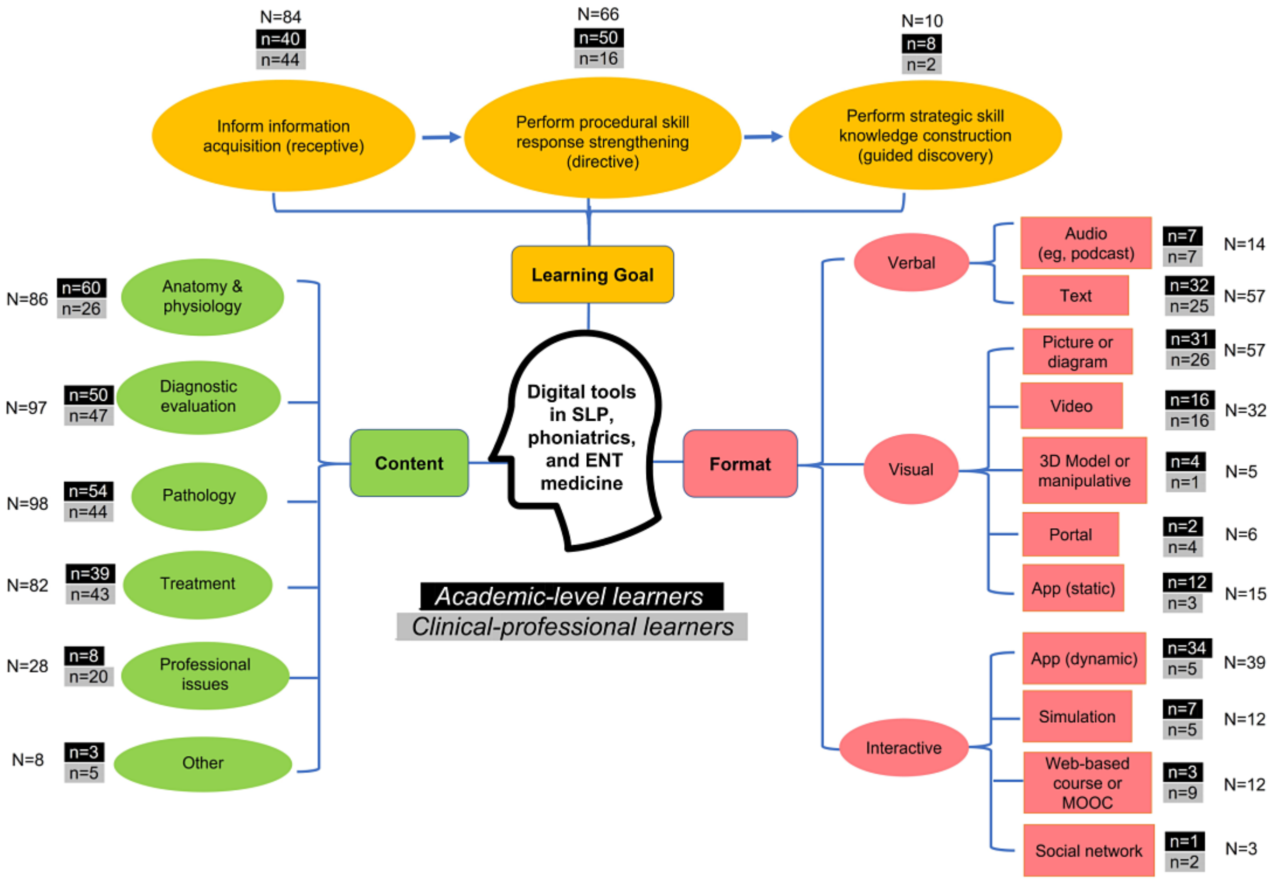
Systematic searches and subsequent analyses were performed by 2 authors, a certified speech-language pathologist (YL) and qualified phoniatrician and otorhinolaryngologist (CNR), both of whom have experience in clinical practice, teaching, and research. It is important to note that internet search results can change depending on a user's browser type, cookie settings, search history, exact location, time, and more [49]. Thus, searches were conducted in the incognito mode on two institution-owned computers. Tools with relevant references underwent two additional iterative searches. The authors independently screened and analyzed the tools, and any disagreements in the analysis among categories were resolved through discussion.

Results

Overview

A total of 125 digital tools and resources that met all the inclusion and exclusion criteria were identified. These are listed in Multimedia Appendix 1. Of these tools, 78.4% (98/125) were appropriate for academic-level learners (introductory and advanced theoretical knowledge with minimal clinical experience) and 49.6% (62/125) were appropriate for clinical-professional learners (eg, residents, clinical fellows, and working professionals), with a 28.8% (35/125) overlap between the two groups. Upon categorizing each of the three components analyzed (ie, content, learning goal, and format), there were often tools with overlapping categories (eg, a digital resource could contain multiple content areas or multiple formats). These overlaps were included in the frequency counts during data analysis to reflect the appropriate proportion of tools specifically fulfilling the indicated category. The full distribution of tools denoted by frequencies (eg, number of tools) and organized according to content, learning goal, and formats is shown in Figure 1.

Figure 1. Summary of digital tools and resources organized according to the learner group, content, learning goal, and format. ENT: ear, nose, throat; MOOC: massive online open course; SLP: speech-language pathology or pathologist.



Content

Overview

Content was broadly divided into the topics of anatomy and physiology, diagnostic evaluation, pathology, treatment, professional issues, and other (eg, networking). Across the 399 total frequency counts for content areas including overlaps, 24.6% (98/399) pertained to pathology, 24.3% (97/399) to diagnostic evaluation, 21.6% (86/399) to anatomy and physiology, and 20.5% (82/399) to treatment. Professional issues and other subjects comprised 7% (28/399) and 2% (8/399) of the total resources, respectively.

Within-Group Differences

The distribution of tools within each learner group is represented as a frequency count, followed by percentages of the total number of tools and resources for that specific learner group. Most tools for academic-level learners consisted of content pertaining to anatomy and physiology (60/214, 28%), pathology (54/214, 25.3%), diagnostic evaluation (50/214, 23.4%), and treatment (39/214, 18.2%). Tools pertaining to professional issues and other subjects (eg, networking) were far fewer in number. Tools and resources for the clinical-professional learner group mostly fell within the content categories of diagnostic evaluation (47/185, 25.4%), pathology (44/185, 23.7%), and treatment (43/185, 23.3%). These data and further details are summarized in Table 1.

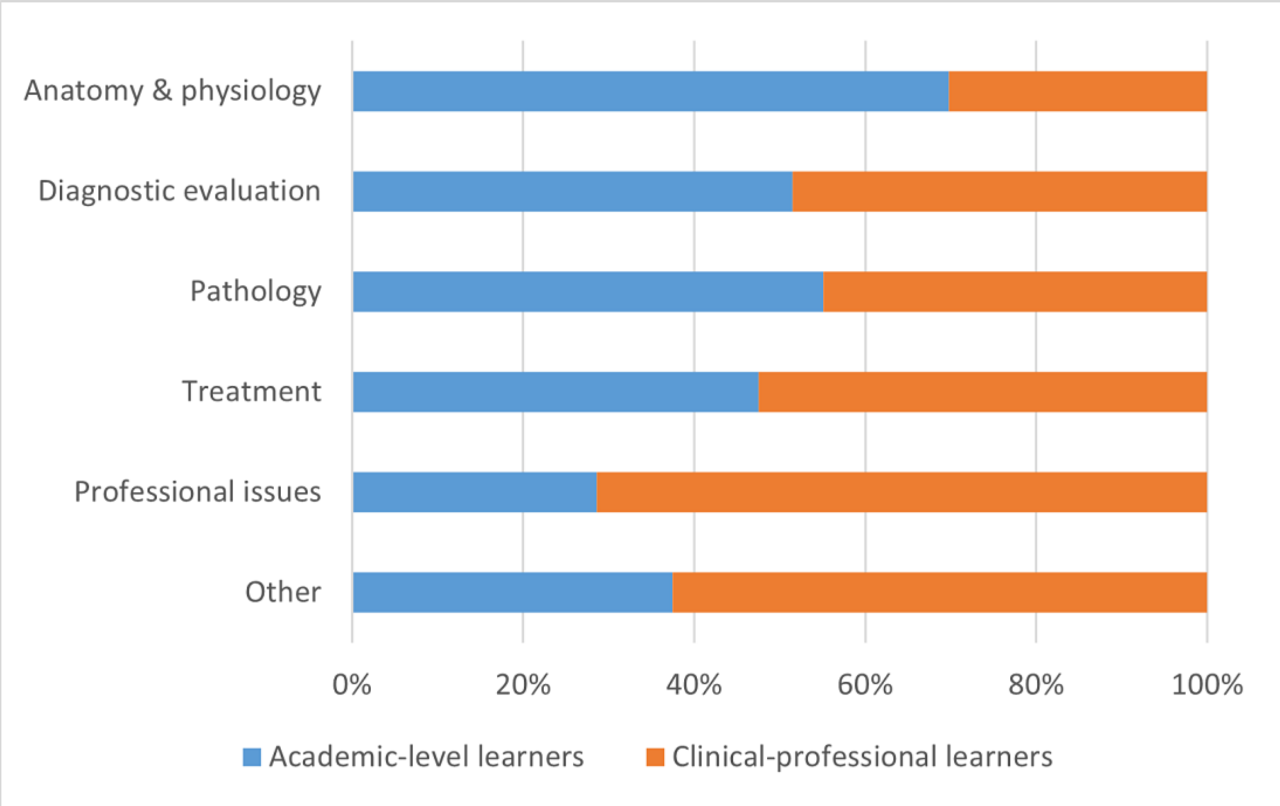
Table 1. Distribution of digital tools within each learner group according to content.

Content category	Academic-level learners (n=214), n (%)	Clinical-professional learners (n=185), n (%)
Anatomy and physiology	60 (28)	26 (14.1)
Diagnostic evaluation	50 (23.4)	47 (25.4)
Pathology	54 (25.3)	44 (23.7)
Treatment	39 (18.2)	43 (23.3)
Professional issues	8 (3.7)	20 (10.8)
Other	3 (1.4)	5 (2.7)

Between-Group Differences

The distribution of tools between academic-level learners and clinical-professional learners is presented as frequency counts and percentages of the total number of tools and resources for a specific content category. Data are always presented as academic-level learners versus clinical-professional learners. Some of the largest differences in terms of digital tools and resources between academic-level learners and clinical-professional learners were observed for the content areas of (1) anatomy and physiology, where academic-level learners had a greater proportion of resources (60/86, 70% vs 26/86, 30%) and (2) professional issues (8/28, 29% vs 20/28, 71%) and (3) other resources such as networking sites (3/8, 37% vs 5/8, 63%). There was a relatively similar number of tools for diagnostic evaluation between the 2 learner groups (50/97, 51% vs 47/97, 49%), slightly more tools relating to pathology for academic-level learners (54/98, 55% vs 44/98, 45%), and slightly fewer tools for them that related to treatment (39/82, 48% vs 43/82, 52%). These data are graphically summarized in Figure 2.

Figure 2. Digital tools available between learner groups according to content.



Learning Goal

Overview

Learning goals were differentiated among those with a (1) *inform* through information acquisition focus and *receptive* learning architecture, (2) to *perform* procedural skills focus and *directive* architecture, and (3) those with a *perform* strategic skills focus and *guided discovery* architecture. Furthermore, 52.5% (84/160) of tools had the learning goal of *receptive* information acquisition; 41.2% (66/160) had the learning goal of performance of procedural skills, a more *directive* learning architecture. Only 6.3% (10/160) of tools supported the highest-level learning goal of performance of strategic skill, which would encourage *guided discovery*.

Within-Group Differences

Approximately half of the digital tools and resources for academic-level learners (50/98, 51%) had the learning goal of performing a procedural skill and thus had a more *directive* learning architecture. A large proportion of the digital resources and tools for the academic-level–learner group (40/98, 41%) also had the learning goal of receptive information acquisition, and only a few targeted the learning goal of performing a strategic skill through the learning architecture of *guided discovery*.

Most tools and resources for clinical-professional learners served the purpose of information acquisition through *receptive* learning architectures (44/62, 71%). A large proportion of tools (16/62, 26%) aimed to perform procedural skills through a *directive* architecture, and very few tools aimed to perform strategic skills through the process of *guided discovery*. These data and details are summarized in Table 2.

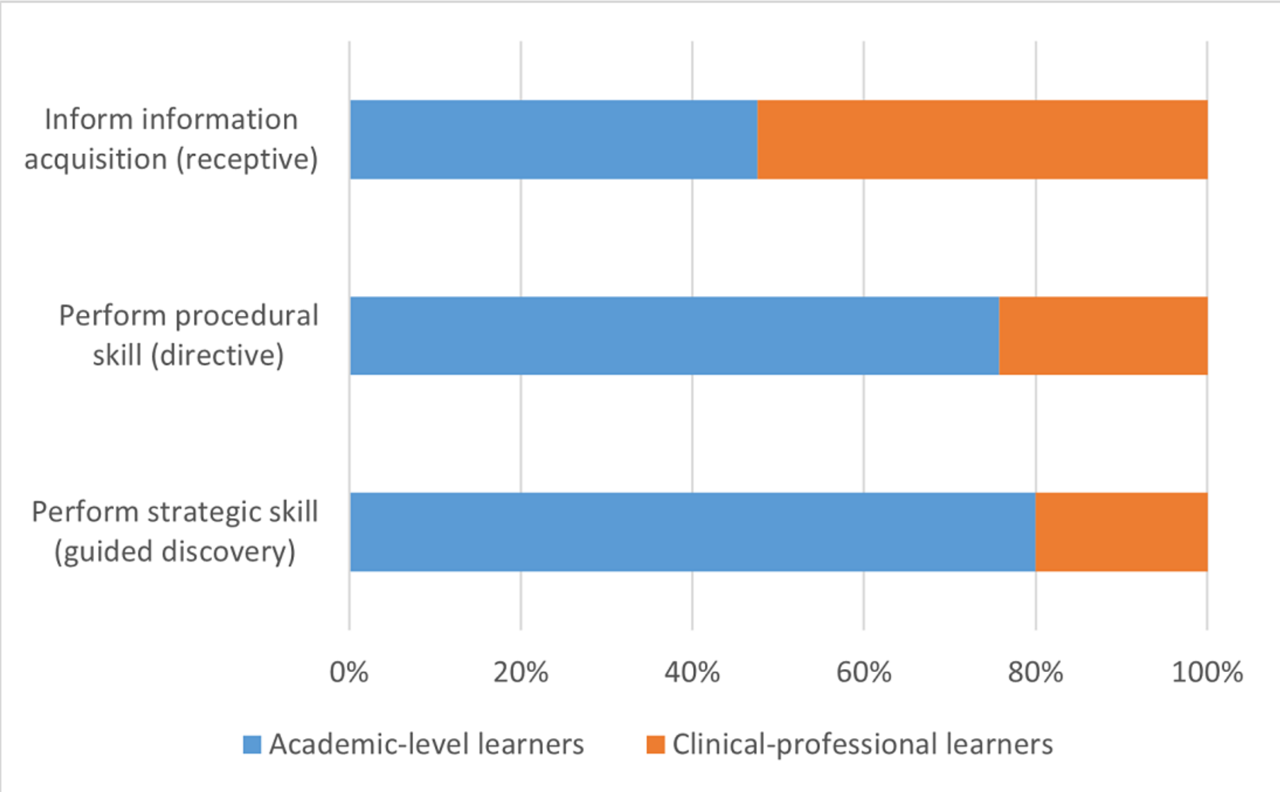
Table 2. Distribution of digital tools within each learner group according to learning goals.

Learning goal	Academic-level learners (n=98), n (%)	Clinical-professional learners (n=62), n (%)
Inform (information acquisition), receptive	50 (41)	44 (71)
Perform (procedural skill), directive	40 (51)	16 (26)
Perform (strategic skills), guided discovery	8 (8)	2 (3)

Between-Group Differences

The distribution of tools between academic-level learners and clinical-professional learners is presented as frequency counts and percentages of the total number of tools and resources for a specific learning goal type. Data are always presented as academic-level learners versus clinical-professional learners. It appears that as the learning goal becomes more advanced, that is from informing through *receptive* information acquisition to performing a strategic skill for *guided discovery*, we observed greater differences in the proportions of tools between academic-level learners and clinical-professional learners. Although it appears that there is a relatively close number of digital tools and resources for both learner groups that support the informing learning goal (40/84, 48% vs 44/84, 52%), academic-level learners have a much greater proportion of the tools that support performing a procedural skill (50/66, 76% vs 16/66, 24%) and those that support performing a strategic skill (8/10, 80% vs 2/10, 20%) than their clinical-professional counterparts. These data are graphically summarized in Figure 3.

Figure 3. Digital tools available between learner groups according to learning goals.

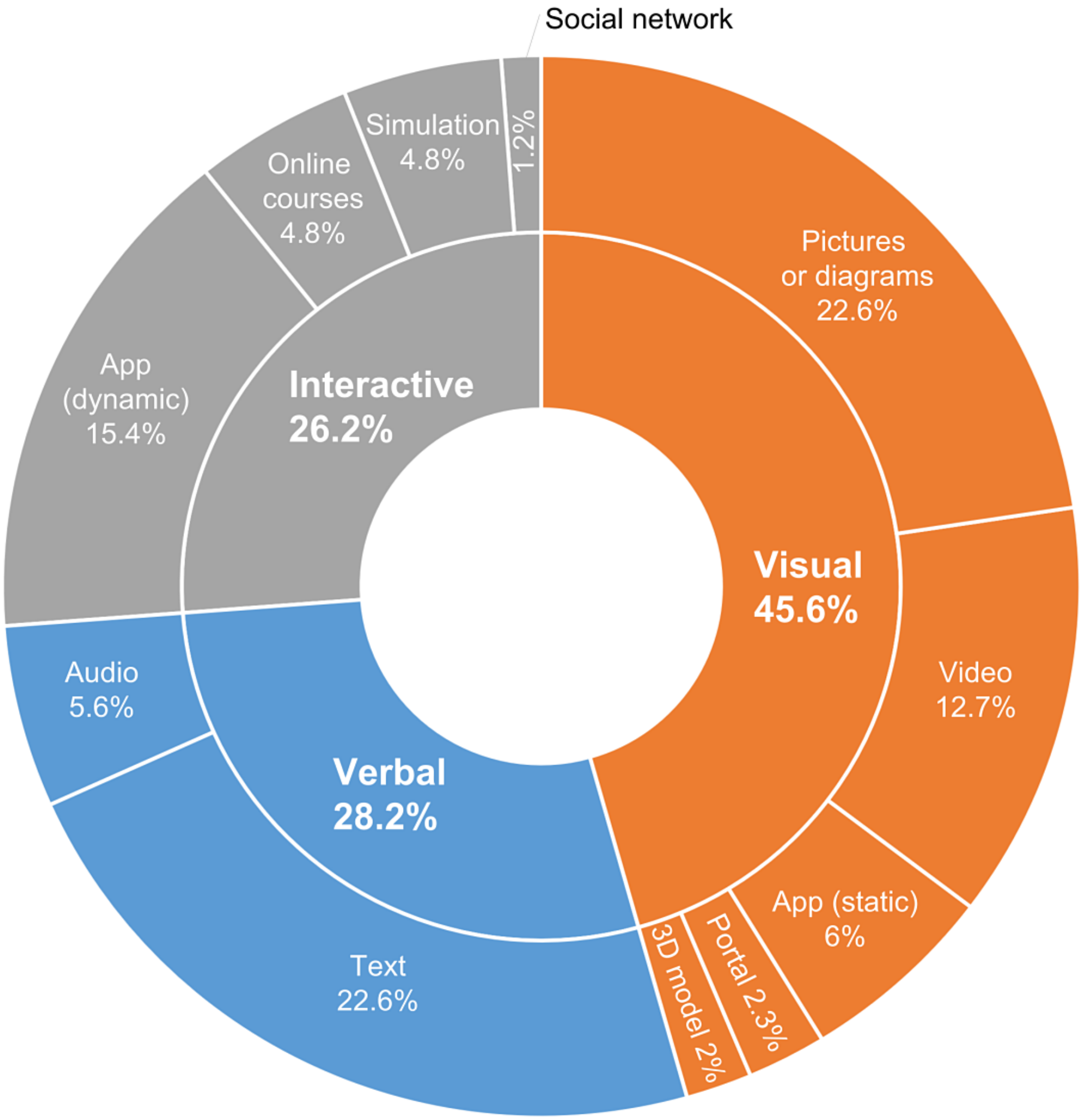


Format

Overview

Digital tools and resources were broadly divided into verbal, visual, and interactive formats. These were further subdivided on the basis of specific format types (eg, video, 3D model, and simulation). Only the formats that were present in the range of the investigated tools and resources were included in the study. There are certainly numerous other existing formats (eg, serious games, and 3D worlds) that were not represented in the sample as they—to the best of our knowledge—do not yet exist or are not yet readily available for the fields of SLP, phoniatrics, or otolaryngology. Overall, a large majority of digital tools were visual in nature (115/252, 45.6%), followed by verbal (71/252, 28.2%), and interactive (66/252, 26.2%). When each of these components was separated further, it was observed that large and equal proportions of the digital tools consisted of pictures or diagrams (57/252, 22.6%) and text (57/252, 22.6%). There were also a notable portion of dynamic apps (39/252, 15.4%) and videos (32/252, 12.7%). The distribution of the different formats and further details are shown in Figure 4.

Figure 4. Summary of the distribution of digital tools according to format types.



Within-Group Differences

Visual formats comprised the largest proportion of formats overall for academic-level learners, with a large proportion of pictures or diagrams (31/149, 20.8%), followed by videos (16/149, 10.7%). The next largest subgroup of formats consisted of interactive formats. Notably, this subgroup predominantly consisted of dynamic apps. Simulations, web-based courses or massive online open courses (MOOCs), and social networks only comprised 7.4% (11/149) of the total frequency count altogether. Here, it is useful to briefly mention that apps were deliberately separated into *static* and *dynamic* apps. Static apps were defined as apps that involved minimal interaction (eg, simple text and visuals in an app form with little to no animation or clickable interactive elements), whereas dynamic apps involved a higher level of virtuality and interaction (eg, animations, virtuality, and more integrated multimedia). In terms of verbal formats for academic-level learners, the majority of the digital tools were text-based (32/149, 21.5%).

For clinical-professional learners, visual formats comprised the largest proportion of the digital resources and tools collected. A quarter of the total number of tools consisted of pictures or diagrams (26/103, 25.2%), followed by a notable proportion of videos (16/103, 15.5%). Other visual formats comprised 7.8% (8/103) of all the tools together. Verbal formats comprised the second largest group of formats, with most being text-based (25/103, 24.3%) and few consisting of audio formats. Finally, interactive formats comprised the smallest proportion of tools and resources for clinical-professional learners. Web-based courses or MOOCs (often used for continuing education credits) accounted for 8.7% (9/103) of tools, followed by equal proportions of dynamic apps and simulations (both 5/103, 4.9%). The data and further details are summarized in Table 3.

Table 3. Distribution of digital tools within each learner group according to formats.

Format	Academic-level learners (n=149), n (%)	Clinical-professional learners (n=103), n (%)
Verbal		
Audio (eg, podcast)	7 (4.7)	7 (6.8)
Text	32 (21.5)	25 (24.3)
Visual		
Pictures or diagrams	31 (20.8)	26 (25.2)
Video	16 (10.7)	16 (15.5)
3D model or manipulative	4 (2.7)	1 (1)
Portal	2 (1.3)	4 (3.9)
App (static)	12 (8.1)	3 (2.9)
Interactive		
App (dynamic)	34 (22.8)	5 (4.9)
Simulation	7 (4.7)	5 (4.9)
Web-based course or MOOC[a]	3 (2)	9 (8.7)
Social network	1 (0.7)	2 (1.9)

[a]MOOC: massive online open course.

Between-Group Differences

The distribution of tools between academic-level learners and clinical-professional learners is represented as frequency counts and percentages of the total number of tools and resources for a specific format type. Data are always presented as academic-level learners first versus clinical-professional learners second. Among the subordinate categories of verbal, visual, and interactive formats, academic-level learners had only slightly more verbal (39/71, 55% vs 32/71, 45%) and visual formats (65/115, 57% vs 50/115, 43%) than clinical-professional learners, although this proportional difference was much more pronounced with interactive formats (45/66, 68% vs 21/66, 32%). Within the subcategory of verbal formats, there was an equal proportion of audio formats across both academic-level and clinical-professional learners (7/14, 50% vs 7/14, 50%) and slightly more text formats for academic-level learners than for clinical-professional learners (32/57, 56% vs 25/57, 44%). Within the subcategory of visual formats, the greatest differences between the 2 learner groups were noted for 3D models (4/5, 80% vs 1/5, 20%) or manipulatives and for static apps (12/15, 80% vs 3/15, 20%). Academic-level learners had fewer tools and resources in a portal (2/6, 33% vs 4/6, 67%), slightly more tools in picture or diagram formats (31/57, 54% vs 26/57, 46%), and the same proportion of video formats (16/32, 50% vs 16/32, 50%) than their clinical-professional learner counterparts. Within the subcategory of interactive formats, the greatest difference was observed in the proportion of dynamic app formats (34/39, 87% vs 5/39, 13%), although a notable difference was also seen in web-based courses or MOOCs (3/12, 25% vs 9/12, 75%) and social networks (1/3, 33% vs 2/3, 67%), for which there were more resources for the clinical-professional learner group. Finally, academic-level learners had a slightly greater proportion of digital tools with simulation formats than their clinical-professional learner counterparts (7/12, 58% vs 5/12, 42%). These data are graphically summarized in Figure 5. Figure 6, Figure 7, and Figure 8 depict the verbal, visual, and interactive tools between the 2 learner groups, respectively.

Figure 5. Digital tools available between learner groups according to format types.

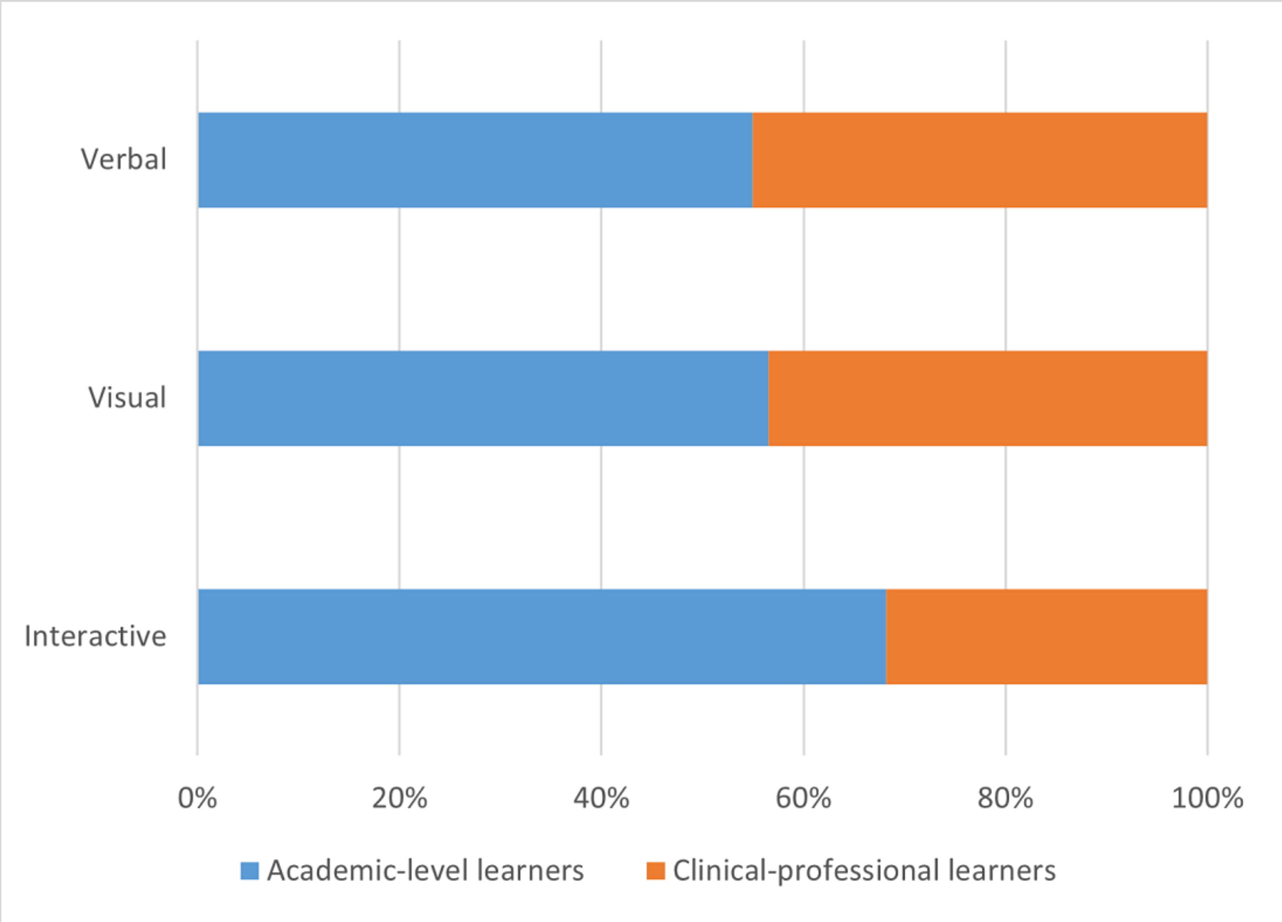


Figure 6. Digital tools available between learner groups in verbal formats.

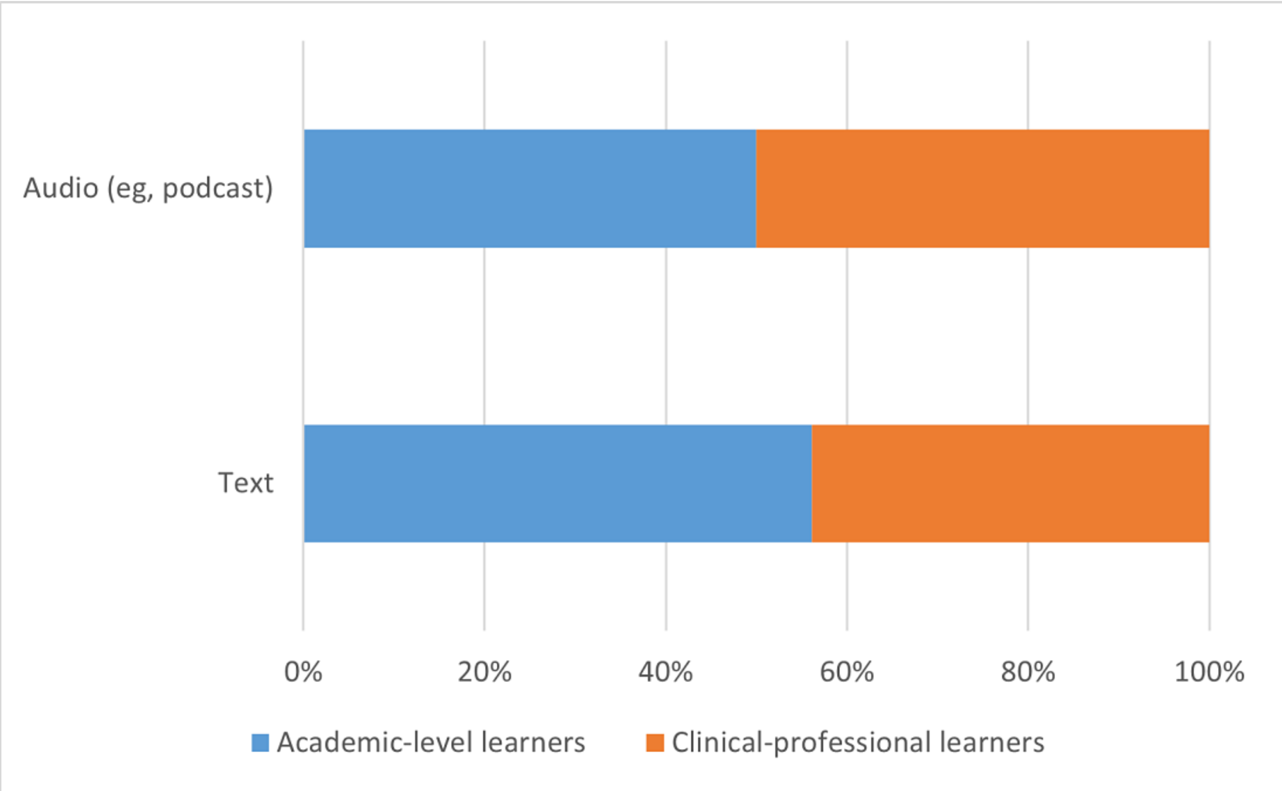


Figure 7. Digital tools available between learner groups in visual formats.

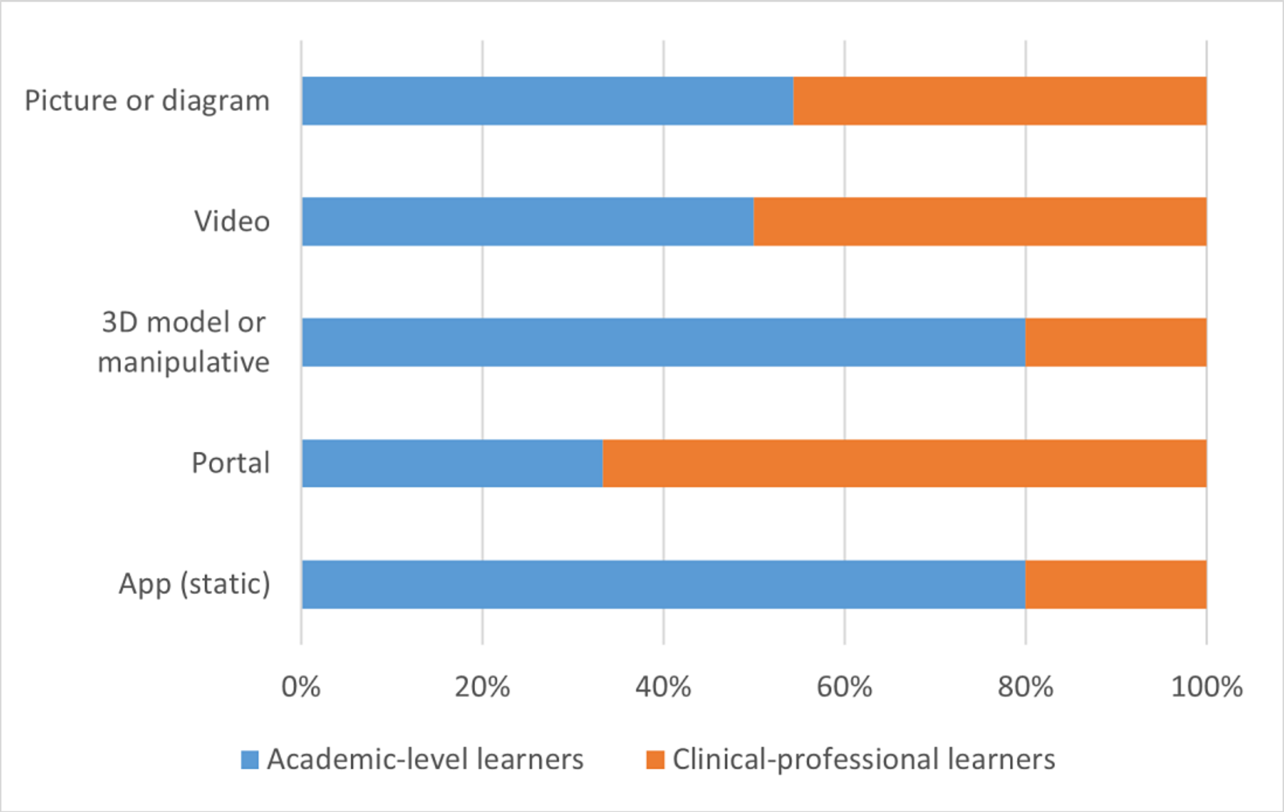
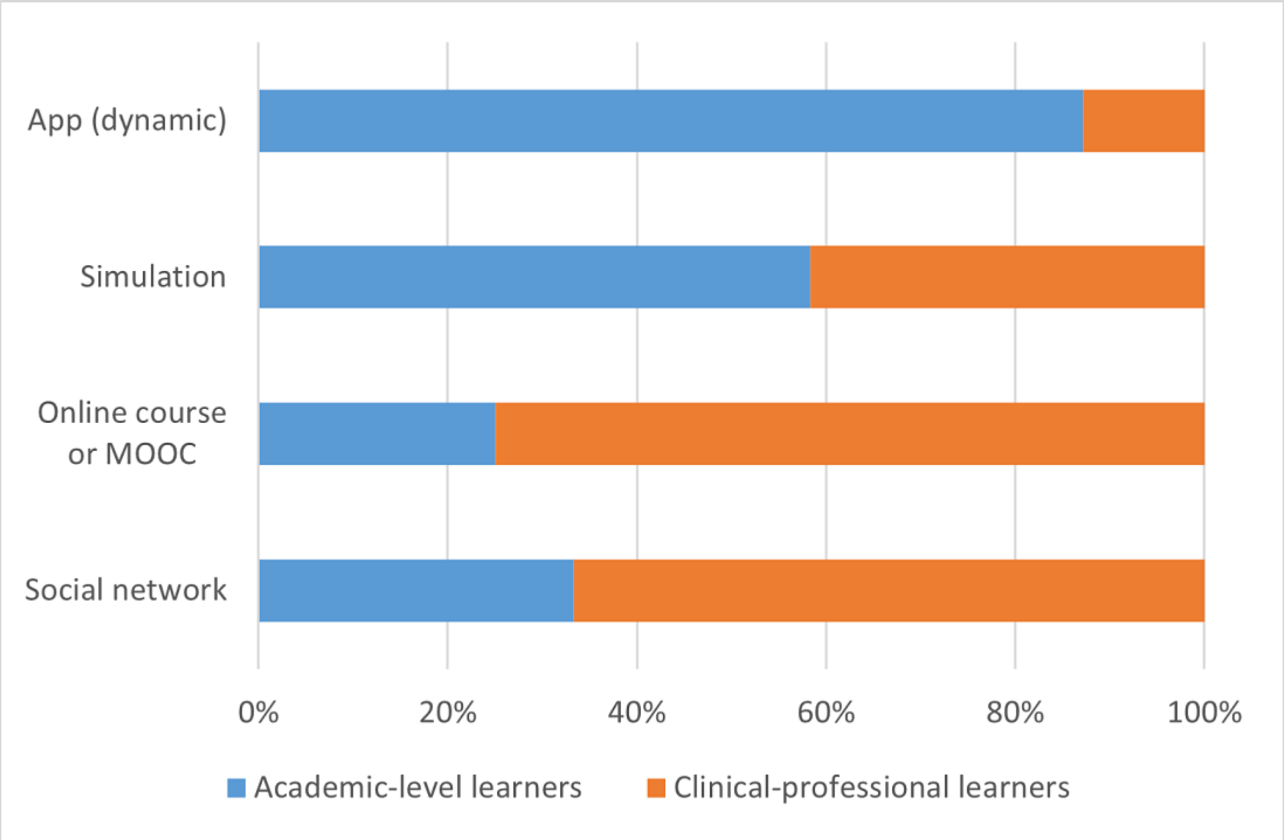


Figure 8. Digital tools available between learner groups in interactive formats. MOOC: massive online open course.



Discussion

Principal Findings

To the best of our knowledge, this is the first study to investigate openly accessible tools within the interdisciplinary context of SLP, phoniatrics, and otolaryngology. Although it appears that significant literature is focused on the implementation of e-learning or digital learning solutions at specific institutions, it is also crucial to analyze tools with greater public accessibility, as despite their growing number and range, their quality remains unassessed and are nevertheless sources of learning and teaching that are also being used.

This initial investigation of tools revealed that overall, there appears to be a greater number of tools and resources for academic-level learners than for clinical-professional learners, although there was also a considerable amount of overlap between them (n=35). These tools contained wide-ranging subject matter, targeted different learning goals, and were presented in various digital formats. Below, the implications of the results for each of these aspects are explored in greater depth.

Content

Overall, between the 2 learner groups, content categories appeared to primarily focus on the topics of pathology, diagnostic evaluation, anatomy and physiology as well as treatment. As these primary subjects comprise the bulk of necessary clinical knowledge, for which there are frequently new findings and developing research, this is not particularly surprising. The smallest proportion of digital tools and resources were dedicated to *other* content, namely those focused on field-specific networking sites or exchange sites. Given the predominance of large networking channels such as Facebook, Twitter, Instagram, and professional blogs, it could be that these *other* resources simply are not as commonly used. Interestingly, when looking within each learner group, the subject with the greatest percentage of tools for academic-level learners was focused on anatomy and physiology. This makes sense as these learners are still developing foundational conceptual knowledge to understand how pathologies affect these anatomical structures and their normal functioning. On the other hand, for the clinical-professional learner group, the largest percentage of tools was focused on diagnostic evaluation. Given that there is constantly new research emerging regarding new diagnostic measures, pathologies, and their treatment strategies, these results are not surprising. Between the two learner groups, we observed that the number of tools focused on anatomy and physiology is notably smaller for the clinical-professional learner group, whereas the number of tools for professional issues is greater. This makes sense given that clinical-professional learners should already be familiar with such foundational concepts of anatomy and physiology and must navigate professional issues such as interdisciplinary exchange or work effectiveness on a day-to-day basis. However, the dearth of tools and resources for academic-level learners regarding professional issues may highlight an area that needs to be bolstered in communication sciences and disorders education; in fact, studies have shown that students often arrive at their clinical placements unprepared for the combination of clinical and professional responsibilities that comprise their day-to-day work [50-53]. Therefore, a greater incorporation of digital tools and resources or curricular content addressing these professional issues for the academic-level learners would be beneficial in the future.

Learning Goals

Across all the digital tools and resources analyzed, the number of tools decreased as a function of increasing level of learning goals. In other words, the higher the learning goal (eg, performing a strategic task through the process of guided discovery), the fewer tools or resources were available to support that goal. When analyzing within each of the learner groups individually, however, the academic-level learner group appeared to have more tools that supported the second-level learning goal of performing a procedural skill, followed by tasks focused on information acquisition and the performance of strategic skills. This aligns with the idea that learners at this level typically need to establish procedural skills (eg, learning how to administer a diagnostic assessment or how to score it) before they can be expected to apply these skills fluently and flexibly to multiple contexts or different patients. They benefit from highly structured, paced, and predefined frameworks within which practical skills can be explored [41]. The large number of tools and resources targeting the learning goal of information acquisition, although more receptive in nature, are useful for introductory learners with low content knowledge; these materials have been demonstrated to be effective in helping learners to link new knowledge with prior knowledge and thus may make new information more concrete, easier to integrate, and comprehend [54,55]. However, given that the ultimate goal of learning is to encourage greater guided discovery and train future professionals in more active, personal sense-making and critical thinking processes, it is discouraging to see that there are only a few digital tools and resources that target this learning goal. This learning goal is characterized by higher levels of learner interaction and lower levels of direct instruction; to become effective, independent health professionals, students need to become more independent self-guided learners [56].

Within the clinical-professional learner group, the trend of decreasing number of digital tools and resources as a function of increasing learning goal level was stark. There was a predominance of tools with the learning goal of receptive information acquisition, many of which consisted of continuing education opportunities. Although this is not particularly surprising, given the fact that clinical professionals are expected to have already attained a certain level of competency and often have limited time to attend such continuing education opportunities, it is nonetheless problematic that many tools only target these more *surface*-level learning goals; after all, performance of strategic skills through a guided discovery learning architecture is typically most beneficial for advanced learners (eg, beginning and even well experienced clinical professionals) who do not require a paced or scaffolded support [57]. Considering that clinical professionals are often expected to flexibly apply new information they learn from continuing educational opportunities without much prior practice directly to their complex caseloads, the question arises as to whether current digital continuing education opportunities truly foster effective lifelong learning [58,59]. As Scott et al [60] emphasized, measures must be implemented to aid retention and evaluate learning outcomes, not just to measure the satisfaction that professionals may have had with a virtual continuing education opportunity.

Formats

Across all tools and resources, it appears that a large majority of tools are in visual format, followed by verbal and interactive formats. Although the large number of tools dedicated specifically to pictures or diagrams, text, and video is not particularly surprising given that these formats dominate the World Wide Web, it is notable that apps also contributed to a large proportion of all the tools. These primarily consisted of what we have termed *dynamic apps*, which involved a higher level of virtuality and interaction (eg, animations, virtuality, more integrated multimedia, and ability to manipulate components). Importantly, however, although an app is labeled as dynamic, this does not mean that its level of virtuality or interactivity is necessarily always the same among the different tools. An app involving 3D simulation and another app that displays animated procedures and only some interactive parts (eg, 3D manipulative or drawing tool) would still be considered dynamic interactive apps. It was beyond the scope of this initial investigation to study the full scope of virtuality and interaction of these tools, as these spectra are still being defined [48,61].

Within the academic-level–learner group, it was encouraging to see that there was a presence of more interactive formats, particularly dynamic apps and simulations; greater interaction is known to be associated with greater levels of learner engagement and thus motivation to promote learning and knowledge retention [62,63]. It is important to mention that many of these tools have not been evaluated for their efficacy. Thus, it would be useful to investigate whether these more interactive formats do indeed foster greater learner motivation, retention of information, or application to academic and clinical contexts (eg, does a simulation of a flexible endoscopic examination of swallowing necessarily translate to the appropriate motor skills to perform such a task in a clinical context?). Considering the current challenges in securing diverse clinical placements and externship experiences for students, it is critical to consider alternative methods for clinical training moving forward, including through digital means [64,65]. There is already evidence that simulation programs, for example, have some level of demonstrated efficacy for improving knowledge, skills, and confidence among health professional students [66-68]. Interactive formats can also serve as a useful platform from which one can begin training for professional skills such as interpersonal collaborative communication skills, which cannot be easily trained through only simple static visual or verbal formats [69].

Within the clinical-professional learner group, it appears that most digital learning resources and tools have relatively static verbal and visual formats at this time (predominated by picture or diagrams and text); there are additionally very few tools with interactive formats, a large portion of which consists of web-based courses or MOOCs, which makes sense given that many continuing education opportunities are currently also available virtually. However, the general dearth of interactive formats for clinical-professional learners points to an area of opportunity to spark greater engagement and more motivated lifelong learning.

Between the two groups, it was observed that in general, academic-level learners tended to overall have more *novel* formats than their clinical-professional learner counterparts (eg, in comparison traditional media such as text, audio, video, these are formats such as apps that have emerged since the 2000s) [70]. This was the case both in terms of within the interactive format subgroup (particularly for dynamic apps) and within the visual format subgroup (particularly for static apps and 3D models or manipulatives). However, considering that this study only investigated digital tools and resources for the purposes of learning, it could be that clinical professionals are rather using the apps for the purposes of clinical practice instead. There are studies that have discussed clinical apps (eg, diagnostic or therapeutic apps) for clinician and physician use [35,38,71]. In the areas of web-based courses or MOOCs, social networks, and portals, a greater proportion of tools and resources for clinical-professional use were found. As mentioned previously, the greater number of web-based courses or MOOCs could be explained by the fact that clinicians and physicians are required to complete continuing education credits, many of which are now web-based. The greater proportion of portals and field-specific social networking sites could be explained by the fact that many of the academic-level learners may still be learning about these field-specific resources in their graduate coursework and generationally, may be more drawn toward exchange on common social networking channels (eg, Facebook, Twitter, Instagram, and blogs). It will be interesting to see whether digital tool formats begin to consolidate between the 2 groups moving forward and to see what new digital formats begin to arise.

Limitations

This study must be interpreted in light of its limitations. First, this initial investigation is not a fully comprehensive collection and analysis of all existing tools that are appropriate in the fields of SLP, phoniatrics, and otolaryngology. Given the specificity of the inclusion and exclusion criteria of this study, we intentionally did not investigate more collaborative digital learning spaces such as blogs or groups on common social media channels (eg, Facebook, Twitter, and Instagram), which are wide in scope and require their own critical investigation. Studies have shown that these seemingly *less academic* channels are an increasingly useful source of professional information and that even academic players (eg, institutions, regulating bodies, and peer-reviewed journals) are beginning to enter these spaces [72-75]. Therefore, it will be important to investigate these channels in future studies. Second, the tools and resources that have been investigated in this study reflect only one method for viewing or organizing digital tools and resources. Our findings are based on several theoretical models (eg, cognitive theory of multimedia learning by Mayer and the presentation forms by Arnold et al [41] as an organizational structure for digital format types) that we deemed appropriate and feasible on the basis of the nature of the tools and resources identified [40,47]. The division between different groups (eg, between academic-level learners vs clinical-professional learners or differentiation between static vs dynamic apps) was made to the best of our knowledge on the basis of a thorough review of previous literature, as many of these organizing structures are not currently well defined and are still developing. It should also be mentioned that the choice of search terms may have limited the range and type of tools that were found. However, these broader terms were chosen to maximize the search results. Considering the rapidly evolving nature of digitalization, this study presents just a snapshot of the digital tools and resources available at the time of the study. Therefore, not only is it difficult to exactly replicate study findings because of continuously changing search results, but the distinctions and definitions used in this study can also be interpreted as somewhat arbitrary in nature. Nevertheless, this study provides an emerging structure for better understanding the breadth and classifications of current digital tools and resources.

Future Directions

Given this initial investigation into the organizing structures and availability of these tools and resources with open or good accessibility, it will be important as a next step to quantify their actual use. Investigating students' and professionals' attitudes toward such tools and resources is critical to understanding their use in practice or how they can be better incorporated into current curricula or learning opportunities. Perhaps most crucially, all digital resources and tools for teaching and learning need to undergo a process of rigorous peer review for quality assessment. In light of the digital revolution, tools such as the Mobile App Rating Scale have been developed to aid in the evaluation of digital applications, although gold standard measures or formal regulations supported by medical regulating bodies have yet to be developed or consistently implemented [76,77]. As standards are important for the processes of streamlining, compatibility, interchangeability, usability, and quality improvement and assurance, it is crucial that quality expectations become a greater area of focus, discussion, and productive problem solving in the future [78]. Although technical standards for e-learning apps are available from institutions such as the International Organization for Standardization, the Learning Technology Standards Committee of the Institute of Electrical and Electronics Engineers, or from the IMS Global Learning Consortium, Inc, it will be important—especially for the interdisciplinary fields of SLP, phoniatrics, and otolaryngology—to consider and begin to explicitly outline how these standards fit within current clinical-professional standards, roles, and responsibilities [79-81].

Furthermore, it will be critical to discuss the incorporation of digital skills into the clinical curricula, so that future professionals are better prepared for the changing medical landscape. The digital revolution has brought opportunities for innovation; however, innovation must be sustainable. As student and patient populations diversify and technologies progress, it is vital that health care professionals are robustly prepared to access, manipulate, critically assess, and improve digital tools and resources. To begin this process, this study presents an initial overview of the current digital landscape and organizing structures of the available tools and resources in fields related to communication disorders. However, there remains much work to be done.

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Conflicts of Interest

None declared.

Multimedia Appendix 1
Summary list of tools.
[PDF File (Adobe PDF File), 179 KB - mededu_v7i3e27901_app1.pdf]

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Abbreviations

mHealth: mobile health
MOOC: massive online open course
SLP: speech-language pathology

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Original Paper

Impact of a Workflow-Integrated Web Tool on Resource Utilization and Information-Seeking Behavior in an Academic Anesthesiology Department: Longitudinal Cohort Survey Study

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Abstract

Background: Medical resident reading and information-seeking behavior is limited by time constraints as well as comfort in accessing and assessing evidence-based resources. Educational technology interventions, as the preferred method for millennial leaners, can reduce these barriers. We implemented an educational web tool, consisting of peer-reviewed articles as well as local and national protocols and policies, built into the daily workflow of a university-based anesthesiology department. We hypothesized that this web tool would increase resource utilization and overall perceptions of the educational environment.

Objective: The goal of this study was to demonstrate that an educational web tool designed and built into the daily workflow of an academic anesthesia department for trainees could significantly decrease barriers to resource utilization, improve faculty-trainee teaching interactions, and improve the perceptions of the educational environment.

Methods: Following Institutional Review Board approval, a longitudinal cohort survey study was conducted to assess trainee resource utilization, faculty evaluation of trainees' resource utilization, and trainee and faculty perceptions about the educational environment. The survey study was conducted in a pre-post fashion 3 months prior to web tool implementation and 3 months following implementation. Data were deidentified and analyzed unpaired using Student *t* tests for continuous data and chi-square tests for ordinal data.

Results: Survey response rates were greater than 50% in all groups: of the 43 trainees, we obtained 27 (63%) preimplementation surveys and 22 (51%) postimplementation surveys; of the 46 faculty members, we obtained 25 (54%) preimplementation surveys and 23 (50%) postimplementation surveys. Trainees showed a significant improvement in utilization of peer-reviewed articles (preimplementation mean 8.67, SD 6.45; postimplementation mean 18.27, SD 12.23; P=.02), national guidelines (preimplementation mean 2.3, SD 2.40; postimplementation mean 6.14, SD 5.01; P<.001), and local policies and protocols (preimplementation mean 2.23, SD 2.72; postimplementation mean 6.95, SD 6.09; P=.02). There was significant improvement in faculty-trainee educational interactions (preimplementation mean 1.67, SD 1.33; postimplementation mean 6.05, SD 8.74; P=.01). Faculty assessment of trainee resource utilization also demonstrated statistically significant improvements across all resource categories. Subgroups among trainees and faculty showed similar trends toward improvement.

Conclusions: Learning technology interventions significantly decrease the barriers to resource utilization, particularly among millennial learners. Further investigation has been undertaken to assess how this may impact learning, knowledge retention, and patient outcomes.

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KEYWORDS

graduate medical education; learning technology; anesthesiology; information-seeking behavior; web tool; teaching; millennial learners

Introduction

Barriers to Resource Utilization

Starting in 1997 with a survey of family medicine residents in internal medicine, physical medicine, and rehabilitation programs, who were followed up with in 2004, several attempts have been made to quantify and evaluate trainees' reading behaviors [1-3]. In alignment with adult learning theory, a study conducted by Cassidy suggests that residents' desire to learn is primarily motivated by personal interests and clinical relevance to patient care rather than by training requirements [4]. Johnson and colleagues' investigation showed that residents read for approximately 3.7 hours per week [1]. They also showed that while trainees desired to read more, they were limited by fatigue and time constraints due to personal obligations. The groups concluded that improved delivery of educational materials, particularly via new databases and technologies, could improve the breadth and depth of resident reading. While this was true in 1997 and 2004, as the body of medical literature grows exponentially, it is even truer today.

With the extensive volume of medical literature available at the click of a mouse, one might wonder why any further learning technology intervention is needed. This expansion of electronic data, as well as fragmentation of resources across multiple websites and forums, has created a barrier to information-seeking behaviors [5,6]. A qualitative study conducted through five focus group interviews about a French general medicine program in 2015 found that both residents and general practitioners understand the importance of utilizing evidence-based medicine (EBM) and the need for unbiased information. However, study participants who generally used a limited number of online sources were not confident with their ability to assess the quality of information found, and they generally sought information in concordance with their existing knowledge [7]. Barriers to resource utilization are a problem that has been well-enough identified to have incited the development of the BARRIERS (Barriers to Research Utilization Scale) scale in 1991, which has been utilized in some 63 studies [8].

Training Tools for Graduate Medical Education

Learning technologies in graduate medical education and anesthesiology are in their early stages but continue to grow. In a broad review of the 21st-century learner, Chandrasoma and Chu confirmed that millennial learners overwhelmingly had smartphones, so they preferred to learn via electronic methods on a variety of platforms as passive consumers as opposed to content creators [9]. Directed reading programs are one learning intervention that can be implemented as a learning technology. de Virgilio and colleagues implemented a nontechnology-based directed reading program, which, along with textbook readings, included weekly exams [3]. This resulted in increased reading and improved examination scores in a surgical residency program. A directed reading program as a learning technology, in which readings were targeted toward in-training exam objectives, has also been successfully implemented in internal medicine as well as obstetrics and gynecology residency programs, resulting in improved board pass rates [10,11].

Use of Web Tools as a Novel Strategy for Learning

With the increased use of digital learning tools in medical education, web tools remain the most frequently utilized digital resource among medical students and residents [12]. A recent survey study of an inpatient medicine team found that web-based learning interventions improved self-directed learning, communication goals, and learning environment among medical students and residents [13].

With consideration to Thomas et al's conceptual framework for curriculum development [14], as well as O'Brien's conceptual framework for learning technology implementation [15], we have sought to build a learning technology into the daily workflow of trainees and faculty. These frameworks, in particular, guided us in attempting to evaluate our learners' needs as well as the effectiveness of our learning technology in an iterative process. This learning technology consisted of an online teaching file of EBM resources as well as local and national policies and protocols that were on the same web tool as the daily operating room schedules and staff assignments. We were guided by a constructivist learning theory in our attempt to provide primary resources to trainees, which allowed them to build constructs in direct connection with their clinical experiences.

Firstly, we hypothesized that implementation of this web tool into the workflow would increase utilization of the provided resources by reducing barriers to access, including time constraints. Secondly, we hypothesized that the web tool would improve the trainees' satisfaction with the educational environment, improve resident-faculty educational interactions, and improve faculty evaluation of trainee resource utilization.

Methods

Setting and Participants

Institutional Review Board approval was obtained on February 16, 2017, to conduct a longitudinal cohort survey study of trainees (ie, anesthesiology resident physicians and student registered nurse anesthetists [SRNAs]) and faculty (ie, physician anesthesiologists and certified registered nurse anesthetists [CRNAs]) at MedStar Georgetown University Hospital, a tertiary academic medical center in Washington, DC. Nonrandom sampling included the full accessible population of trainees and faculty. The primary outcome of this study was to determine if an educational web tool (Multimedia Appendix 1) for trainees designed and built into the daily workflow of an academic anesthesia department could significantly increase the trainees' utilization of provided resources. The secondary outcome was to determine if this web tool could improve the perceptions of the educational environment, faculty evaluation of trainee recourses, and resident-faculty educational interactions.

Survey Development

Surveys attempted to elicit information regarding the 3 months prior to, and the 3 months after, implementation of the web tool. The trainee survey (Multimedia Appendix 2) queried the number of journal articles read or referenced, the number of local and national policies referenced, trainees' self-perceived efficiency for accessing these resources, and their overall satisfaction with their education and educational resources within the department. The faculty survey (Multimedia Appendix 3) queried the faculty members' perception of their trainees' use of journal articles as well as local and national policies and their perception that the department provided effective educational resources. Evaluative queries were rated on a 10-point Likert scale, ranging from 1 (strongly disagree) to 10 (strongly agree). All surveys were completed on paper and administered by two medical students working with the research team.

Introduction of the Online Web Tool

Following the collection of the preintervention surveys, the online web tool—Departmental Intranet—was introduced, with operating room schedules and assignments published daily. Resources on the web tool were compiled and indexed by the research team. The web tool consisted of 121 journal articles, indexed in a variety of subject matter; 156 local policies and protocols; and 38 national society policies. The web tool was introduced with a brief oral presentation at the monthly faculty meeting, the resident morning lecture, and at grand rounds. A total of 3 months following the introduction of the web tool, identical postimplementation surveys were passed out to both trainee and faculty groups.

Data Analysis

Data were compiled in a deidentified manner and analyzed as trainee and faculty composite data, as well as in subgroups. Data were analyzed unpaired using the Student *t* test for continuous data and the chi-square test for ordinal data.

Results

Survey Responses

Survey response rates were greater than 50% in all groups: of the 43 trainees, we obtained 27 (63%) preimplementation surveys and 22 (51%) postimplementation surveys; of the 46 faculty members, we obtained 25 (54%) preimplementation surveys and 23 (50%) postimplementation surveys (Table 1).

Table 1. Survey response rates for trainees and faculty in the preimplementation and postimplementation periods.

Participants	Responses preimplementation, n (%)	Responses postimplementation, n (%)
Trainees		
Total (n=43)	27 (63)	22 (51)
Residents (n=23)	15 (65)	14 (61)
Student registered nurse anesthetists (n=20)	12 (60)	8 (40)
Faculty		
Total (n=46)	25 (54)	23 (50)
Physicians (n=27)	16 (59)	14 (52)
Certified registered nurse anesthetists (n=19)	9 (47)	9 (47)

Trainee Resource Utilization

Postimplementation trainee survey results showed a significant increase in the utilization of all resource categories, including journal articles (preimplementation mean 8.67, SD 6.45; postimplementation mean 18.27, SD 12.23; *P*=.02), national guidelines (preimplementation mean 2.3, SD 2.40; postimplementation mean 6.14, SD 5.01; *P*<.001), and local policies (preimplementation mean 2.23, SD 2.72; postimplementation mean 6.95, SD 6.09; *P*=.02). There was also significant improvement in the resources that residents referenced, specifically for their clinical cases (preimplementation mean 4.63, SD 3.75; postimplementation mean 16.09, SD 20.07; *P*=.005), as well as faculty-trainee discussions of journal articles (preimplementation mean 1.67, SD 1.33; postimplementation mean 6.05, SD 8.74; *P*=.01) (Figure 1).

Trainees also self-reported feeling that it was more efficient to identify EBM resources in their clinical practice after implementation of the web tool (preimplementation mean 5.81; postimplementation mean 7.36; *P*=.03) (Figure 2).

Figure 1. Trainee resource utilization. EBM: evidence-based medicine.

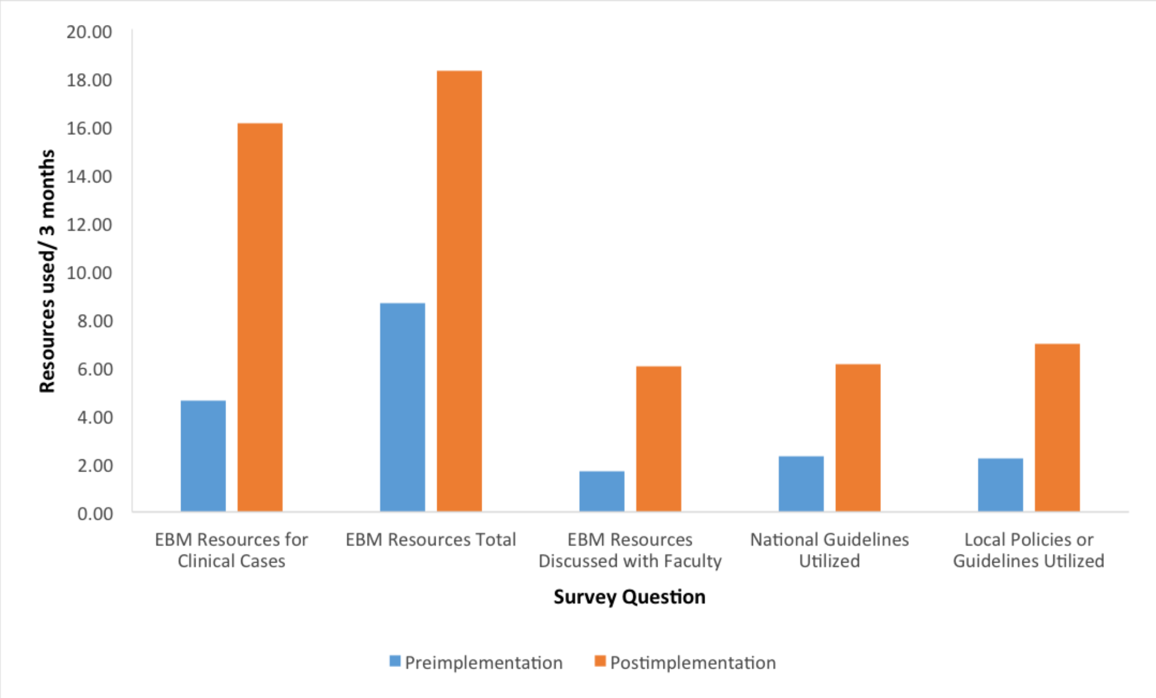
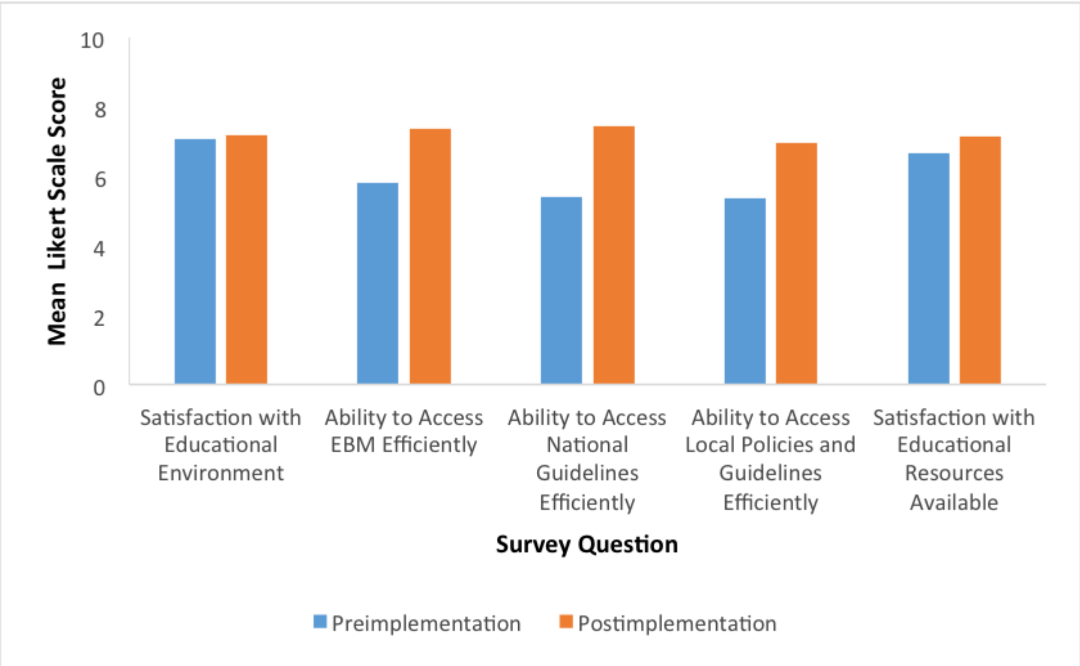


Figure 2. Trainee evaluation of educational environment. Questions were rated on a 10-point Likert scale, ranging from 1 (strongly disagree) to 10 (strongly agree). EBM: evidence-based medicine.



Trainee Subgroup Analysis

Subgroup analysis showed that implementation of the web tool led to broad increases in resource utilization for both SRNAs and resident physicians as well as satisfaction among both groups with the educational resources, though not all results were statistically significant (Table 2).

Table 2. Subgroup analysis: trainee resource utilization and trainee perceptions.

Trainee survey item	Student registered nurse anesthetists			Resident physicians		
	Pre[a], mean (SD)	Post[b], mean (SD)	*P* value	Pre, mean (SD)	Post, mean (SD)	*P* value
How many EBM[c] articles have you read for your cases in the past 3 months?	4.92 (3.70)	12.63 (7.71)	.007	4.40 (3.91)	18.07 (8.64)	.04
How many EBM articles have you read in total in the past 3 months?	11.58 (6.73)	15.00 (7.60)	.30	6.33 (5.33)	20.14 (8.64)	.045
How many days have faculty discussed EBM articles in the past 3 months?	2.33 (1.30)	2.50 (1.85)	.85	1.13 (1.13)	8.07 (4.45)	.02
Satisfaction with educational environment (score[d])	7.67 (2.02)	8.50 (1.07)	.29	6.60 (1.59)	6.43 (2.03)	.80
I can access EBM resources efficiently (score[d])	5.92 (2.02)	8.38 (2.77)	.03	5.73 (2.79)	6.79 (2.08)	.26
How many national guidelines have you referenced in the past 3 months?	1.58 (1.88)	4.25 (3.06)	.02	2.87 (2.67)	7.21 (5.66)	.01
I can access national guidelines efficiently (score[d])	4.58 (3.34)	7.63 (2.33)	.04	6.07 (2.37)	7.36 (1.86)	.11
How many local policies and guidelines have you referenced in the past 3 months?	3.67 (3.26)	3.00 (3.21)	.65	1.07 (1.49)	6.93 (6.96)	.003
I can access local policies and guidelines efficiently (score[d])	5.08 (2.57)	7.38 (3.20)	.09	5.60 (2.80)	6.71 (2.89)	.31
I am satisfied with educational resources provided (score[d])	7.00 (1.95)	8.75 (1.16)	.04	6.40 (1.40)	6.21 (2.15)	.78

[a]Pre: preimplementation.

[b]Post: postimplementation.

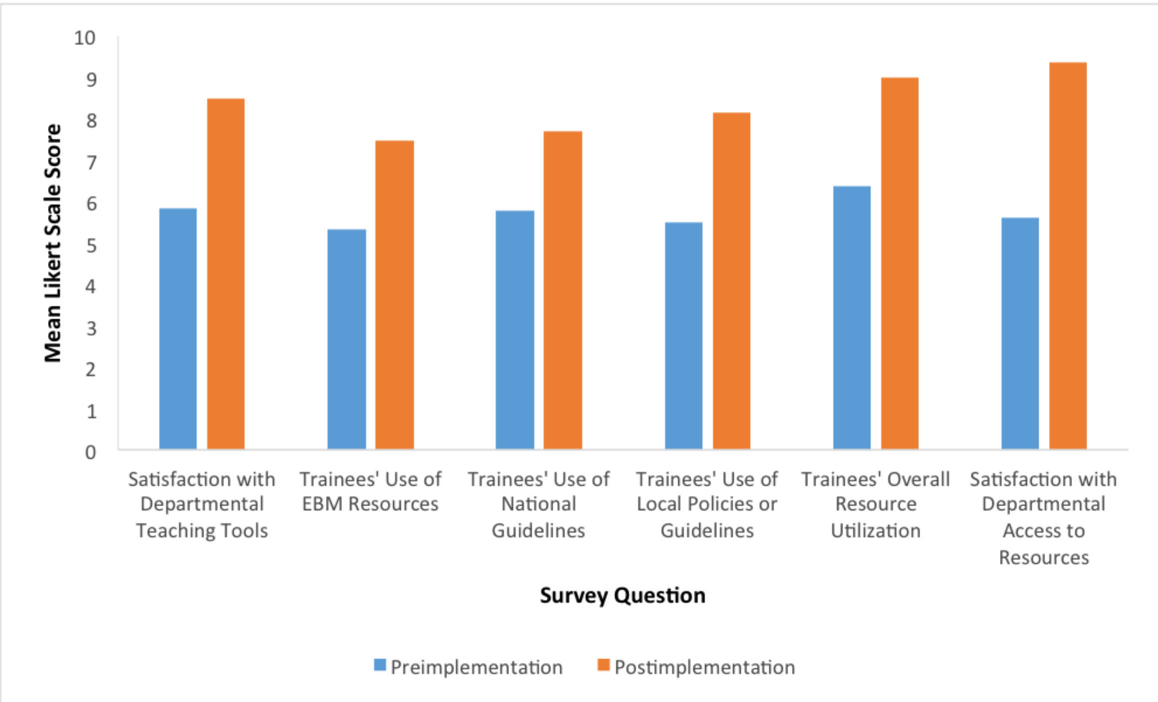
[c]EBM: evidence-based medicine.

[d]Survey items were rated on a 10-point Likert scale, ranging from 1 (strongly disagree) to 10 (strongly agree).

Faculty Evaluation

Faculty were asked to assess the trainees' ability to efficiently utilize evidence-based articles, local policies, and national policies. Faculty reported that trainees showed an improved ability to locate resources and reported increased satisfaction with resources provided by the department (Figure 3).

Figure 3. Faculty evaluation of educational environment. Questions were rated on a 10-point Likert scale, ranging from 1 (strongly disagree) to 10 (strongly agree). EBM: evidence-based medicine.



Faculty Subgroup Analysis

Subgroup analysis showed that both CRNAs and attending physicians reported similar improvements in trainee abilities to identify and utilize resources (Table 3).

Table 3. Subgroup analysis: faculty evaluations of trainees and faculty perceptions.

Faculty survey item	Certified registered nurse anesthetists (score[a])			Physician anesthesiologists (score[a])		
	Pre[b], mean (SD)	Post[c], mean (SD)	*P* value	Pre, mean (SD)	Post, mean (SD)	*P* value
The department provides effective teaching tools	5.78 (2.68)	8.78 (0.97)	.01	5.88 (1.93)	8.29 (1.73)	.002
Trainees effectively locate and implement EBM[d] resources	4.89 (2.71)	7.33 (1.12)	.02	5.56 (2.39)	7.57 (2.10)	.02
Trainees effectively locate and implement national guidelines	6.00 (2.40)	7.11 (1.62)	.26	5.63 (2.53)	8.07 (1.73)	.005
Trainees effectively locate and implement local policies and guidelines	5.33 (2.06)	8.33 (1.41)	.002	5.56 (2.48)	8.00 (1.57)	.003
Trainees can be effectively directed to the above resources	6.56 (1.59)	8.67 (1.32)	.007	6.25 (2.11)	9.21 (1.05)	<.001
The department has an effective system for faculty to access the above resources	5.22 (3.23)	9.44 (0.88)	.002	5.81 (2.79)	9.29 (1.14)	<.001

[a]Survey items were rated on a 10-point Likert scale, ranging from 1 (strongly disagree) to 10 (strongly agree).

[b]Pre: preimplementation.

[c]Post: postimplementation.

[d]EBM: evidence-based medicine.

Discussion

Principal Findings

Following the implementation of the web tool, our trainees showed a significant improvement in the utilization of peer-reviewed articles, national guidelines, and local policies and protocols. Postimplementation surveys demonstrated a significant improvement in faculty-trainee educational interactions as well as faculty assessment of trainee resource utilization.

The development of an online web tool, more specifically, a centralized repository of academic articles, local policies and protocols, and national policies, was considered a first step in the implementation of improved educational technology at our institution. While there is certainly an abundance of materials available to faculty and trainees alike, searching and indexing through an ever-growing volume of information can be daunting. The goal of our web tool was to build these resources into the daily workflow, decrease barriers to utilization, and create a base for further educational technology interventions.

Adult Learning Theory for Millennials

The implementation of a departmental educational web tool is an example of applying adult learning theory for the millennial learner. Adult learning theory tells us that our residents are not oriented toward classical methods of lecture-based education with a postponed application of knowledge. Alternatively, they are oriented toward educational materials that are integrated into their current clinical experience and the immediacy of application. For this reason, modern e-learning in a professional environment is asynchronous, personalized, and just-in-time [16]. Millennial learners in the digital age prefer modalities that are online and self-paced. Meeting these needs requires us to build relevant educational tools into the learning environment [17]. Our survey study shows that creating such tools is an effective way to connect with millennial adult learners via their preferred methods. By meeting them where they are, we are able to encourage our learners to read, to improve their satisfaction with the educational environment, and to better connect trainees and faculty.

Integration Into the Workflow

We focus on the concept of integrating our web tool into the daily workflow of our learners because this method approximates a passive clinical decision support (CDS) system. By providing resources to providers based on the patients they are seeing, CDS systems ease the barriers to information-seeking behaviors, as discussed earlier [18]. CDS systems have been used in our field of anesthesiology to encourage protocol utilization, remind providers to administer antibiotics, and to improve compliance and billing [19-21]. Active CDS systems send notifications to providers, while passive systems like ours require providers to click links to access information [22]. Our web tool is not a full CDS system. The web tool lacks the data acquisition and rules modules to be considered an independent CDS system. However, by taking the relevant resources, including local and national protocols, and linking them directly into the workflow, we lessen the barriers to utilization of these resources and approximate a CDS system with many of the benefits. CDS systems have been shown to be very effective in increasing protocol utilization, with findings similar to our web tool implementation [21,22].

Limitations

The primary use of self-reported resource utilization via surveys introduces certain limitations and the potential for bias. Surveys were administered in person, preventing false respondents.

Surveys were administered by medical students and were deidentified to minimize *social desirability* bias; however, this cannot be eliminated and may be particularly prevalent among trainees. Given that survey response rates were 50%, there was a possibility of self-selection bias in which trainees and faculty that did not find the intervention helpful may have elected not to respond, which would skew results in the positive direction. Additionally, recall bias must be considered when asking respondents about their past behaviors, even over a 3-month period.

Utilizing data such as web tool click rates or log-in data would have provided more "hard" data regarding resource utilization. Survey response rates were acceptable at 50% but could have been higher; in addition, due to the variance in pre- and postsurvey respondents, and the desire to deidentify data, the analysis was performed using an unpaired method. Additionally, this survey study looked at only one pre- and postimplementation time point and, therefore, says nothing about the long-term use of resources, and certainly says nothing about an improvement in knowledge gain or educational achievement. An underlying assumption is that more resource utilization is better, though this may be unproven.

Future Studies

As we continue to build electronic resources to assist in anesthesiology training, further investigations should ascertain what the ideal volume and type of resources would be for such a web tool, and what delivery mechanisms are ideal to introduce these resources to trainees and encourage utilization. Additionally, determinations can be made for what sorts of systems will decrease barriers to faculty-trainee teaching. This group has begun to undergo further investigations to deliver resources from this web tool to providers in a more targeted method utilizing a CDS system. We have begun evaluation of how such targeted delivery methods increase utilization of policies, improve resident reading, and improve trainee knowledge acquisition and retention.

Conclusions

As we hypothesized, the implementation of our web tool did increase the volume of journal articles, local policies, and national policies that our trainees utilized. The web tool also subjectively increased the self-rated comfort of trainees in their utilization of resources, as well as the faculty evaluation of trainee resource utilization. Encouragingly, this common framework for access to shared resources also increased the volume of faculty-trainee discussions about evidence-based resources. We are encouraged with the belief that building from this, such a framework can ease barriers to faculty-trainee educational interactions.

Conflicts of Interest

None declared.

Multimedia Appendix 1
Sample screenshots of the web tool.
[PDF File (Adobe PDF File), 2755 KB - mededu_v7i3e26325_app1.pdf]

Multimedia Appendix 2
Trainee survey.
[PDF File (Adobe PDF File), 78 KB - mededu_v7i3e26325_app2.pdf]

Multimedia Appendix 3
Faculty survey.
[PDF File (Adobe PDF File), 70 KB - mededu_v7i3e26325_app3.pdf]

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Abbreviations

BARRIERS: Barriers to Research Utilization Scale
CDS: clinical decision support
CRNA: certified registered nurse anesthetist
EBM: evidence-based medicine
SRNA: student registered nurse anesthetist

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Original Paper

Individual and Institutional Factors Preventing Completion of Research by Medical Graduate Students at Cairo University: Questionnaire Study

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Abstract

Background: Medical research plays a significant role in advancing the level of health care worldwide. This research is a crucial part of the development of any educational system. In developing countries, the publication rate related to the medical sciences is lower than that in developed countries.

Objective: The aim of this study was to explore the causes of delay in publishing research and the factors that hinder the completion of master's degree projects in a group of medical graduate students at Cairo University Faculty of Medicine.

Methods: A web-based questionnaire was introduced to approximately 150 medical graduates in different specialties through social media. The questionnaire aimed to investigate the reasons for delays in publishing master's degree manuscripts after graduation among a group of medical graduates.

Results: Of the graduates contacted, 130 responded to the web-based survey. The ages of the participants ranged from 23-38 years (SD 3.88); 72 of them were male, and 58 were female. Causes of noncompletion of manuscripts were analyzed; lack of proper research training and the absence of supportive mentorship were top reasons. We found a significant relationship between being married and failing to complete the assigned project from its start up to publication. Moreover, we found that the frequency of nonfulfillment increased among those who experienced poor mentorship.

Conclusions: Several factors are contributing to the delay in publication of medical manuscripts related to research projects by medical graduates of the Cairo University Faculty of Medicine. Pensive supervision must be implemented to decipher the persistent institutional problems that obstruct research progress.

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KEYWORDS

research; Cairo University; medical; nonpublication

Introduction

Currently, medicine is considered to be not only an art of clinical skill but a multidisciplinary approach that adapts research to clinical achievements. Reflecting on the importance of this consideration, medical schools have started to add research curricula along with medical classes to increase the motivation of students to participate actively in research projects. It is now obligatory for medical students at different medical schools in the United Kingdom to participate in a research project as an essential step for their future medical career [1]. Hypothesis testing and evidence-based medicine are now hallmarks of the medical sciences to ensure excellent care for patients.

Currently, in North America and the United Kingdom, medical program directors ask applicants about their work on research projects when they apply to residency programs, and an applicant has merit if their application contains many cited publications. Although schools invest many resources to improve the research skills of medical students and graduates, a large cohort of these students are not interested in scholarly activities. It is important to evaluate different factors that cause medical graduates to not publish their research. These factors may be related either to the individuals or to their medical institutions.

In this study, we attempted to interpret the reasons for noncompletion of research projects because the most important factor in postgraduate master's degree programs at the Cairo University Faculty of Medicine is completion of a degree-related thesis for publication. We administered a web-based survey with several items to determine if a group of medical doctors completed their research projects and published them and to elucidate any difficulties they faced in publishing their research.

Methods

Data Collection

A self-reported web-based questionnaire survey that included 10 questions was introduced to a group of medical school graduates through Facebook and WhatsApp (Figure 1, Table 1). All respondents were Cairo University Faculty of Medicine medical graduates, and they specialized in different clinical and academic departments. The survey asked about the respondents' interest in research, possible applications of their research project in the medical field, reasons for the delay in completion (ie, the delay in final publication), and suggested reasons for journal rejection. The research success of the participants was measured by the completion rate of publishing any number of papers, even one paper, as well as their state of authorship of the paper (first or other author). Out of 150 recipients, 130 responded to the survey in the period from June 15-30, 2020. Data from the survey were exported to an Excel spreadsheet (Microsoft Corporation) and analyzed using GraphPad Prism, version 8.0.0, for Windows (GraphPad Software Inc). We considered two-tailed *P* values <.05 to be statistically significant for all differences. Descriptive analysis was performed regarding age, gender, and marital status. The Mann-Whitney U test was applied as a nonparametric test to identify significant differences for each of the variables under study and how they relate to each other, such as whether the rates of completion and publishing differ according to the graduate's marital status or the availability of a helpful mentor.

Figure 1. Screenshot of the web-based self-reported questionnaire administered to the study participants.

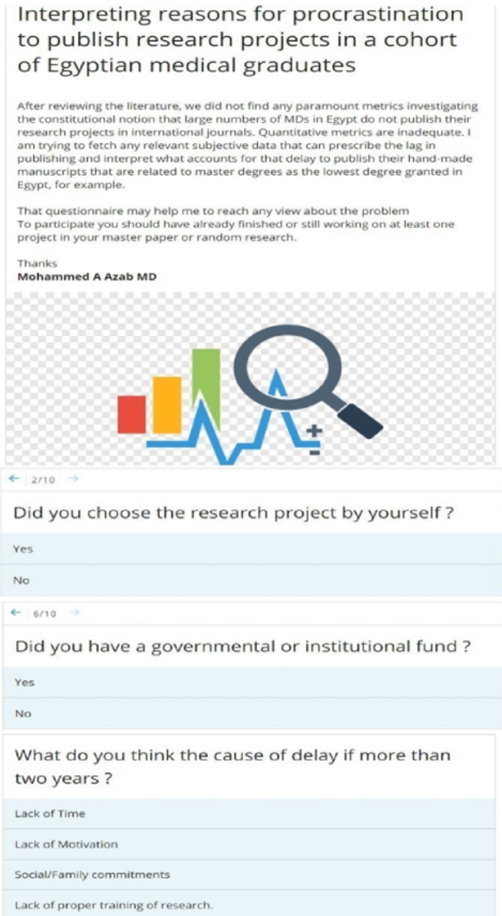

Table 1. Questions and possible responses in the web-based self-reported questionnaire.

Question	Responses
Are you interested in research, whether clinical or basic science?	• Yes • No
Did you choose your research project by yourself?	• Yes • No
Did you consider it a new addition to academic and clinical research?	• Yes • No
What do you think the cause of delay was if your research was delayed more than two years?	• Lack of time • Lack of motivation • Social/family commitments • Lack of proper training of research. • Unsupportive supervisor • Lack of proper internet facilities/opportunities • Lack of proper laboratory facilities • Lack of funding • Overloaded curriculum
Did you have a governmental or institutional fund?	• Yes • No
Have you finished your research project?	• Yes • No
How long did it take from finishing the entire study to publishing it, if it has already been published?	• 2 years • More than 2 years • Didn't publish
Do you think your supervisor was cooperative?	• Yes • No
If your work was not published, why do you think it was not published?	• Not beneficial • Discussed many times in the literature ("lack of novelty") • Plagiarism • The manuscript is out of scope of the journal • The peer reviewers' comments were not properly answered or went unanswered • Incomplete or insufficient information in the abstract • Title was not representative of the study • Inaccurate or inconsistent data were reported • Defective tables or figures

Ethics Approval and Consent to Participate

All participants were consented to share their views and test results in the survey. All data used were anonymized and encrypted to comply with all research ethics. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Results

Out of 150 graduates, 130 responded to the web-based survey. Frequencies were counted for demographic data such as age, gender, and marital status (Table 2). By analyzing the results, we found that 73/130 of the participants (56.2%) were not interested in research. Among the contributors, 102/130 (78.5%) did not secure any type of funding for their master's degree program research project.

Table 2. Demographic data of the study respondents (N=130).

Variable	Value
Age (years)	
Range	23-38
Mean (SD)	29.13 (3.9)
Sex, n (%)	
Male	72 (55.4)
Female	58 (44.6)
Marital status, n (%)	
Married	76 (58.5)
Single	54 (41.5)

Regarding the attitudes of individuals in different groups toward research facilities, we observed that (34/130 of them (26.2%) described their mentors as unsupportive and considered that lack of support to be a cause of delay in publishing their master's degree research manuscripts. With further assessment of different factors that influenced the research activities, 39/130 participants (30%) reported that the lack of proper training played a principal role in their lack of interest in research; 34/130 (26.2%) complained about unsupportive research mentors as a cause of failing to finalize their assigned research project, while 26/130 (20%) declared that social commitments were a hurdle to their motivation to pursue their research projects (Table 3).

Table 3. Reasons for participants' failure to complete their assigned research projects (N=130).

Reason	Value, n (%)
Lack of motivation	12 (9.2)
Uncooperative supervisor	34 (26.2)
Lack of proper training	39 (30)
Difficulty of finding a suitable research project	2 (1.5)
Social commitments	26 (20)
Lack of time	10 (7.7)
Other causes	7 (5.3)

A variety of factors that prevented the participants' research projects from being published are summarized in Table 4. The most frequent proposed etiology was a lack of novel ideas, as most of the used research designs were discussed extensively in the literature and were not considered to be new ideas. Of the medical graduates in the study group, 21/130 (16.2%) judged their research to be "pointless."

Table 4. Suggested reasons for rejection of submitted manuscripts among the study participants (N=130).

Reason	Value, n (%)
Discussed many times (lack of novelty)	39 (30)
Not beneficial	16 (12.3)
Plagiarism	14 (17.77)
Incomplete information in the abstract	13 (10)
Out of scope of the journal	10 (7.7)
Reviewers' questions not answered properly	8 (6.15)

Using the Mann-Whitney *U* test to assess relationships and differences between available variables, we found that the frequency of noncompletion of master's degree research projects was higher in married individuals than in those who were single, as testified by a two-tailed *P* value of .002. Moreover, we did not find any relationship between interest in research and the completion rate of the research project (*P*=.50, which is not significant). There is a strong relationship between the availability of a supportive research supervisor and the completion of a master's degree project; of 130 students who completed their research projects, 96 stated they had a cooperative mentor (96/130, 73.8%; *P*=.04).

Discussion

Principal Findings

Postgraduate medical education is constantly changing on a large scientific scale. Very large data sets and technological advances have begun to demonstrate different clinical applications. Therefore, a proper methodology to investigate the lack of interest in research among medical graduates is needed. Research is a dynamic process that includes creating a research idea, followed by scientific writing and publishing. Some factors impede this process at any step; therefore, we attempted to summarize these factors as well as possible.

In this study, 72.3% of the participants reported that they did not have a good supervising mentor, and they considered that to be a cause of delay in publishing their research. Mentorship is a responsibility that requires diligent availability of time and scientific resources, and it is a crucial item in research implementation [2]. In developing countries, mentors are usually busy focusing on clinical activities such as performing surgeries and attending outpatient clinics, and they do not have sufficient time for research mentoring [2]. The significance of providing proper active mentorship at academic and clinical institutions is receiving increasing attention worldwide [3].

We observed that 56.2% of the respondents to our survey were not interested in research. Therefore, it is pivotal to delineate the factors that eventually lead to this lack of interest. One remarkable issue that may decrease interest in research is the absence of an interesting project idea. Scientific idea design is an essential step in the process of research accomplishment. Lack of novelty and outdated ideas are a major cause of manuscript rejection; in this study, this represents the cause for rejection of 39.2% of the participants (51/130), as analyzed above. The research question plays a valuable role in the overall research process and should be fashioned meticulously [4].

It is noteworthy that most research is costly and requires funding. Lack of adequate funding, especially in developing countries, is an obstacle that disrupts the process of publishing. Resource allocation for research is a critical point that should be well considered. In this study, 78.5% of medical graduates did not have any funding for their research projects. We found a strong relationship between the scarcity of funds and the noncompletion of research (P=.04). Financial aid for researchers at academic institutions should be assigned properly, as this is considered to be an investment in proper patient care in the future [5].

One of the factors that affected the completion rate was the social restrictions for married medical graduates. Of the 130 respondents, 76 (58.5%) were married, and we found that a significant number of married researchers did not complete or publish their work compared to unmarried researchers, as indicated by the P value of .002. Family commitments and social relations are considered to be a source of stress for some medical graduates, specifically at the beginning of their careers. The academic performance of married researchers will certainly improve if both partners are cooperative, are helpful, and support each other [6].

The rate of rejection of manuscripts submitted to different medical journals is higher in developing countries than in Europe and North America [7]. We attempted to explicate the causes of manuscript rejection and review the suggested reasons among a group of postgraduate medical researchers. We found that 51 of the 130 persons involved in the study (39.2%) suggested that their work was rejected mainly because the idea was extensively discussed in the literature and did not provide any new scientific or statistical data to the reader. Therefore, a careful, systematic selection of the idea of the research project should be emphasized. The next suggested reason is the lack of value of the research idea; 16% of the participating physicians reported that their research projects were not beneficial. Plagiarism was the cause of 13.8% of the rejected work in this study. Plagiarism is a serious ethical issue that is considered to be misconduct by most research institutions. It is important for research program directors to arrange workshops and lectures to teach young researchers how to avoid plagiarism. The Indian Journal of Dermatology prohibited a group of Tunisian researchers from publishing in the journal due to the submission of a plagiarized article [8]. Proper training and educational courses about scientific writing should be presented to medical students and graduates to improve their research skills, which will help them to accomplish their research projects for the sake of improving patient care.

Limitations of the Study

Online questionnaire surveys are subjective and liable to bias from some respondents. The sample size is small, so it cannot be generalized; moreover, the study relates to only one institution in Egypt, the Cairo University Faculty of Medicine, and thus it does not represent all medical graduates. Generalization of the study requires a multi-institution approach.

Conclusion

Factors affecting the pursuit of research by medical graduates are clear to the scientific community. Dedicated efforts and organized plans should be assigned to help medical graduates in developing countries to improve their research skills.

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Conflicts of Interest

None declared.

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Original Paper

Orthopedic Surgery Residency Program Website Content and Accessibility During the COVID-19 Pandemic: Observational Study

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Abstract

Background: The exceptional competitiveness of the orthopedic surgery specialty, combined with the unclear impact of the COVID-19 pandemic on residency recruitment, has presented significant challenges to applicants and residency program directors. With limited in-person opportunities in the 2020-2021 application cycle, applicants have been pressed to gauge chances and best fit by browsing program websites.

Objective: The aim of the study was to assess the accessibility and content of accredited orthopedic surgery residency program websites during the COVID-19 pandemic.

Methods: Using the online database of the Electronic Residency Application Service (ERAS), we compiled a list of accredited orthopedic surgery residency programs in the United States. Program websites were evaluated across four domains: program overview, education, research opportunities, and application details. Each website was assessed twice in July 2020, during a period of adjustment to the COVID-19 pandemic, and twice in November 2020, following the October ERAS application deadline.

Results: A total of 189 accredited orthopedic surgery residency programs were identified through ERAS. Of these programs, 3 (1.6%) did not have functional website links on ERAS. Data analysis of content in each domain revealed that most websites included program details, a description of the didactic curriculum, and sample rotation schedules. Between the two evaluation periods in July and November 2020, the percentage of program websites containing informative videos and virtual tours rose from 12.2% (23/189) to 48.1% (91/189; $P<.001$) and from 0.5% (1/189) to 13.2% (25/189; $P<.001$), respectively. However, the number of programs that included information about a virtual subinternship or virtual interview on their websites did not change. Over the 4-month period, larger residency programs with 5 or more residents were significantly more likely to add a program video ($P<.001$) or virtual tour ($P<.001$) to their websites.

Conclusions: Most residency program websites offered program details and an overview of educational and research opportunities; however, few addressed the virtual transition of interviews and subinternships during the COVID-19 pandemic.

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KEYWORDS

orthopedic surgery residency programs; COVID-19; website; residency applicants; residency; medical student; content; accessibility; observational; surgery

Introduction

Applicants to orthopedic surgery residencies spend significant time and resources gathering information about potential programs [1-7]. A valuable resource that has been shown to influence application decisions across specialties is program websites [8]. Multiple studies have found that applicants heavily use residency websites when deciding where to apply and interview and, subsequently, how to rank programs [7,9-11]. In orthopedics specifically, Yong et al surveyed 610 applicants to an orthopedic surgery residency program and found that 98% of students used program websites to gather information [9].

Despite the clear utility of websites for residency applicants and programs alike, content is inconsistent and often severely lacking. In a recent review of orthopedic surgery residency websites, Oladeji et al found widespread inconsistencies and noted a scarcity of information desired by prospective applicants [12]. Yong et al also found that, although applicants referenced websites frequently, the quality of information was ranked lower than that provided by medical school advisors or orthopedic surgery residents at home programs [9]. While it was possible to supplement inadequate information found on websites with in-person experiences in previous years, the COVID-19 pandemic has limited this year's applicants to mostly virtual experiences. Consequently, applicants have been forced to rely more heavily on websites in the 2020-2021 application cycle [9,13-15].

The purpose of this study was to assess the content and quality of orthopedic surgery residency program websites and to evaluate adaptations made in response to the COVID-19 pandemic. We hypothesized that, despite the evolving pandemic, updates to program websites, videos, and virtual tours would be limited. This study aims to both describe how orthopedic surgery programs adapted their websites in light of unprecedented circumstances and provide actionable items for programs to improve their online presence during future application cycles.

Methods

Overview

The Electronic Residency Application Service (ERAS) website contains an updated list of all accredited orthopedic surgery residency programs in the United States [16]. Upon accessing this website in July 2020, 189 accredited programs were identified and included in this study. A hyperlink to each program's website and accreditation IDs were gathered from the ERAS website. The hyperlinks were then accessed and classified as functional, indirect (ie, functional link, but required navigation to reach the orthopedic surgery residency page), or direct. Two authors independently gathered information from each website at two separate time periods of the application cycle. The first data collection occurred in the first 2 weeks of July 2020, a period of relative adjustment to COVID-19, and the second data collection occurred within the first 2 weeks of November 2020, a period shortly after the ERAS application deadline.

Information gathered from the orthopedic surgery websites fell into four broad domains: program overview, education, research opportunities, and application details.

Program Overview

Program overview included program director name; contact information, including email, phone number, and address; fellowship match lists; wellness opportunities; and salary and benefits information. Efforts to promote diversity were also reported for programs that mentioned underrepresented minorities or gender diversity in their mission statements.

Education

The education domain included the mention of extracurricular meetings and courses (ie, travel to conferences), didactic sessions, a journal club, sample rotation schedules, clinic and call responsibilities, and educational support, such as funding for loupes and leads.

Research

Research opportunities were identified by scanning websites for evidence of a research requirement, publication lists, lab spaces, or funding for national presentations and conferences.

Application Details

Application details gathered from the websites included the number of residents accepted into each program per year, a subinternship description, and guidelines for United States Medical Licensing Examination (USMLE) Step 2 score and Electronic Standardized Letter of Recommendation (eSLOR) submission.

Virtual Updates

Due to the nature of this virtual application cycle, websites were also assessed for the inclusion of program videos, video lengths if applicable, virtual tours, remote opportunities such as virtual subinternships, and details about virtual interviews.

All data collected from this study were analyzed after the second website review in November 2020. Data from July 2020 were compared to data from November 2020 to assess how programs have modified their websites in response to the virtual application cycle. Unless otherwise noted, statistics were reported on data obtained in July 2020. Analyses were performed using paired-sample *t* tests, Pearson chi-square tests, and Fisher exact tests. Significance was established at a *P* value of .05.

Results

Program Overview

Overall, 189 residency programs were identified on ERAS in July 2020. All but 3 residency programs (n=186, 98.4%) listed a functional link to the program website. Most programs listed the program director's name in July 2020 (n=164, 86.8%; Table 1). Email and phone number were included in 85.7% (n=162) and 84.1% (n=159) of websites, respectively, while address was included in 65.1% (n=123) of websites. Only 22.2% (n=42) of websites addressed underrepresented minorities and 20.6% (n=39) mentioned gender diversity. Efforts to promote wellness or engagement in social events were identified among 50.3% (n=95) of websites. Only 56.1% (n=106) of programs included a fellowship match list. Benefits and salary information was included in 63.5% (n=120) of websites.

Table 1. Content of orthopedic surgery residency program websites in July 2020.

Category	Value (N=189)
Program overview, n (%)	
Program director	164 (86.8)
Address	123 (65.1)
Phone	159 (84.1)
Email	162 (85.7)
Address underrepresented minorities	42 (22.2)
Address gender diversity	39 (20.6)
Wellness	95 (50.3)
Fellowship match list	106 (56.1)
Salary and benefits	120 (63.5)
Education, n (%)	
Didactics	159 (84.1)
Journal club	129 (68.3)
Rotation schedule	132 (69.8)
Call responsibility	96 (50.8)
Educational support	92 (48.7)
Meetings and courses	106 (56.1)
International opportunities	32 (16.9)
Research, n (%)	
Research requirement	138 (73.0)
Research output	68 (36.0)
Research support	139 (73.5)
Application details, n (%)	
Electronic Standardized Letter of Recommendation	27 (14.3)
Step 2	53 (28.0)
Number of residents per year, mean (SD)	4.6 (2.1)

Education

Of the 189 program websites, 84.1% (n=159) noted didactic sessions, 68.3% (n=129) mentioned a journal club, and 69.8% (n=132) included a sample rotation schedule (Table 1). Less commonly reported metrics included mention of meetings and courses outside of the traditional program curriculum (n=106, 56.1%), call responsibilities (n=96, 50.8%), international opportunities (n=32, 16.9%), and educational support (n=92, 48.7%).

Research

Most of the 189 program websites noted a research requirement (n=138, 73.0%) and demonstrated research support (n=139, 73.5%), such as funding for residents (Table 1). Research output, such as a list of resident publications, was less commonly included among websites (n=68, 36.0%).

Application Details

The average number of residents accepted into each program ranged from 4 to 5 residents per year (SD 2.1). Upon reviewing application requirements, only 28.0% (n=53) of 189 websites mentioned a Step 2 score requirement and 14.3% (n=27) requested an eSLOR.

Virtual Updates

Between July and November 2020, the number of program websites out of 189 that mentioned a virtual subinternship experience remained unchanged at 6.9% (n=13; *P*>.99; Figure 1). The percentage of websites including a program video rose from 12.2% (n=23) to 48.1% (n=91; *P*<.001), and the percentage of websites including a virtual tour increased from 0.5% (n=1) to 13.2% (n=25; *P*<.001; Table 2). A total of 71 program videos were identified across all 186 programs with functional websites in November 2020. The length of the videos ranged from 57 seconds to 24 minutes and 40 seconds.

A chi-square analysis was performed to gauge whether larger programs, characterized as having 5 or more residents per year, were more likely than smaller programs to add program videos or virtual tours by November 2020 (Table 3). Of the 94 larger programs, 48% (n=45) added videos, compared to only 24% (n=23) of the 95 smaller programs (*P*<.001; Multimedia Appendix 1). Larger programs (20/94, 21%) were also more likely than smaller programs (4/95, 4%) to add virtual tours by November 2020 (*P*<.001; Multimedia Appendix 2).

Figure 1. Percentage of orthopedic surgery residency program websites with updated virtual information between July and November 2020.

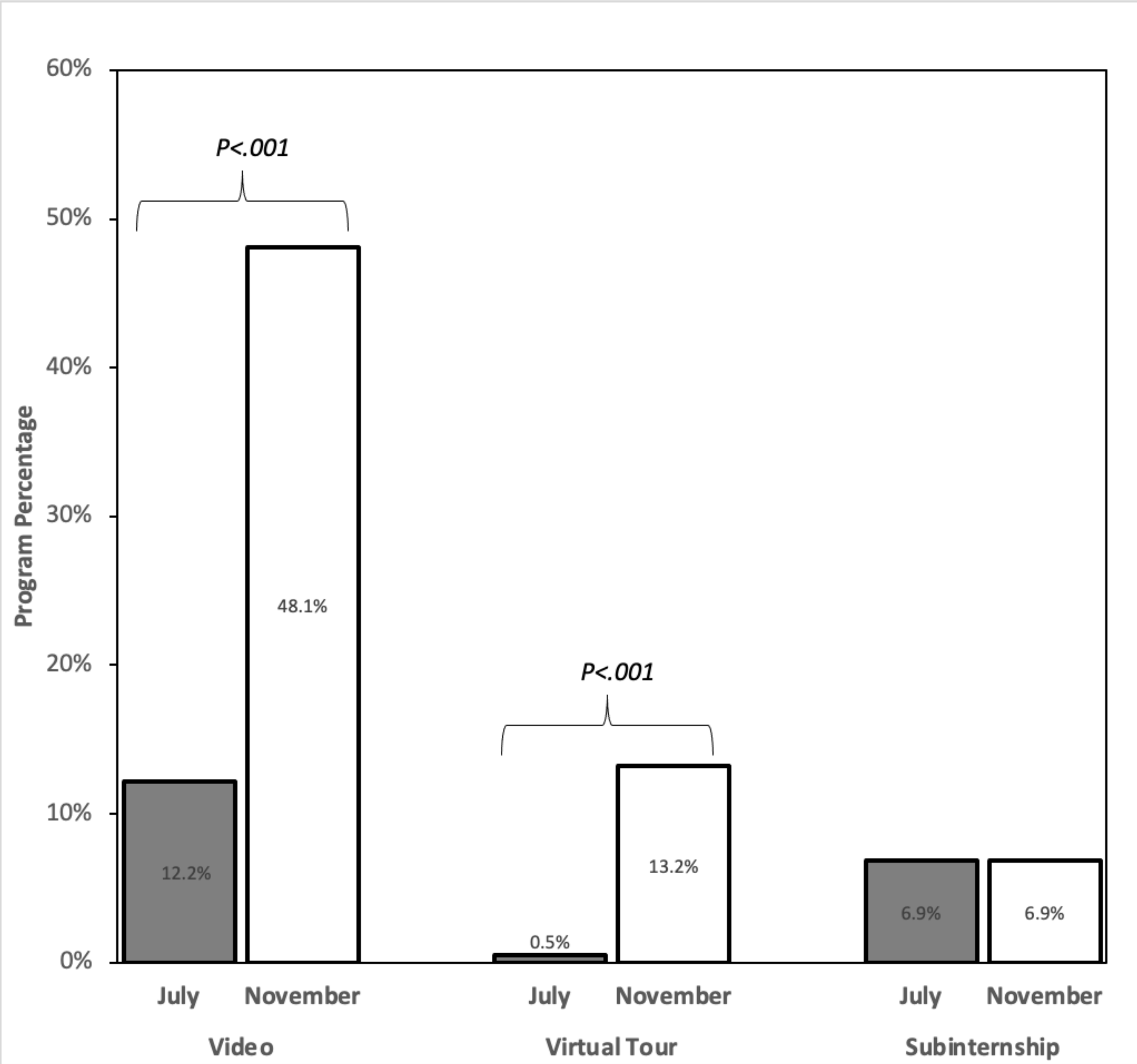

Table 2. Virtual offerings identified on program websites in July and November 2020.

Category	Websites (N=189), n (%)		*P* value[a]
	July 2020	November 2020	
Program video	23 (12.2)	91 (48.1)	<.001
Virtual tour	1 (0.5)	25 (13.2)	<.001
Subinternship	13 (6.9)	13 (6.9)	>.99

[a]Significance was established at *P*<.05.

Table 3. Orthopedic residency program websites with added virtual content between July and November 2020 compared by program size.

Category	Websites, n (%)		*P* value[a]
	Small programs (<5 residents/year) (n=95)	Large programs (≥5 residents/year) (n=94)	
Added program video	23 (24)	45 (48)	<.001
Added virtual tour	4 (4)	20 (21)	<.001

[a]Significance was established at *P*<.05.

Discussion

Principal Findings

The exceptional competitiveness of the orthopedic surgery specialty, compounded with the unclear impact of COVID-19 on residency recruitment, has presented significant challenges to both applicants and programs. Since most in-person opportunities and interviews in the 2020-2021 match cycle were cancelled due to COVID-19, we anticipated that applicants would increasingly rely on residency websites to gain insight into programs and cultural fit [13,17-19]. The purpose of this study was to explore the extent to which orthopedic surgery residency websites were updated throughout the pandemic.

In our study, we accounted for 98.4% (n=186) of the existing 189 orthopedic surgery residency programs through either hyperlinks provided by ERAS or via Google search. We reasoned that the programs would prioritize making COVID-19–related adjustments to websites prior to the ERAS application deadline in October 2020. Therefore, we recorded data in July 2020 and again in November 2020, once the ERAS deadline expired. Our analyses mostly supported our original hypothesis. While the percentage of program videos rose significantly from 12.2% (23/189) to 48.1% (91/189; *P*<.001) and the percentage of virtual tours rose significantly from 0.5% (1/189) to 13.2% (25/189; *P*<.001) from July to November 2020, the percentage of websites that mentioned a virtual subinternship experience remained stagnant at 6.9% (13/189). This is concerning because, historically, the role of the subinternship in pursuing orthopedic surgery residencies has been to provide both visiting students and programs an opportunity to assess fit based on personal skills, clinical aptitude, and the ability to integrate into program culture [5].

While our results suggest applicants would struggle to find updated information on websites regardless of program characteristics, virtual offerings were also evaluated by program size. Large programs with 5 or more residents were significantly more likely to add a program video (*P*<.001) and a virtual tour (*P*<.001) to their websites between July and November 2020. Further, with less than half (45/94, 48%) of larger residency programs and less than a quarter (23/95, 24%) of smaller programs adding a program video during the application season, applicants have been tasked with learning more about orthopedic surgery residency programs using dated videos and online information. Additionally, with only 21% (20/94) of larger programs and 4% (4/95) of smaller programs adding a virtual tour, applicants have limited representations of the physical environment surrounding their potential residency placements. Collectively, these findings indicate that smaller programs were at a potential disadvantage for recruiting applicants since they were less likely than larger programs to have information that applicants would find critical in lieu of in-person interaction.

Comparison With Prior Work

Consistent with previous research, this study identified gaps in the quantity and quality of information on orthopedic surgery residency websites. Rozental et al completed the first review of orthopedic program websites at a time when only 40% of the United States had access to the internet and discovered that only 113 of 154 programs (73.4%) had working websites [20]. In a follow-up study conducted by Oladeji et al, 97% of programs had websites, but less than 50% provided information about call schedules, resident benefits, and resident research [12]. All of these factors have been ranked as important to residents [7,21]. Between the shared categories with Oladeji et al, we found that more programs mentioned resident salary, resident research requirements, publications, research and educational support, journal clubs, and didactics [12]. Information on call responsibility rose slightly to 50.8% (96/189), and resident wellness activities remained at 50.3% (95/189). Only information regarding rotation schedules dropped between studies (132/189, 69.8%).

For data collection unique to our study, we found that international opportunities were listed on 16.9% (32/189) of websites and fellowship match lists were included on 56.1% (106/189) of websites. While the mention of international opportunities was scarce, the low percentage of fellowship match lists was particularly concerning, given that over 90% of residents choose to complete an orthopedic surgery fellowship following graduation [22]. We also found that, despite the anticipated changes to application metrics, including scoring changes to USMLE Step 1, only 28.0% (53/189) of websites mentioned USMLE Step 2 application requirements and 14.3% (27/189) indicated preferences for an eSLOR [23].

Perhaps the most concerning of our findings was the low effort to promote racial and gender diversity on websites. Less than 25% of programs addressed either underrepresented minorities (42/189, 22.2%) or gender diversity (39/189, 20.6%). Over the past 10 years, racial and gender diversity among orthopedic surgery residency programs has remained stagnant compared to the rise observed in medical schools [24]. Despite feedback provided by faculty and residents, orthopedic surgery residency programs continue to have the lowest ratio of female to male residents than any other specialty [19,24].

Limitations

Several limitations to this study exist. Since this study started in July 2020, we could not capture COVID-19–related changes prior to this period. Additionally, authors only documented if variables were mentioned on the websites and did not assess the quality of the information. Although data collection by two authors added to the internal validity of the study, we could not control for interrater variability. This study also did not include potential items of interest, such as interview dates, cases performed and their volumes, and operative approaches.

Recommendations

The data for this study were collected within a 5-month period from July to November 2020. Although traffic metrics are unavailable, it is reasonable to assume that most applicants visited sites during this time to prepare for ERAS deadlines. This study identified an overall paucity of information on program sites and an inadequate response to the COVID-19 pandemic. Further, websites were difficult to navigate, and important information was dispersed across several tabs. This may have led applicants to overlook time-sensitive application requirements and miss deadlines.

We propose several recommendations to improve website quality and quantity of information during the current pandemic and future states of emergency. First, we encourage the ERAS directory of programs to include hyperlinks for all orthopedic surgery residency programs. If a functional hyperlink to a program cannot be found, ERAS should contact the program and encourage it to either provide a link or create a new one if unavailable. Second, all programs should be made aware of standardized information and organization that applicants find useful, such as the ones described in this study. It will ultimately be left to the discretion of the programs whether or not to adjust. Due to the evolving situation of the COVID-19 pandemic, ERAS should encourage and potentially require websites to upload monthly updates. Uploading information about the program's response to COVID-19 not only has implications for recruitment, but also addresses concerns about safety [8,25]. Since travel restrictions have limited physical visits by applicants to programs, programs should also be encouraged to include at least one virtual tour and one program video on their websites. Additional videos should be uploaded to highlight program diversity and wellness. To make the application process more personable, applicants should also have the option to schedule video meetings with current residents and faculty via program websites [26]. The COVID-19 pandemic has drastically altered the virtual arena. Making the changes proposed in this study will undeniably facilitate the application process for future residents.

Conclusions

This study highlights the inadequate response of orthopedic surgery residency programs to update their websites during this entirely virtual application cycle. As a competitive specialty with the third-lowest specialty match rate, orthopedic surgery programs still have a lot of work to do to improve their online presence, promote diversity, and enhance opportunities for virtual applicants [1,19]. With limited information, applicants must identify unique ways to learn about residency programs and gauge their chances for a successful match.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Orthopedic surgery residency program websites with added videos between July and November 2020 compared by program size.

[PNG File , 51 KB - mededu_v7i3e30821_app1.png]

Multimedia Appendix 2

Orthopedic surgery residency program websites with added virtual tours between July and November 2020 compared by program size.

[PNG File , 26 KB - mededu_v7i3e30821_app2.png]

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Abbreviations

ERAS: Electronic Residency Application Service
eSLOR: Electronic Standardized Letter of Recommendation
USMLE: United States Medical Licensing Examination

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Short Paper

Rates of Assessment of Social Media Use in Psychiatric Interviews Prior to and During COVID-19: Needs Assessment Survey

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Abstract

Background: Current research suggests that there is a nuanced relationship between mental well-being and social media. Social media offers opportunities for empowerment, information, and connection while also showing links with depression, high-risk behavior, and harassment. As this medium rapidly integrates into interpersonal interactions, incorporation of social media assessment into the psychiatric evaluation warrants attention. Furthermore, the COVID-19 pandemic and containment measures (ie, social distancing) led to increased dependence on social media, allowing an opportunity to assess the adaptation of psychiatric interviews in response to sociocultural changes.

Objective: The first aim of this study was to evaluate if general psychiatry residents and child and adolescent psychiatry fellows assessed social media use as part of the clinical interview. Second, the study examined whether changes were made to the social media assessment in response to known increase of social media use secondary to social distancing measures during the COVID-19 pandemic.

Methods: As part of a quality improvement project, the authors surveyed general psychiatry residents and child psychiatry fellows in a university-based training program (n=21) about their assessment of social media use in patient evaluations. Soon after the survey closed, “stay-at-home” orders related to the COVID-19 pandemic began. A subsequent survey was sent out with the same questions to evaluate if residents and fellows altered their interview practices in response to the dramatic sociocultural changes (n=20).

Results: Pre-COVID-19 pandemic survey results found that 10% (2/21) of respondents incorporated social media questions in patient evaluations. In a follow-up survey after the onset of the pandemic, 20% (4/20) of respondents included any assessment of social media use. Among the 15 participants who completed both surveys, there was a nonsignificant increase in the likelihood of asking about social media use (2/15, 13% vs 4/15, 27%, for pre- and during COVID-19, respectively; McNemar χ^2_1=0.25, P=.617, Cohen d=0.33).

Conclusions: These small survey results raise important questions relevant to the training of residents and fellows in psychiatry. The findings suggest that the assessment of social media use is a neglected component of the psychiatric interview by trainees. The burgeoning use and diversity of social media engagement warrant scrutiny with respect to how this is addressed in interview training. Additionally, given minimal adaptation of the interview in the midst of a pandemic, these findings imply an opportunity for improving psychiatric training that incorporates adapting clinical interviews to sociocultural change.

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KEYWORDS

social media; screentime; problematic Internet use; psychiatric interview; psychiatric training; COVID-19; residency; training; survey; psychiatry; evaluation; quarantine

Introduction

Social media can be defined as computer-mediated technology that allows individuals to use online profiles to share user-generated content as well as network and communicate within the platform [1]. In the United States, 90% of adolescents [2] and 72% of adults report using at least one social media platform [3], and it is rapidly becoming a significant component, if not the leading one, in many interpersonal interactions.

Social connection is a long-investigated component of mental well-being. Social isolation and loneliness are associated with negative mental health outcomes including depression and suicidality [4], and in turn, symptoms of psychiatric illnesses can make it more difficult to establish and sustain close relationships [5]. Social support has been shown to bolster resilience to stress, improve functionality in the setting of trauma-related disorders, and decrease the rate of medical comorbidities [6]. As social media becomes integrated into the fabric of human connection, it has great potential to influence mental well-being, and incorporation of social media assessment into the psychiatric evaluation as part of a complete history warrants attention.

Rather than being uniformly negative or positive, the psychological impact of social media is nuanced [7]. Benefits include easier access to new information and more opportunities for interaction with support networks that otherwise may not be as easily accessible [8]. This is particularly significant for patients with disabilities, those who identify with a marginalized group, and those who live in more geographically isolated areas [7]. Social media platforms can be spaces for positive support around healthy behaviors including smoking cessation, meditation, exercise, and nutrition [7].

In contrast, research indicates that problematic internet use and gaming could reflect symptomology of addiction, with 50% of adolescents and 27% of adults stating they feel “addicted” to their device [9]. Social media use also creates new arenas for sexual exploitation, harassment, and bullying as well as for exposure and access to potentially harmful behaviors including drugs, alcohol, and higher-risk sexual behavior [7].

The specific impact of social media use seems to be influenced by how and how much individuals engage. For example, adolescents who spend more than 3 hours per day using social media may be at heightened risk for mental health problems, and those who actively post and share content report increased satisfaction than those who engage more passively [10,11]. A survey of young adults indicated that, while social media use itself was a poor predictor of mental health outcomes, “vaguebooking,” a style of post offering little information but written to elicit concern, is correlated with increased risk for suicidal ideation [12].

Despite evidence linking well-being with some social media usage patterns, there are not official guidelines on screening for social media use within psychiatry. In January 2020, the University of Wisconsin psychiatry residency program held both a journal club and a Grand Rounds on the topic of social media and mental health. While those in attendance clearly recognized the relevance of the topic, we questioned whether our clinical training reflected this perspective. We developed a quality improvement project to examine this, starting with a survey of current clinic practice.

Soon after this survey was closed, the COVID-19 pandemic began, leading to a significant increase in social isolation and increased use of social media for connection and communication [13]. A recent article examining social media use in Wuhan, China during lockdown due to COVID-19 indicated that there were here higher rates of anxiety and depression among individuals with more social media exposure [14]. The unique circumstances instigated by the pandemic prompted further investigation into whether the frequency of assessing social media use during psychiatric interviews increased in response to this global shift in communication practices.

Methods

The pre-COVID-19 survey was developed as part of a needs assessment for a quality improvement project that aimed to identify rates of assessment of social media by residents during psychiatric interviews. The survey included 5 items (see Multimedia Appendix 1). Participants rated their own knowledge about social media use and mental health on a 3-point scale: very, somewhat, and not familiar (item 1). Participants indicated whether they routinely asked patients about their social media use (“Yes,” “No,” “only inpatient,” “only emergency room”; item 2). Participants then indicated whether they had clinical cases where they found social media use to be of benefit (item 3) or harm (item 4) to their patients. Lastly, participants indicated whether they would find a brief interview guide useful for their clinical practice (item 5).

The pre-COVID-19 survey was sent by email to a listserv including residents and child and adolescent fellows in the Department of Psychiatry at the University of Wisconsin. This listserv included 42 individuals. Of note, residents begin evaluating child and adolescent patients halfway through their intern year, thus all participants have exposure to patients of all ages. Respondents were entered into a random drawing to receive a gift card as thanks for participation. The pre-COVID-19 survey was open from February 7, 2020 through March 5, 2020.

On March 21, 2020, in response to the COVID-19 pandemic, the Wisconsin governor passed a “safer at home order.” Businesses, schools, and parks were closed, and people were confined to their homes. A second survey was sent out to the same listserv. This “during COVID-19 survey” reassessed participants’ frequency of asking about social media use since the safer at home order and their perception of benefit or harm of social media use (ie, items 2, 3, and 4 from the pre-COVID-19 survey). The during COVID-19 survey was opened on May 7, 2020 and closed on June 1, 2020.

We focused primarily on descriptive statistics for data collected pre- and during COVID-19. However, as pre- and during COVID-19 data were available for a subset of participants, we also conducted exploratory McNemar tests to evaluate whether responses changed significantly. Given the small sample size and likelihood that tests were underpowered, we included Cohen *d* effect sizes to allow interpretation of the magnitude of changes pre- and during COVID-19.

Results

The response rate for the pre-COVID-19 survey was 50% (21/42) and for the during COVID survey was 48% (20/42); 15 participants completed the survey at both time points. The majority of participants (17/21, 81%) indicated they were "somewhat familiar" with the impact of social media on mental health. Most respondents reported having noted clinical case(s) in which social media was of benefit (13/21, 62%) as well as cases in which social media was hazardous (17/21, 81%). However, a minority of residents and fellows (2/21, 10%) routinely asked patients about their social media use pre-COVID-19. All participants noted a brief interview guide for assessing social media use would be valuable.

On the during COVID-19 survey, rates of benefits (13/20, 65%) and hazardous use (14/20, 70%) were similar to pre-COVID-19. Similar to pre-COVID, a minority of participants (4/20, 20%) indicated they routinely ask patients about social media use.

Among the 15 participants with data at both times points, there was a nonsignificant increase in the likelihood of asking about social media use (2/15, 13% vs 4/15, 27%, for pre- and during COVID-19, respectively; McNemar χ^2_1=0.25, *P*=.617, Cohen *d*=0.33). There was a nonsignificant increase in the likelihood of cases in which social media use was a benefit (10/15, 67% vs 11/15, 73%, for pre- and during COVID-19, respectively; McNemar χ^2_1=0.00, *P*=.999, Cohen *d*=0.14) and a nonsignificant decrease in the likelihood of cases in which social media use was hazardous (13/15, 87% vs. 11/15, 73%, for pre- and during COVID-19, respectively; McNemar χ^2_1=0.25, *P*=.617, Cohen *d*=–0.33).

Discussion

We initially set out to examine if psychiatry residents ask patients about social media use as part of a quality improvement project. Subsequently, the COVID-19 pandemic and its impact on social media use at the population level motivated us to assess whether the psychiatric interview was modified accordingly. At both time points, survey responses suggest that social media use is rarely included by trainees during psychiatry interviews, despite the fact that respondents recognized the clinical relevance of social media use and were able to identify clinical cases of both benefit and harm. Although nonsignificant, there was a numeric increase in the likelihood of assessing social media usage during COVID-19, potentially in response to increased social isolation occurring in the population [13,15]. Not surprisingly, this small-magnitude effect (*d*=0.33) was not statistically significant in our sample of 15. Despite the possibility that rates may have increased, the fact that the vast majority of clinicians failed to assess social media usage even amidst COVID-19 highlights a potential gap in training.

There are important methodological limitations in this study. Consistent with a quality improvement project, we conducted no a priori sample size planning. Ultimately, the sample size was small, and analyses were underpowered to detect small or even moderate magnitude effects. Initially designed as a needs assessment, the survey design prioritized brevity and sacrificed complexity. Only a single residency was evaluated, thus limiting generalizability. Lacking a during COVID-19 assessment only group, we are unable to rule out the possibility that follow-up responses were influenced by repeated testing rather than COVID-19.

Future areas of study include querying faculty assessment and teaching practices, extending the survey to other residencies, evaluating barriers to assessing social media use, and investigating whether residents feel equipped to respond to higher-risk behavior or information they gather as a result of assessing for social media use. More broadly, future studies could evaluate residents' comfort adapting the general interview to different sociocultural contexts and changes.

These limitations notwithstanding, we believe these preliminary data highlight an important training gap in the assessment of social media utilization during the psychiatric interview and areas for future study and improvement.

Conflicts of Interest

ZS received grant support from the National Institutes of Health and the Centers for Disease Control and Prevention. He is also on the advisory board of Sage Therapeutics. SBG received grant support from the National Center for Complementary & Integrative Health of the National Institutes of Health (K23AT010879).

Multimedia Appendix 1
Survey items and responses.
[DOCX File , 16 KB - mededu_v7i3e28495_app1.docx]

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Original Paper

The Role of Online Arts and Humanities in Medical Student Education: Mixed Methods Study of Feasibility and Perceived Impact of a 1-Week Online Course

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Abstract

Background: The arts and humanities have been integrated into medical student education worldwide. Integrated arts and humanities courses have been found to serve four primary functions: mastering skills, perspective taking, personal insight, and social advocacy. To what extent and how arts and humanities programs achieve these educational outcomes remain unclear.

Objective: In this study, we aimed to explore how the arts and humanities may lead to perceived benefits in clinical skills development, professional identity formation, and self-care, and to evaluate the feasibility of delivering an arts and humanities–based course online.

Methods: We developed and delivered a 1-week online arts and humanities course to second- through fourth-year medical students. A total of 18 students enrolled in the course across its 2 offerings in Spring 2020. The course was primarily visual arts based but also included activities based in other arts and humanities, such as literature, reflective writing, dance, film, music, philosophy, and religion. Using a mixed methods approach, daily polls assessed student engagement in and perceptions of the various activities, and a postcourse survey assessed student perceptions of the course as a whole.

Results: At least 93% of poll respondents (14/15 to 17/18) across the 2 cohorts rated each type of activity as good or excellent. Qualitative analysis of student responses to the postcourse survey revealed themes concerning both the form (overall course design and online format) and the function of the course (skills development, appreciation of new perspectives, and personal inquiry).

Conclusions: Results suggested that the arts and humanities may support the development of clinically relevant skills and attitudes. A more unique finding was that integrative arts and humanities courses delivered online—including those that are primarily visual arts based—engage students and may yield personal and professional benefits.

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KEYWORDS

visual arts; professional identity formation; online; visual thinking strategies; arts and humanities; arts; humanities; education; medical students; medical education; teaching

Introduction

The practice of medicine requires both bioscientific knowledge and humanistic caregiving. As the presence of science and technology in medicine expands, the scales increasingly tilt away from humanism to the detriment of patient care. The arts and humanities hold promise for righting that imbalance, and educators worldwide are calling to integrate arts and humanities programs across the continuum of medical education [1].

With regard to *what* the integration of the arts and humanities into medical education might achieve, the current literature highlights a number of diverse but related benefits. A previous review of the literature suggests that integrative arts and humanities programs serve three roles in medical education: additive, curative, and intrinsic. Art serves as a catalyst for reflection and discussion that can be enjoyable, enhance well-being, and support the development of clinically relevant skills, such as observation, communication, and clinical reasoning [2,3]. A more recent review proposes a slightly different conceptual model that suggests that, in addition to traditional skill mastery, the arts and humanities can promote perspective taking, personal insight, and social advocacy among medical learners [1,4].

A related concept, also thought to benefit from exposure to the arts and humanities [1], is professional identity formation (PIF), defined as a process of psychological and social development that occurs within the larger context of overall identity formation [5]. As part of PIF, medical learners must integrate reflection at an individual level and a collective level, iteratively rethinking and remolding their view of themselves as they reconcile their personal and professional identities [5].

With regard to *how* the arts and humanities might be effectively integrated, most programs have primarily used literature, reflective writing, or narrative medicine to teach medical students [1]. The few programs that focus on visual arts to teach clinical skills development are administered to preclinical medical students [6]. No visual arts–based program—either online or in-person—specifically designed for clinical-year medical students has been described in the literature.

To address this gap, we developed an in-person visual arts–based elective designed specifically for fourth-year medical students prior to entry into residency. We aimed the course primarily at PIF, with secondary considerations of clinical skills development and self-care, as clinical skills development is directly relevant to one's development as a professional. Furthermore, support of self-care can help address the anxiety associated with reflection and compromise in PIF [5]. To meet the needs of our university's students due to the COVID-19 pandemic, in March 2020 our team restructured this planned 4-week in-person course to a 1-week online course offered to second- through fourth-year medical students. We delivered this 1-week online course twice in Spring 2020.

Through this course, we sought to evaluate the feasibility of online engagement and to explore to what extent the arts and humanities, and particularly the visual arts, may facilitate clinical skills development, PIF, and self-care. In addition, we sought to understand which pedagogical strategies might best support engagement with the arts and humanities, using the unique circumstances of the COVID-19 pandemic to assess the feasibility or benefit of an online format. We hypothesized that students would engage in an online course and perceive growth in clinical skills, PIF, and self-care. We further hypothesized that participation in the course would lead students toward a clearer understanding of and a deeper appreciation for the role of arts and humanities in medical education.

Methods

Course Overview

In consultation with three museum educators (authors EB, SW, PY), the course was developed by a multidisciplinary team, comprised of a Johns Hopkins University (JHU) medical school faculty member and physician (author MSC), an internal medicine resident (author HJK), a medical student (author KS), and a research coordinator (author MKH). Two of the museum educators (EB and SW) were instrumental in developing the in-person activities, which the teaching team (MSC, HJK, KS, MKH, PY) adapted to an online format with the assistance of the third museum educator (PY) [7].

This 5-day full-time (40 hours/week of total expected work) online course was offered as an elective to second- through fourth-year JHU medical students in April and May 2020. The course consisted of five 2-hour synchronous online Zoom sessions each morning (Monday to Friday), followed by 6 hours of out-of-class assignments, which the students completed independently each afternoon. Each synchronous session followed the same structure: daily check-in, a visual thinking strategy (VTS) session, sharing of the previous day's independent assignments, a unique daily group activity, an individual written reflection, and a closing meditation. VTS sessions were led by PY, co-developer of the VTS method and curriculum. In this method, the facilitator leads students in discussion of a particular object of observation—most frequently a piece of art—using a series of three questions: (1) What's going on in this picture? (2) What do you see that makes you say that? and (3) What more can we find? [7]. In a randomized controlled trial with nonmedical learners, the VTS method has been shown to improve critical thinking skills and has been incorporated in a wide variety of educational settings among a spectrum of child to adult learners [8]. Other activities were facilitated by one or more members of the teaching team, with breakout rooms accommodating the variety of formats for these activities (Table 1).

Table 1. Synchronous session course structure.

Activities	Day 1	Day 2	Day 3	Day 4	Day 5
Daily check-in (5 min)	Same each day	Same each day	Same each day	Same each day	Same each day
First group activity (35 min)	Pair and Share Introduction	VTS[a] session (*Interior, Mother and Sister of the Artist*, Édouard Vuillard)	VTS session (*St Hugh in the Carthusian Refectory*, Francisco de Zurbarán)	VTS session (*Wedding Portrait*, Njideka Akunyili Crosby)	VTS session (*Love After Love*, Derek Walcott)
Sharing from the previous day's independent assignments (35 min)	N/A[b]	Object of Connection: Students find an object in their space that connects them to their family or community.	Relationship Gift: Students create a gift out of objects at home or in nature for the relationship described in the previous day's group activity.	Motivations and Aspirations: Students select and reflect on an image from a collected set that resonates with their motivations and aspirations in the field of medicine.	Forest Bath: Students take a mindful walk through nature.
Unique large group activity (30 min)	VTS session (*Christina's World*, Andrew Wyeth)	Relationship Activity: Students choose an image from a collected set and describe the relationship between two figures in the image.	Group Poem: Students are divided into two groups. Each member writes what the figure in the image is thinking or saying. The group constructs a poem out of each member's phrase and performs the poem for the other group.	Video (*Martyrs*, Bill Viola)	Self-Care Personal Responses Tour: Students choose an image from a collected set in response to individual, unique prompts oriented toward self-care.
Individual written reflection (15 min)	Prompt: "Describe yourself through glasses of a different prescription than your own."	Prompt: "Write about a family member you've never met."	Prompt: "Write about the world within you."	Prompt: "Describe the weight of the day."	Prompt: "Write about what you hope is in that package, lies beneath that shell, or is written on the next page."
Closing meditation (5 min)	*The Guesthouse*, Jelaludin Rumi	*Mercy Now*, Mary Gauthier	*One Art*, Elizabeth Bishop	*December 25*, Ted Kooser	*Lead*, Mary Oliver

[a]VTS: visual thinking strategy.

[b]N/A: not applicable.

Daily postsynchronous session independent assignments included online videos (eg, "The Danger of a Single Story," TED talk by Chimamanda Ngozi Adichie, "Pina" by Wim Wenders), podcasts (eg, "A Poem About What Grounds You" from Poetry Unbound), readings (eg, "The Moral Urgency of Anna Karenina: Tolstoy's Lessons for All Time and for Today" by Gary Saul Morson, "A Small Good Thing" by Raymond Carver, "The Hollow Men" by T.S. Eliot), a mindful walk through nature, and creating activities (eg, finding an object in their current space that reminds them of home, creating a gift for a relationship they observed in a chosen image) about which the group debriefed together the next day.

Evaluation Methods

All 18 students who enrolled in the 2 offerings of the course (10 and 8, respectively) were introduced to the optional research study at the beginning of the course and invited to participate via daily polls and a postcourse survey. This research study protocol was reviewed and deemed exempt by the JHU School of Medicine Institutional Review Board (IRB00244745).

Quantitative Measures

To assess real-time engagement in the online course, at the end of each synchronous session, we asked the students to rate the day's synchronous and the previous day's independent assignments and closing meditation on a 5-point Likert scale (1=poor to 5=excellent). Polls were anonymous, and we informed the students that participation was optional. The previous day's independent assignments and closing meditation were evaluated 4 times due to the retrospective timing of these events, whereas all other activities were evaluated 5 times.

Qualitative Measures

We conducted simple thematic analysis of the open-ended items of our survey. At the end of the last day of the course, we invited students to complete an anonymous 9-item Qualtrics survey soliciting their opinions on overall course execution (ie, choice and format of activities) and perceptions of any benefits of the course. To assess the latter, we asked students to complete the prompts "I used to think . . ." and "Now I think . . ." with regard to their view on the arts' role in PIF, self-care, and clinical skills development (see Multimedia Appendix 1, which contains the complete survey). A total of 7 students in April (response rate=70%) and 4 students in May (response rate=50%) participated in the survey (11/18, 61% overall response rate).

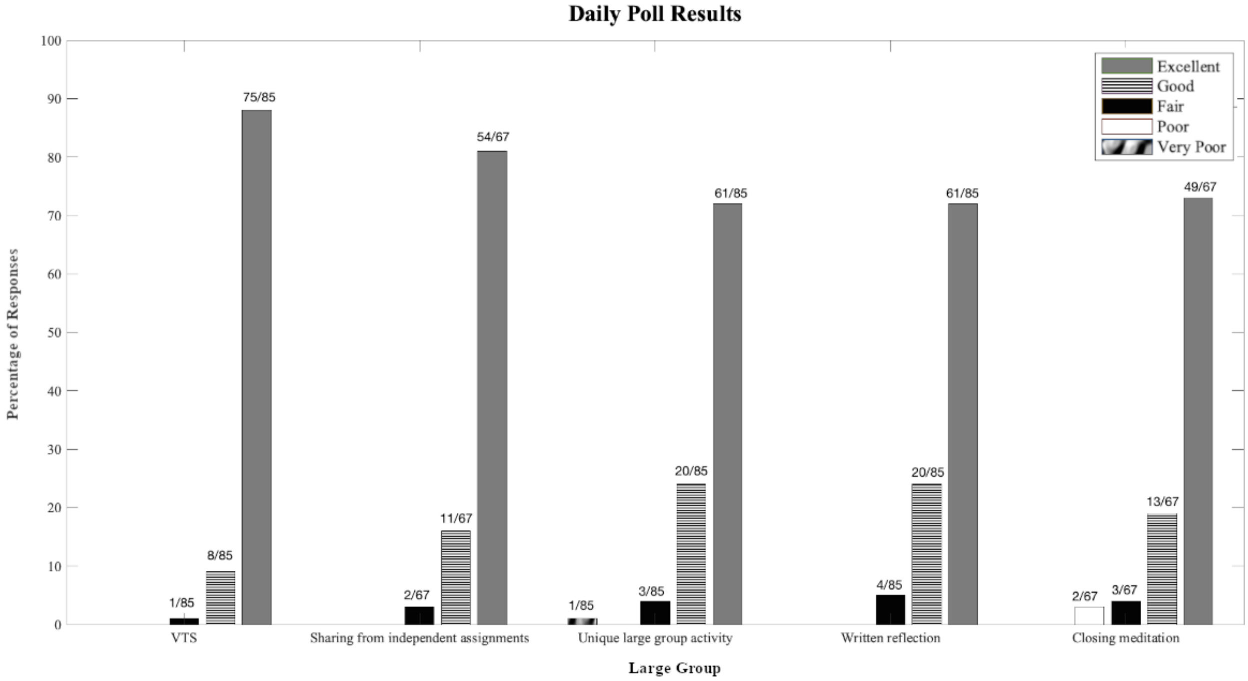
To evaluate responses to the open-ended survey items, we followed a phasic method of coding and analysis [9]. First, two reviewers (HJK and KS) independently generated themes of surveys from cohorts 1 and 2 using open coding. Initial codes were then consolidated for each survey with the help of a third reviewer (MSC), and the two codebooks were merged into one final codebook. HJK and KS then independently recoded the surveys with NVivo software (QSR International, Doncaster, Australia) using the final codebook [10]. Final coding discrepancies were resolved with the third coder.

Results

Quantitative Measures

We report results of the daily polls in Figure 1. Results reflect average ratings across all 5 days of the course, with items evaluated 4 or 5 times over the course. At least 75% of students in each session (9/10 and 6/8 students in cohorts 1 and 2, respectively) participated in the polls each day, and the total participation across the 2 sessions summed to between 83% (15/18) and 100% (18/18) each day with an average of 94% (17/18) participation across the week. At least 93% (between 14/15 and 17/18) of respondents rated all activities as good or excellent. The most highly rated activities were VTS sessions and debriefs/discussions of the previous day's assignments.

Figure 1. Daily poll results from cohorts 1 and 2 (N=8-10 and N=6-8 per day, respectively) tallied across 5 days. Percentages taken over the total number of responses per activity across 5 days across 2 cohorts. VTS: visual thinking strategy.



Qualitative Measures

We report results of the postcourse survey in Table 2. From the survey, 5 themes emerged, which we grouped into 2 broad categories: form and function.

Table 2. Emergent themes from survey responses across cohorts 1 and 2 (n=11).

Theme	Description/content	Exemplary quote(s)
Form		
Course design	• Course activities • Format of activities (synchronous vs asynchronous, large vs small group) • Sequence of activities • Facilitation methods	• "In the spirit of recognizing how various activities and actions build on each other in subtle ways to make a big difference, I felt that each day was complementary to and enhanced the previous day's work."
Online format	• Aspects uniquely specific to the virtual platform	• "The comfort of home can also facilitate reflection. Although there are benefits to being in a museum, being at home comes with unique advantages for self-reflection."
Function		

Skills development	• Building of clinical skills:
	  • Observation
	  • Interpretation
	  • Clinical reasoning
	  • Empathy
	  • Communication
		• "It can help me to have an open mind, to observe, to listen."
		• "We can . . . come up with different interpretations [of art] like [a] differential diagnosis."

Appreciation of new perspectives	• Exposure to diverse perspectives of others • Understanding and appreciation of the importance of multiple perspectives in meaning making	• ". . . each person's perspective (including my own) is valid and enables us to see more; there are no right or wrong answers."
Personal inquiry	• New and rediscovery of aspects of self • Personal growth • Inner peace • Personal and professional identity integration • Expansion of personal perspective • Broadened view of the role of art in one's personal life and profession	• "The synthesis of all of this work left me feeling more mindful and human." • "It really helped me get in touch with myself and remember why I wanted to become a physician, which I feel is something I had lost recently." • "I feel that art can help me connect with the core feelings that led me to this profession and guide my career goals. Thus, art can help facilitate professional identity formation."

Form

Course design and online format themes encompass insights into how structural elements of the course facilitate learning.

Course Design

This theme emerged from comments related to the sequence and facilitation methods of specific activities. Students appreciated beginning each synchronous session with a VTS session, describing it as a way to "get creative juices flowing." Students enjoyed the interactive nature and varied format of the activities, facilitated via the use of breakout rooms.

Online Format

This theme emerged from comments regarding the advantages and disadvantages of an online platform. Some students cited physical distance as a "barrier to speak and share." Others said "the comfort of home . . . facilitate[d] self-reflection" and allowed them to "share and overcome fears of speaking to a group."

Function

Skills development, appreciation of new perspectives, and personal inquiry themes focused on the role the course played more broadly in the students' professional and personal lives.

Skills Development

This theme emerged from comments highlighting the development of concrete skills applicable outside of the course.

Students felt that skills of empathy, observation, listening, and communication were strengthened through the course, transferrable "tools" they could "practice on their own time or with another group." Students observed that discussions around art paralleled diagnostic reasoning and could help them "form a differential diagnosis."

Appreciation of New Perspectives

This theme emerged from comments related to the importance of others' perspectives in shaping one's own understanding, recognizing bias, and building something larger than themselves.

Through group activities and discussions, students became "more aware" of the many interpretations that coexist around a single piece of art. They noticed the "power of observation as a group" and of multiple perspectives in prompting the "acceptance of uncertainty/ambiguity" and recognition of their own biases and "pre-existing thoughts." Students welcomed the opportunity to "broaden their perspectives" and praised the summative perspective that resulted from teamwork as "something greater than each on [their] own."

Personal Inquiry

This theme emerged from comments describing personal growth and a deepened connection with self.

Students "learned more about [themselves]," reflected on their growth in medical school, and "rediscovered parts of [themselves]," such as their motivations for pursuing medicine. They achieved an "inner peace" and a sense of "being in touch with oneself." The course "built character" and "made [them] a better person." Students realized a sense of ownership over their development, recognizing how they, not others, "need to be the one[s] to form [their] professional identity."

Students noted shifts in their views of the meaning of art and its role in their lives. They deemed art a means of self-expression, a teaching tool, an active rather than a passive activity, and a discussion-based group experience rather than an individual one. They cited art as a platform for "approaching difficult topics like death." Students considered art "essential" to their PIF, allowing them to "connect with [themselves]" and others and cultivate self-care practices.

Complex Comments

We also identified a number of complex comments embodying multiple themes. Intersecting both personal inquiry and an appreciation of perspectives, one student wrote, "Arts have an important role in clinical skills development—VTS [sessions] helped [me] recognize the limitations of [my] own views and cultivate an appreciation for others' views." Another student encompassed all three functional categories in writing that "a sense of community and connection to others . . . can enhance one's professional identity and connect with others in [the] field."

Discussion

Principal Findings

We explored the role of an online, primarily visual arts–based arts and humanities course designed to facilitate clinical skills development, PIF, and self-care in 2 cohorts of medical students. From student responses to open-ended survey items, we identified 2 formal themes (course design and online format) and 3 functional themes (skills development, appreciation of new perspectives, and personal inquiry). Consistent with a recent review of online medical education endeavors [11], our results suggest an online platform can be an effective format for integrative arts and humanities programs, particularly visual arts–based courses. Additionally, in supporting self-care, our course addresses the need for more holistic approaches in medical education in order to combat the impact on students of not only the usual stresses medical education and training in general hold but also those additional stresses experienced by students during the COVID-19 pandemic [11].

The functional themes that emerged from our study reflect elements of the major conceptual models regarding integrative arts and humanities programs [1,2,4]. Overall, the similarities in themes that emerged from our study to those of models described previously in the literature suggest the strength and validity of these models' conceptualization of the role of integrative arts and humanities programs in skills, relational, and personal development. This congruence—coupled with complex statements that reflect multiple themes—highlights that benefits of integrative arts and humanities programs are multifaceted and interwoven, and, as a result, can be difficult to measure.

Our results offer several additional insights into how arts and humanities programs can be effective. First, the results suggest that it is feasible to deliver arts and humanities programs online—even if primarily visual arts based—in a way that engages students. This expands upon the previously identified role of visual arts–based courses solely in skills development and supports the use of such courses in other educational avenues as well [12]. Second, our results suggest that even brief arts and humanities programs, such as this 1-week course, can lead to benefits. Third, arts and humanities programs may offer benefits to both preclinical- and clinical-year students. Fourth, integrative arts and humanities programs have the potential to inspire future growth and development, both personally and professionally. Fifth, delivering arts and humanities programs in an interactive group format may be especially important in fostering skills mastery, perspective taking, and personal insight among students. In many ways, the structure of VTS sessions parallels the process of forming a clinical diagnosis. In VTS sessions, students are asked to (1) make observations over time, (2) base inferences on evidence, (3) listen to others' ideas, (4) hold multiple interpretations as plausible, and (5) revise their interpretations, often tolerating ambiguity. As such, the VTS method supports the development of observational, communication, interpersonal, and diagnostic skills (1,2,3); of perspective taking (3,4); and of personal insight (5) in students as they reflect on their own views.

Limitations

Although our study supports a role for online arts and humanities programs in medical student education that is consistent with previous studies, we acknowledge several limitations. First, like all studies, ours was vulnerable to bias. Yet, to attempt to mitigate bias, we conformed to a standard methodology for our qualitative analysis, with two independent reviewers and the use of a third reviewer for resolving discrepancies. Second, our course enrollees were a self-selected sample from a single institution, and thus, their experience of the course may not be generalizable to other students. Third, although our daily poll and postcourse survey response rates were greater than 50%, our total class enrollment (N=18) and subsequent sample size (n=11, 61%) were both small. Fourth, our methods of evaluation were limited to one survey administered one time (at the end of the course) and, therefore, could not assess (1) potential longitudinal benefits of our course, (2) discrete changes in skills or behavior, or (3) more extensive sentiments as might have been gleaned through measures such as interviews or focus groups. Fifth, although the course faculty was interprofessional, including learners, our museum educator facilitator (PY) who led the VTS sessions is a cofounder of the method and thus the impact of the VTS activity may not be generalizable to other teaching teams. Sixth, as the course was delivered during the COVID-19 pandemic, this unusual circumstance may have exaggerated the educational benefits of online arts and humanities programs compared to pre-pandemic times.

Conclusions

Amid the COVID-19 pandemic, we transitioned an in-person art museum–based course aimed at fourth-year medical students to an online platform. We aimed to quantitatively and qualitatively explore whether and how the course engaged students and influenced clinical skills development, PIF, and self-care. In addition, we aimed to understand which activities were perceived by the students as most impactful in achieving these results. Our study highlighted the role of a diverse set of activities, including visual arts–based activities, such as VTS sessions, in engaging students and potentially fostering development in areas of skills development, appreciation of new perspectives, and personal inquiry. Additionally, we demonstrated that these activities could be engaging and perceived as beneficial even when delivered online. Overall, our findings support the Association of American Medical Colleges' recommendations for investigating and implementing arts and humanities integration into medical education [1]. To accurately capture the full breadth and depth of the impact of the arts and humanities in medical student teaching, continued evaluation of such programs, including controlled trials, learner assessment at the level of behavioral change, longitudinal follow-up, and ongoing revision of current conceptual models [1], will be needed.

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Authors' Contributions

KS, HJK, MKH, MSC, and PY designed and ran the online course. SW and EB designed the in-person museum sessions on which the online course was based. JS aided in background research and quantitative analysis of data from polls. KS, MKH, and MSC conducted the thematic analysis of surveys. KS drafted the manuscript. EB, MSC, HJK, MKH, JS, SW, and PY provided feedback on the manuscript. All authors approved the final version and agree to be accountable for all aspects of the work.

Conflicts of Interest

None declared.

Multimedia Appendix 1
Postcourse survey administered to students.
[PDF File (Adobe PDF File), 115 KB - mededu_v7i3e27923_app1.pdf]

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Abbreviations

JHU: Johns Hopkins University
PIF: professional identity formation
VTS: visual thinking strategy

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Tutorial

Creation of a Student-Run Medical Education Podcast: Tutorial

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Abstract

Background: Podcasting has become a popular medium for medical education content. Educators and trainees of all levels are turning to podcasts for high-quality, asynchronous content. Although numerous medical education podcasts have emerged in recent years, few student-run podcasts exist. Student-run podcasts are a novel approach to supporting medical students. Near-peer mentoring has been shown to promote medical students' personal and professional identity formation. Student-run podcasts offer a new medium for delivering near-peer advice to medical students in an enduring and accessible manner.

Objective: This paper describes the creation of the *UnsCripted Medicine Podcast*—a student-run medical education podcast produced at the University of Cincinnati College of Medicine.

Methods: The planning and preparatory phases spanned 6 months. Defining a target audience and establishing a podcast mission were key first steps. Efforts were directed toward securing funding; obtaining necessary equipment; and navigating the technical considerations of recording, editing, and publishing a podcast. In order to ensure that high professionalism standards were met, key partnerships were created with faculty from the College of Medicine.

Results: The *UnsCripted Medicine Podcast* published 53 episodes in its first 2 years. The number of episodes released per month ranges from 0 to 5, with a mean of 2.0 episodes. The podcast has a Twitter account with 217 followers. The number of listeners who subscribed to the podcast via Apple Podcasts grew to 86 in the first year and then to 218 in the second year. The show has an average rating of 4.8 (out of 5) on Apple Podcasts, which is based on 24 ratings. The podcast has hosted 70 unique guests, including medical students, resident physicians, attending physicians, nurses, physicians' family members, graduate medical education leadership, and educators.

Conclusions: Medical student–run podcasts are a novel approach to supporting medical students and fostering professional identity formation. Podcasts are widely available and convenient for listeners. Additionally, podcast creators can publish content with lower barriers of entry compared to those of other forms of published content. Medical schools should consider supporting student podcast initiatives to allow for near-peer mentoring, augment the community, facilitate professional identity formation, and prepare the rising physician workforce for the technological frontier of medical education and practice.

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KEYWORDS

podcast; medical student; near-peer; medical education

Introduction

Podcasting has become an established and increasingly popular means of delivering asynchronous educational content and entertainment. The potential for podcasts to be a platform for educational content was identified in the early 2000s [1,2]. Over the past decade, several medical education podcasts have risen to prominence and have been formally and informally included in both undergraduate and graduate medical education. For example, nearly 90% of emergency medicine residents have reported listening podcasts at least once per month to stay up to date with relevant literature [3]. Additionally, a small pilot study showed that podcasting was as effective as conventional lectures in increasing anesthesia residents' knowledge of electroencephalogram interpretation [4]. Medical students have also been identified as significant consumers of medical education podcasts [5]. Listeners have reported that podcasts deliver quality content, allow for personalized learning, and are more convenient than traditional print media [5]. Furthermore, podcasting platforms offer several benefits to content creators and educators.

A key benefit of podcast hosting is a lower barrier of entry compared to those of other forms of digital media. Video media production often requires expensive and specialized equipment; however, podcast creators can quickly and affordably produce quality content for their listeners. With regard to assisting physicians and medical educators in creating their own podcasts, several articles have been published describing the process of starting a medical education podcast [1,6-9]. However, all of the published literature regarding medical education podcast creation has been written by resident physicians, attending physicians, or professional medical educators; medical students' voices are absent.

Student-run podcasts are a novel approach to supporting medical students. Student-run podcasts can augment the sense of community within a medical school and introduce new opportunities for near-peer mentoring. For the purposes of this paper, near-peer mentoring is defined as a mentoring relationship in which a more senior learner (≥1 year higher) provides guidance and support to a new junior learner to enable the new student to navigate their own education [10]. Near-peer mentoring has been shown to promote medical students' personal and professional identity formation [10]. Student-run podcasts offer a new medium for delivering near-peer mentoring to medical students in an enduring and accessible way. Very few medical student–run podcasts exist, despite their potential to facilitate community engagement and empower learning. This paper describes the successful creation of the *UnsCripted Medicine Podcast*—a medical student–run podcast produced at the University of Cincinnati College of Medicine (COM).

Methods

Overview of the Podcast

Our podcast project was formed to address a perceived need for increasing the amount of near-peer mentoring in the COM community. Through discussions with medical students across all 4 years of training, the creators of the *UnsCripted Medicine Podcast* found that medical students frequently seek informal advice from more experienced senior peers. Additionally, many students attended formal events involving expert panels that were comprised of senior medical students to prepare for upcoming courses and clerkships. Students reported an affinity for near-peer advice and mentoring resulting from the collegiality of the relationships they formed and a general trust of senior medical students resulting from their recent direct exposure to relevant experiences. Despite their popularity and perceived benefits, formal near-peer mentoring events occur at infrequent intervals, and informal relationships rely on both the initiative of the mentee and the availability of a sufficient number of willing mentors.

Podcasting was identified as an alternative and more accessible medium for providing near-peer mentoring and support to a larger and more diverse cohort of students. As such, 4 students who were interested in addressing this identified need engaged in conversations about the steps required to launch a podcast hosted by and for medical students. The early planning and discussions between these future hosts focused primarily on the target audience, mission and content, equipment and costs, technical skills, and professionalism.

Launch Timeline

Preliminary discussions, which started in July 2018, were followed by a 6-month preparatory phase. During this time, the podcast team engaged in strategic planning, performed a literature review, underwent technical training on audio recording and editing, developed a website with podcasting capabilities, and worked with COM leadership to ensure that administrative support and mentorship were available. The first episode was recorded in December 2018 and published in January 2019 (Figure 1).

Figure 1. A timeline of key milestones in the creation of the *UnsCripted Medicine Podcast*.

Target Audience

Identifying a target audience is the most crucial step in podcast creation [8]. It was intentionally determined that the podcast's content would target medical students within the local COM community. To best provide relevant and valuable content for our audience, we emphasized the delivery of local content—all episodes involved a combination of students, residents, physicians, and educators from within the COM community. Although this approach may have had the effect of limiting the breadth of listenership, it provided a way to build connections and enrich the depth of the community within the academic medical center.

Mission and Content

Podcasting is an open format that can accept any number of different views, perspectives, voices, and approaches to content creation. Although this is a great asset, open platforms pose unique challenges. Content creation must balance utility with entertainment and balance generalizability with specificity. Defining our mission—promoting student success through near-peer advice; uplifting the COM community by creating a broader sense of solidarity; and highlighting local clinicians, leaders, and educators—facilitated the creation of relevant and high-value content for our audience. At the core of our efforts was an emphasis on broadcasting diverse perspectives and creating an inclusive environment in which guests and hosts alike could share their unique stories. Through this mission, we sought to create a platform in which students could discuss their personal barriers and facilitators to academic and clinical success as well as relevant topics in wellness, humanism, and other domains that are not frequently discussed in the core curriculum.

The first 3 episodes were part of a series covering the US Medical Licensing Examination (USMLE) Step 1 exam. These episodes sought to provide general advice on how to approach the exam, included discussions of study schedules, and covered test day logistics. Given the efficacy of near-peer USMLE review courses, this was a natural starting point [11]. Due to its heightened relevance for preclinical medical students, this series had tremendous potential to quickly establish a large listenership. Subsequent episodes focused on academic success in preclinical coursework and subsequent core clinical clerkships. In these episodes, third-year and fourth-year medical students shared their experiences and success strategies. The recruitment of student guests focused equally on those who exhibited strong conversation skills and enthusiasm and those who demonstrated academic achievement. This was done to fulfill the stated goals of demystifying upcoming coursework and presenting multiple strategies for success through fluid and entertaining discussion. Episodes were recorded and released in accordance with the academic schedule, thereby providing just-in-time, near-peer advice for upcoming coursework. Upon the conclusion of the curricular series, episode content was expanded to other topics and themes (Textbox 1).

Textbox 1. Topics and themes of the UnsCripted Medicine Podcast.

Topics and themes

- US Medical Licensing Examination preparation
- Curricular success
- Web-based shadowing
- *Digital Second Look* series of episodes
- Careers in academic medicine
- Humanism
- Personal finance
- Social media
- Premedicine and admissions
- Fireside chats (conversations with the College of Medicine faculty and leadership)

Equipment and Costs

PCs were used for the recording and editing of all episodes. During initial in-person recording, we used a standard USB microphone. The COVID-19 pandemic necessitated a shift to remote recording, which required the purchase of additional USB microphones. The total costs associated with starting and operating the *UnsCripted Medicine Podcast* are detailed in Table 1.

The cost of entry could be a barrier for new podcast creators. Website hosting services and domain names are notable and recurring budget items. During the COVID-19 pandemic, remote recording software may add an additional expense. As medical students, our team has received partial funding from the COM Medical Student Association, which provides funding for student groups. Additional expenses were paid out of pocket by team members.

Table 1. Start-up costs for the launch of the *UnsCripted Medicine Podcast*.

Start-up requirements	Items and services used (cost; manufacturer)	Alternatives considered (cost; manufacturer)
Website and podcast hosting	Squarespace (US $144/year; Squarespace Inc)	Buzzsprout (US $144/year; Higher Pixels)
USB microphone[a]	Blue Microphones Yeti (US $129.99; Baltic Latvian Universal Electronics LLC)	Blue Microphones Snowball (US $69.99; Baltic Latvian Universal Electronics LLC)
Headphones[b]	Wired and wireless options (variable costs)	—[c]
Domain name	Squarespace (US $20/year; Squarespace Inc)	GoDaddy (variable; GoDaddy Inc)
Recording and editing software	GarageBand (free; Apple Inc)	Audacity (free)
Intro and outro music	YouTube Audio Library (free; Google LLC)	—
Logo	Freelance graphic designer (free)	—

[a]As a budget option, wired headphones with a microphone offer acceptable audio quality and are widely available. We discouraged the use of Bluetooth headphone microphones due to subjectively inferior audio quality.

[b]Headphone use during remote podcast recording is highly recommended to remove echoes.

[c]Not available. No alternatives were considered for this requirement.

Technical Skills

Although podcasting offers a relatively low barrier of entry, it is important to note the technical skills required. Each step of the process—audio recording, editing, publishing, operating a website, and social media promotion—requires a unique skill set. Depending on their technological fluency, podcasting could present a steep learning curve for new podcast hosts. Numerous web-based resources exist to facilitate this learning [12-15].

At the beginning of podcast production, each team member was assigned to only 1 portion of the production process. One individual edited all of the episodes, another managed the website and publishing process, and a third distributed the episodes to the student body. This resulted in a streamlined production process and allowed team members to become proficient in their assigned task. Once a steady workflow was established, expertise was shared within the group to ensure that each team member could record, edit, and publish episodes independently. The ability to independently produce an episode from start to finish was an important step for ensuring the steady production of episodes regardless of any one student's schedule or workload. This system also promoted sustainability because graduating students did not leave the podcast team without the necessary skills for carrying the project forward.

Professionalism

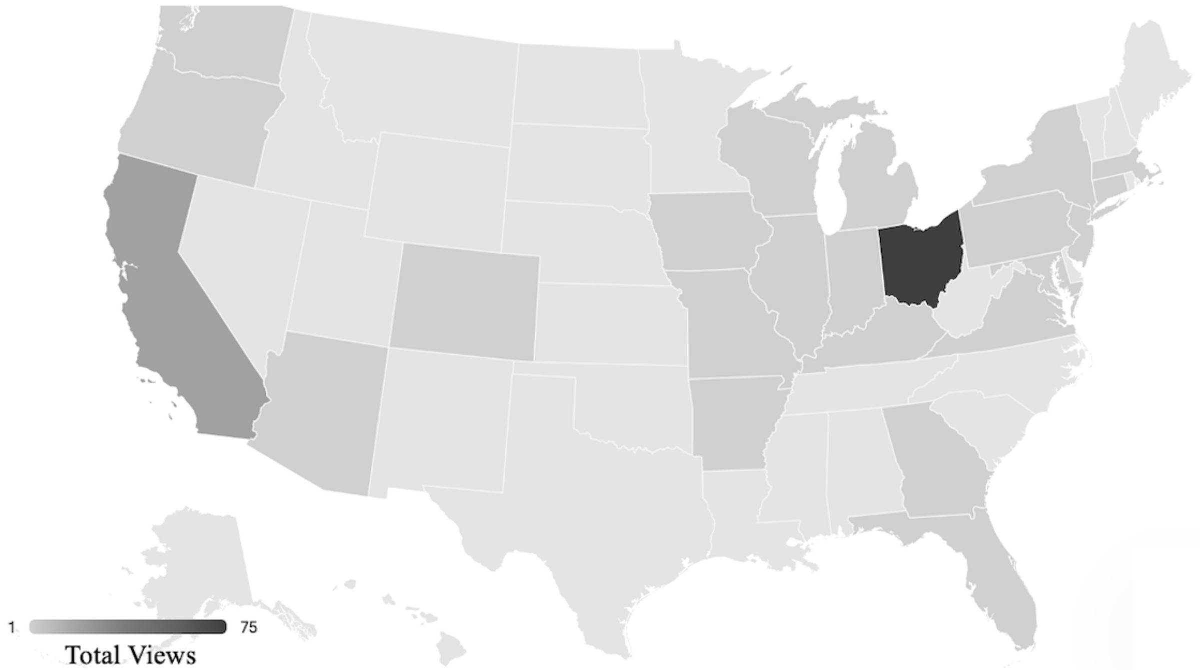
Medical students are held to high standards of professionalism while in and out of the school, hospital, and clinic. For medical students who are interested in starting a podcast, there are important professionalism considerations. It is crucial to acknowledge that medical students are not yet physicians; they should therefore not represent themselves as such and must refrain from offering medical advice. Content published via podcasts creates a lasting digital footprint; accordingly, we avoided using offensive, derogatory, and explicit language. Paramount to ensuring professionalism was our partnership with the COM administration. The Office of Student Affairs was closely involved with episode review in the first year of production. The COM faculty approved each episode prior to its public release and infrequently requested the omission or modification of content to ensure accuracy and freedom from professionalism concerns. After producing numerous episodes with close oversight, both the podcast team and COM administration agreed to transition to a self-regulatory system, which involved internal reviews as well as faculty consultation when appropriate.

Results

The *UnsCripted Medicine Podcast* published 53 episodes in its first 2 years. The number of episodes released per month ranges from 0 to 5, with a mean of 2.0 episodes. The podcast has a Twitter account with 217 followers. The number of listeners who subscribed to the podcast via Apple Podcasts grew to 86 in the first year and then to 218 in the second year. The show has an average rating of 4.8 (out of 5) on Apple Podcasts, which is based on 24 ratings. The podcast has hosted 70 unique guests, including medical students, resident physicians, attending physicians, nurses, physicians' family members, graduate medical education leadership, and educators. To characterize podcast listenership, the podcast's geographical reach was analyzed over a 1-week period for a specific 4-episode series (*Digital Second Look*). Ohio had the most listeners (75/154, 48.7%), followed by California (17/154, 11%), Florida (10/154, 6.5%), New York (6/154, 3.9%), Massachusetts (6/154, 3.9%), and others (combined: 40/154, 26%; Figure 2).

Episode duration ranges from 6 minutes to 85 minutes. The mean episode duration is 46 minutes (SD 17 minutes). This is in line with our target length of <50 minutes as well as with the mean episode length for podcasts across all categories (41 minutes and 31 seconds) [16]. Overall, podcasts in the Medicine category have a median duration of about 26 minutes [16].

Figure 2. Geographic distribution of listeners of the *Digital Second Look* series of episodes. DC: District of Columbia.



State	Ohio	California	Florida	New York & Massachusetts	Indiana & Pennsylvania	DC & Michigan
Total Views	75	17	10	6	5	4

Discussion

The *UnsCripted Medicine Podcast* was created to address the need for increasing the amount of near-peer mentoring. Through a close relationship with the COM faculty, students were able to launch a podcast with high standards of professionalism that provided near-peer advice on curricular blocks and rotations. Since its creation, the podcast has also served as a catalyst for fostering community engagement with a diverse array of guest hosts, including community pediatricians, assistant program directors, COM deans, COM faculty, professors from outside institutions, and students from each class. Pockets of the academic medicine campus that were previously disconnected have been connected through storytelling and mentorship. Further, as episode content begins to expand beyond local, COM-specific topics, the podcast team recognizes their growing potential to reach an increasingly comprehensive audience via discussions that apply more broadly to premedical and medical students across the country. The early analysis of a limited sample of episodes revealed that while listenership remains primarily local, the podcast has also reached small audiences from other parts of the country. Given the overall local nature of this podcast, the number and distribution of downloads may not be optimal metrics for gauging success. Instead, alternative metrics that assess community building and student well-being should be considered in future research.

Many structural elements were key to the podcast's success. Building a team that spanned the spectrum of preclinical and clinical years was paramount to remaining in touch with the needs of the student body. The perspectives of preclinical medical students also enabled the podcast to successfully penetrate the premedical market through the *Admissions and Second Look* series. Furthermore, a team comprised of second-, third-, and fourth-year medical students established a framework to ensure podcast longevity; as 1 or more podcast hosts transition to residency, younger team members step into leadership roles to mentor the next generation of podcast leaders. Medical student–run podcasts provide a tremendous opportunity for professional identity formation. As such, the podcast team established a recruiting infrastructure that will enable medical students from each year to interface with the podcast as either hosts or guests. Social connections that were established through faculty mentors and other student organizations broadened the candidate pool for guests beyond immediate social circles. Placing an emphasis on local topics with high relevancy helped the podcast team establish a listenership within the target audience. The use of a hosting website that provided a Really Simple Syndication feed to major podcasting services ensured that listeners could conveniently listen to episodes by using their preferred podcast app. Podcast promotion via social media (ie, Twitter) helped the team rapidly disseminate new content and increased the podcast's visibility to listeners outside of the COM community.

The *UnsCripted Medicine Podcast* faced a gamut of challenges while the team navigated podcasting infancy. Defining the relationship with COM advisors required time and frequent communication. Given that this podcast was a novel undertaking, there was little national precedent for empowering students' voices while holding fast to expert review and professionalism standards. A method of graduated autonomy facilitated the team's close contact with key podcast advisors at pivotal stages without squelching authentic student voices. Due to privacy considerations regarding academic performance, the recruitment of student guests mostly relied on preexisting social connections rather than the rigid, widespread screening of candidates. Although this may have weakened the overall credibility of the curricular success–related and USMLE-related episodes, this method ensured that there was good rapport between hosts and guests, which substantially contributed to the overall quality of conversations. Despite continually striving for excellent audio quality, finances and production naivety were frequent barriers to improvement. Funding provided by the Medical Student Association was appreciated, but social distancing guidelines generated additional costs during the transition to web-based hosting. The podcast team was able to overcome many technical barriers by consulting with seasoned podcasters in academic medicine and reading literature published on podcasting best practices [1,5]. Understanding listenership trends and preferences proved difficult, although frequent anecdotal feedback provided some limited insight.

To better understand podcast efficacy and listeners' perceptions, we aim to collect data from the COM student body as part of an ongoing needs assessment. The literature regarding educational podcast creation is sparse, especially literature that pertains to the medical student population. Research is needed to understand the perceived benefits of medical education podcasts, their efficacy as teaching tools, and best practices for podcast production.

As medical education transitions from print formats to digital formats [17], medical student–run podcasts represent novel tools for supporting medical students, leading the student community into the future of medicine, and fostering professional identity formation. Podcasts are widely accessible and convenient for listeners, and podcast creators can publish content with lower barriers of entry compared to those of other forms of published content. Although school-specific podcasts may exclude a national audience, they enhance the depth of the sense of community among local students, clinicians, and educators. Medical schools should consider supporting student podcast initiatives to allow for near-peer mentoring, augment the community, facilitate professional identity formation, and prepare the rising physician workforce for the technological frontier of medical education and practice.

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Authors' Contributions

KJM, RSD, and ZTSC are fourth-year medical students at the University of Cincinnati COM. They were involved in data collection, data analysis, and the authoring of the manuscript. They are founding members and hosts of the *UnsCripted Medicine Podcast.* MVE is a graduate of the University of Cincinnati COM and a current postgraduate year 1 resident of Otolaryngology-Head and Neck Surgery at the University of Michigan. MVE was involved in the authoring of the manuscript. She is a founding member and former host of the *UnsCripted Medicine Podcast.* RMH is a second-year medical student at the University of Cincinnati COM. RMH was involved in the authoring of the manuscript. She is a host of the *UnsCripted Medicine Podcast*. JDS is a faculty member of the University of Cincinnati COM in the Department of Family and Community Medicine. JDS was involved in the authoring of the paper. He serves as the faculty advisor for the *UnsCripted Medicine Podcast*.

Conflicts of Interest

None declared.

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Abbreviations

COM: College of Medicine
USMLE: US Medical Licensing Examination

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Viewpoint

Removing Educational Achievement Points From the Foundation Programme Application System: Is This the Right Decision?

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Abstract

The UK Foundation Programme Office has announced that medical students graduating from 2023 onward will not receive Foundation Programme Application System points for additional degrees or journal publications. In this viewpoint paper, we acknowledge the reasons for this decision, such as socioeconomically advantaged students having greater access to these achievements and the promotion of intercalated degrees for the sake of point accumulation. Additionally, the predictive value of these achievements with regard to junior doctors' performance has been questioned when compared to that of other Foundation Programme Application System components. Conversely, we also highlight the drawbacks of the UK Foundation Programme Office's decision, since this might discourage medical students from completing additional degrees and attempting to publish their work, thereby resulting in clinicians with little to no academic experience or interest. Finally, we attempt to provide suggestions for future improvements in this system by analyzing different medical schools' approaches, such as the BMedSci Honors program offered at Nottingham University. Furthermore, promoting and supporting engagement with academia, especially among socioeconomically disadvantaged students, are the responsibility of all medical schools; such actions are needed in order to produce doctors who are both clinically and academically competent. We conclude that the aforementioned changes should only affect new cohorts in the interest of universities' transparency and fairness to their students.

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KEYWORDS

medical student; medical education; research; academic medicine; medical school; United Kingdom; achievement; test scores; transferable skills

Introduction

On November 30, 2020, the UK Foundation Programme Office (UKFPO) announced their decision to reform the points-based Foundation Programme Application System (FPAS) by removing educational achievement (EA) point scores. This reform is set to take effect in 2023 [1]. In this viewpoint paper, we aim to summarize the benefits and drawbacks of the changes proposed by the UKFPO as well as offer potential solutions to the issues presented by this reform.

The UKFPO is the governing body that manages the transition of graduating medical students into Foundation Programme rotations as newly qualified doctors by using the FPAS scoring system to allocate junior doctors to different locations [1]. The FPAS scoring system is a method of ranking final year medical students nationally by using a variety of parameters to award them with up to 100 points. The more FPAS points that an applicant has, the more likely they are to be accepted into their top choice rotation in their preferred deanery. The two main parameters used in the FPAS scoring system are the Situational Judgement Test and Educational Performance Measure (EPM), which have been used in equal proportion [2]. The EPM score is primarily calculated by using students' performance at medical school in the form of decile rankings. EAs are optional components that also contribute to the EPM score and are achieved by completing additional degrees and having work published in PubMed-indexed journals.

Obtaining intercalated degrees is a popular choice among medical students; students can take 1 year off from their medical studies to explore other fields of interest, thereby gaining an additional degree and opportunities to present at conferences and publish their work [2]. Some students also obtain EA points by completing additional degrees prior to attending medical school. Further, EA points can be earned by publishing original research or other article types, such as letters to the editor, commentaries, and case studies.

The Disadvantages of EA Points in the FPAS

We acknowledge the UKFPO's reasoning that opportunities for completing EAs favor those from more advantaged backgrounds [3]. Obtaining an intercalated degree is costly in terms of tuition fees and living expenses, and graduating 1 year later can result in a delay of 1 year's worth of earnings. These factors are more detrimental to students from lower socioeconomic backgrounds [4]. Moreover, the value of EA points that are achieved by publishing articles can be skewed by wealthier students paying article processing charges in order to publish their work more easily in lower-impact journals [5]. Similarly, some institutions cover the cost of article processing charges for their students. This is not standard practice across all medical schools and therefore creates nationwide inequalities in opportunities.

As highlighted by the UKFPO, in several UK medical schools, intercalated degrees are compulsory components that have been integrated into 6-year courses. As such, admission into these institutions will assuredly gain students EA points. Since intercalated degrees are closely linked to publication opportunities, they can further the advantages of mandatory intercalation [1]. In contrast, the number of students who are allowed to intercalate at universities where intercalation is optional is often limited [6]. This creates a biased system in which some students have advantages in gaining EA points depending on their medical schools. Additionally, medical students who have already obtained additional degrees prior to entering medical school are also advantaged; this cohort of students makes up approximately 8% of the medical student population [7]. As a result, students who hold additional degrees and those who attend institutions with compulsory intercalation requirements are automatically scheduled to gain EA points and thus are given advantages by the FPAS.

We are also increasingly concerned that the current FPAS promotes a tick-box culture in which substandard engagement is rewarded by points and genuine interest in research is not promoted. For example, recent research has shown that approximately one-third of medical students obtain an intercalated degree [8], but only 16% of these students pursue an academic career [6]. This concept is also reflected when students have their work published while in medical school. The incentive of obtaining EA points by publishing articles compels medical students to submit articles that require less time and effort, such as letters to the editors, compared to the harder alternative of original research publications. As a result, the benefits of original research, such as developing scientific, statistical, and critical appraisal skills, are overshadowed. A study across 7 UK medical schools revealed that only 21% of students who submit articles for publication do so due to having genuine academic interests, whereas 51% of students submit articles purely for career progression [9]. Therefore, it is integral to resist tick-box culture by removing or restructuring EA points and refocusing medical education to encompass clinical academia within its core curriculum.

We are also mindful of the role that the FPAS plays in creating a maldistribution of academically inclined graduates across the United Kingdom. Students with additional degrees and publications receive more EA points and thus rank higher in the FPAS. This allows them to have their preferred choice in deaneries and hospitals prioritized for Foundation Programme allocation [2]. Therefore, more academically inclined, higher-scoring students are recruited into oversubscribed deaneries. In 2019, 11 of the top 20 ranked National Health Service trusts for research were situated in the most competitive deaneries [10]. Consequently, research-minded students are more likely to enter the foundation programs of trusts with more academic opportunities. This perpetuates a cycle of clinical research in these competitive trusts. As a result, a disparity in the advancement of health care may arise across the country, as undersubscribed trusts may fall behind due to a lack of more academically motivated students. These academic hubs across the country are also likely to cultivate competition among students who aim to secure a spot in trusts. This system perpetuates a problematic culture that focuses on unhealthy competition, which is inherent to any point-based ranking system. Conversely, the ideal mentality would be focusing on self-improvement due to having a true interest in medical practice and science.

The Advantages of EA Points in the FPAS

For many medical students, EAs offer an introductory insight into the field of academic medicine. This involvement is essential for encouraging students, especially due to the downward trend of doctors engaging in research. Moreover, intercalation and publications offer additional benefits at the postgraduate level, such as developing research competencies and promoting the practice of evidence-based medicine [6]. The exclusion of EAs from the FPAS has the potential to discourage students from pursuing academic avenues later on in their careers due to their lack of experience, thereby jeopardizing the future community of clinical academics.

Some studies have reported that EAs in medical school have an unclear predictive effect on successful Foundation Year Program completion compared to decile rankings and Situational Judgement Test scores; hence, their benefit to the FPAS has been questioned [11,12]. However, we believe that the value of

EA points is greater than that of their sole contribution to the FPAS and Foundation Year Program.

Undertaking clinical research can benefit students during their medical curriculum. A study revealed that students who completed an intercalation had higher exam results upon resuming their medical degree [13]. This finding was most profound when evaluating the scores of final year students. This improvement may indicate that intercalation leads to the development of better learning techniques, greater analytical and organizational abilities, and enhanced self-directed learning methods. Additionally, intercalated degrees are frequently examined by using essay-based questions, which support the development of critical and divergent thinking as well as scientific writing skills. These skills are valuable to doctors, as they improve clinical communications and reasoning and thus improve patient care. Moreover, obtaining additional degrees provides medical students with the opportunity to work alongside individuals from nonmedical backgrounds, much alike an interdisciplinary team in a clinical setting.

The removal of EA points will also inevitably reduce students' motivation to publish their work in journals. Publishing articles as a medical student is strongly associated with better future academic achievements. For example, studies have concluded that medical students who have their work published prior to graduating from medical school are almost twice as likely to publish again following graduation [14]. Moreover, studies have also revealed that students who have their work published prior to graduation go on to publish a greater number of papers after graduation and publish papers with higher citation impact [14]. We therefore acknowledge the immense added value of contributing publications while in medical school, given the importance of medical academia to doctors.

EA points can also influence the progression of junior doctors in their training. Specialty training programs are competitive and involve a strict selection process that takes into account academic excellence, extracurricular achievements, and interview performance [15]. Intercalated degrees and publications in an applicant's portfolio can provide significant evidence of one's interest in and early commitment to a specialty. However, removing EA points may discourage medical students from obtaining intercalated degrees, thereby resulting in a weaker and less diverse portfolio. Thus, socioeconomically deprived students may end up being disadvantaged later in their career due to being less likely to undertake EA opportunities.

Moving Forward

EAs add an academic-enriching aspect to medical degrees. Despite their association with systemic inequity, perhaps a preferred solution for encouraging engagement with medical academia should involve widening the participation of disadvantaged students as opposed to removing EAs completely. To encourage more disadvantaged students to intercalate, medical institutions can offer scholarships, subsidize intercalated degree costs, and offer bursaries. A study at the University of Aberdeen identified that early research exposure in medical school in the form of an 8-week program that involved an academic supervisor encouraged intercalation [16]. The results showed that 66% of participants who were undecided on whether to pursue an intercalated degree opted to do so after completing the mentoring program [16]. As such, we believe that launching early, research-based opportunities for socioeconomically disadvantaged students and offering a form of financial support will motivate students in clinical academia and minimize the issues associated with inequality.

We further recommend that medical schools consider Nottingham Medical School's approach to integrating an intercalated BMedSci Honors Year Project as a standard constituent within 5-year medical courses [17]. This project was conducted over 4 months during the 5-year medical curriculum and provided valuable insight into balancing research while also undertaking clinical responsibilities. This format ensured that all students within the medical school were able to access research opportunities without the common obstacles of financial constraints and limited resources. Often, students from low-income backgrounds are more likely to have part-time jobs, which may limit their ability to pursue research opportunities. Incorporating programs that foster academic skills will ensure that these students will have access to research opportunities.

The promotion of short and time-efficient research opportunities offer an alternative to obtaining additional degrees and promote proactivity in clinical academia. In New Zealand, 75% of students who underwent a 2- to 3-month summer studentship expressed an interest in further research opportunities as a result of their studentship [18]. Similarly, a University of Auckland longitudinal study that investigated summer research studentships revealed that one-third of participating students published at least 1 article with their supervising team within the 10-year follow-up [19]. Positive outcomes in advancing clinical academics were also reported during audits; research electives; and student-led initiatives, such as The Student Audit and Research in Surgery collaborative [18,20].

We would also like to take this opportunity to urge medical journals to adopt a more student-friendly approach. An example of this is the allocation of student-dedicated spaces within journals, such as those in *JMIR Medical Education*, *The Lancet*, and the *Student British Medical Journal* [21]. There have also been an increasing number of student-led peer-reviewed journals that allow students to publish their research [21]. These platforms allow students to familiarize themselves with the process of writing and submitting publications. It also introduces them to the peer-review system, and interested students can even partake in critically appraising submissions. We strongly feel that such initiatives would encourage more medical students to consider publishing their work and promote a genuine interest to contribute to the scientific community. They would also inspire future research and widen student readership.

Conclusion

The General Medical Council's "Good Medical Practice" document states that doctors "must be competent in all aspects of work, including management, research and teaching" [22]. We strongly believe that to fulfill the expected, multidimensional qualities of a doctor, it is essential for medical students to have exposure to and experience with academic medicine. As such, while we appreciate the reasoning behind the UKFPO's decision to remove EA points from the FPAS to promote equality among medical students of all socioeconomic backgrounds, reduce the misdistribution of academically inclined graduates, and minimize the degree of damaging competitiveness, we also recognize the multifaceted significance and value of EAs. Consequently, we are concerned with the negative impacts that will result from the removal of EA points.

To minimize the negative outcomes of EAs and maintain their benefits, we urge medical schools to provide greater support nationwide. Studies have reported that as little as 15% of medical students are well informed about research opportunities, intercalating, and publishing [8]. This highlights a need for medical schools to educate students about the benefits of undertaking research opportunities. Such education allows students to make informed choices when pursuing research opportunities, irrespective of EA points. We also hope that medical schools implement more measures for widening the participation of disadvantaged students, especially in research.

To further support students in the absence of EA points, we encourage medical schools to increase the promotion, provision, and accessibility of research-based opportunities in order to produce well-rounded doctors and promote students' engagement with clinical academia. As such, we propose that EAs should not be removed until the aforementioned measures are defined and in place. We believe that focusing more on promoting clinical research and providing opportunities in academia will turn curious students into inquisitive researchers.

We believe that the removal of EA point scores should take effect only for new cohorts of medical students. Many students who are set to graduate in 2023 are currently in the process of obtaining additional degrees and contributing publications (or have already done so). The exclusion of their hard-earned achievements from contributing to their FPAS score at such late notice is unreasonable. Ultimately, we believe that a delay in the implementation of the UKFPO policy will allow medical schools to become more prepared in supporting its students as well as ensuring that current students are not subject to unexpected, last-minute changes.

In their decision, the UKFPO consulted with representatives from the British Medical Association [3], Medical Schools Council [23], and various other stakeholders. Of concern is the fact that the UKFPO ignored the opinions of the British Medical Association and Medical Schools Council, who also strongly opposed the removal of EA points. In the future, we request that the UKFPO be more receptive to voiced concerns.

Finally, we would like to highlight that in 2015, the UKFPO implemented reforms to the FPAS. Due to these reforms, academic prizes and conference presentations no longer contribute toward EA points [24]. To date, there is no research on the effect of this policy change in terms of the number of prizes received as well as quantity and quality of conference presentations. As such, we urge an investigation into the 2015 policy change, as this may provide insights into the impact of current policy reforms.

Conflicts of Interest

None declared.

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Abbreviations

EA: educational achievement
EPM: Educational Performance Measure
FPAS: Foundation Programme Application System
UKFPO: UK Foundation Programme Office

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Review

Digital Health Training Programs for Medical Students: Scoping Review

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Abstract

Background: Medical schools worldwide are accelerating the introduction of digital health courses into their curricula. The COVID-19 pandemic has contributed to this swift and widespread transition to digital health and education. However, the need for digital health competencies goes beyond the COVID-19 pandemic because they are becoming essential for the delivery of effective, efficient, and safe care.

Objective: This review aims to collate and analyze studies evaluating digital health education for medical students to inform the development of future courses and identify areas where curricula may need to be strengthened.

Methods: We carried out a scoping review by following the guidance of the Joanna Briggs Institute, and the results were reported in accordance with the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines. We searched 6 major bibliographic databases and gray literature sources for articles published between January 2000 and November 2019. Two authors independently screened the retrieved citations and extracted the data from the included studies. Discrepancies were resolved by consensus discussions between the authors. The findings were analyzed using thematic analysis and presented narratively.

Results: A total of 34 studies focusing on different digital courses were included in this review. Most of the studies (22/34, 65%) were published between 2010 and 2019 and originated in the United States (20/34, 59%). The reported digital health courses were mostly elective (20/34, 59%), were integrated into the existing curriculum (24/34, 71%), and focused mainly on medical informatics (17/34, 50%). Most of the courses targeted medical students from the first to third year (17/34, 50%), and the duration of the courses ranged from 1 hour to 3 academic years. Most of the studies (22/34, 65%) reported the use of blended education. A few of the studies (6/34, 18%) delivered courses entirely digitally by using online modules, offline learning, massive open online courses, and virtual patient simulations. The reported courses used various assessment approaches such as paper-based assessments, in-person observations, and online assessments. Most of the studies (30/34, 88%) evaluated courses mostly by using an uncontrolled before-and-after design and generally reported improvements in students' learning outcomes.

Conclusions: Digital health courses reported in literature are mostly elective, focus on a single area of digital health, and lack robust evaluation. They have diverse delivery, development, and assessment approaches. There is an urgent need for high-quality studies that evaluate digital health education.

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KEYWORDS

digital health; education; eHealth; medical students; scoping review; electronic health records; computer literacy

Introduction

Digital health (defined as the use of digital technologies for health and health care) is, because of COVID-19, at the center of the pandemic response and support of patients [1,2]. It is a vast and growing field that encompasses the use of digital technology for monitoring, tracking, and informing health; supporting communication among various stakeholders; and managing health data [3,4]. The adoption of digital technologies in health care has increased in recent decades [5,6]. The use of digital technology in health care can reduce errors and costs, increase productivity and efficiency, support clinicians in health care delivery, and allow shared decision-making and self-advocacy for patients [7-9].

There is a pressing need for future clinicians to develop digital health competencies [10,11], and medical schools worldwide have started to introduce digital health education in their curricula [10]. There have been strong pushes for health care systems and services to be digitally enhanced and transformed both in the United States and internationally [12,13]. Patients expect health care providers to offer digital tools as part of health care service delivery [14]. In addition, digital health is a rapidly evolving field in which the new technologies are being developed and emerging, such as artificial intelligence, robotics, wearable devices, and virtual or augmented reality [15,16]. Doctors are expected to keep up with these changes. Correspondingly, a growing number of frameworks outlining digital health competencies for clinicians at various stages of their careers have been developed [4,17-20]. However, health care providers and students have reported a lack of digital health competencies and the need for more digital health–related training [21,22].

Currently, digital health courses are not formally provided or incorporated in most medical school curricula [21]. An analysis of existing studies on digital health courses for medical students should be of use to curriculum planners, educators, and policy makers in the design, development, and adoption of such courses [23]. Therefore, an analysis of existing digital health courses is urgently needed. Such an analysis should explore the content, duration, pedagogy, learning objectives, course integration, assessment methods, format, delivery, and evaluation of reported digital health courses with the aim of informing the development of future courses. Several reviews have been published focusing on training in specific areas within digital health, such as telemedicine [24-26], electronic health record (EHR) training [27], computer literacy, and medical informatics [28,29]. However, digital health education should be comprehensive and systematic [30,31]. To address this gap, we collated and analyzed studies reporting on digital health courses for medical students. Our aim is to inform the development of future courses and identify evidence gaps related to (1) currently available digital health courses for medical students; (2) course design, development, and delivery processes; (3) learning objectives and how they are assessed; (4) use of digital health competency framework and learning theories used during course development; and (5) learning outcomes associated with digital health courses. On the basis of the findings of this review, we aim to provide up-to-date evidence-based recommendations related to digital health courses for future researchers, curriculum designers, and educational policy makers.

Methods

Overview

We conducted a scoping literature review following the methodological guidance of the Joanna Briggs Institute [32]. The results were reported in accordance with the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines [33]. A search strategy aligned with our aim was developed based on the Joanna Briggs Institute guidelines. The search was performed on November 8, 2019. We searched 6 bibliographic databases indexing biomedical and education journals: MEDLINE, Embase, CINAHL, Education Resources Information Center database (ERIC), PsycINFO, and the Cochrane Library. The search strategy was developed collaboratively and iteratively by the reviewers with support from a medical librarian (Multimedia Appendix 1). For unpublished studies in this area, we searched OpenGrey, ResearchGate, Google Scholar, the first 10 pages of Google results, websites of relevant professional associations (eg, the International Medical Informatics Association and European Federation of Medical Informatics), accreditation councils (eg, the US Accreditation Council for Graduate Medical Education), key government websites, and other organizations with the mandate of training and lifelong learning of health care professionals. We also screened the reference lists of the included studies based on the eligibility criteria.

Eligibility Criteria

We included all articles published between January 1, 2000, and November 6, 2019, because digital health is a rapidly evolving area and has changed substantially over the last 20 years. We included articles published in English and assessed their eligibility. The inclusion criteria were developed in alignment with the aims of our review (Multimedia Appendix 2). We defined *digital health* as any form of information technology (IT) used in health care practices or health professions education. For a list of technologies classified as digital, please refer to Multimedia Appendix 2. We included all types of primary studies on digital health, clinical, or health informatics training at all medical schools, regardless of setting. We included experimental (eg, randomized controlled trials [RCTs] and before-and-after studies), observational (eg, cohort studies), and descriptive (eg, case studies and qualitative studies) studies. We included both controlled experimental studies (ie, studies in which digital health education was compared with another intervention or no intervention at all) and uncontrolled ones (ie, studies that examined only 1 group of participants receiving digital health training). We also included quasi-RCTs, that is, RCTs in which participants were allocated to different arms of the study without a proper randomization method.

Screening and Data Extraction

We screened the articles by applying our predefined inclusion and exclusion criteria first to the title and abstract and then to the full texts of the relevant articles. For the title and abstract screening, we screened the articles independently in pairs by using Covidence (Veritas Health Innovation Ltd) [34]. Any discrepancies or disagreements between the reviewers were resolved through discussion and consensus, and when required, a third reviewer was engaged as an arbiter. For full-text screening, the same screening process was followed by using EndNote X8 (Clarivate) [35]. The data extraction form was aligned with the research questions or objectives (Multimedia Appendix 3). Two review authors extracted the data independently and discussed them until they reached a consensus on the final extracted data.

Data Synthesis

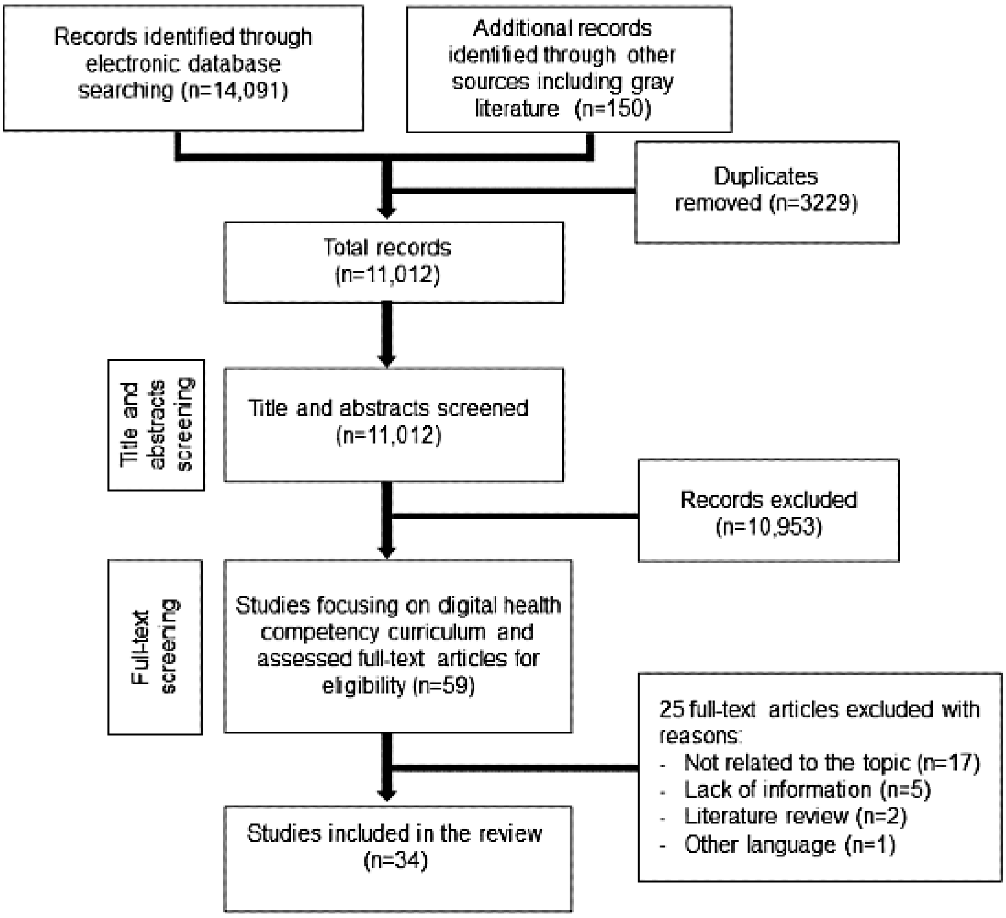
We analyzed the identified digital courses in terms of year or type of study, digital health topic, format of the course, development, delivery, and assessment approaches. We then narratively synthesized the contents of the identified digital health courses in each area, including learning objectives and the associated challenges related to the development and implementation of digital health courses for medical students. We classified the digital health courses into different domains according to the terminology and aims presented in the included studies. For example, studies focusing on EHR or medical informatics training were classified under the EHR or medical informatics domains, respectively. As medical informatics encompassed diverse digital health topics in the included studies, we identified and presented the specific medical informatics that the courses focused on.

Results

Study Characteristics

The search strategy yielded 14,241 publications, and of these, 14,091 (98.95%) were from database searches and 150 (1.05%) were from gray literature. In total, 34 articles met the inclusion criteria (Figure 1). Most of the studies (22/34, 65%) were published between 2010 and 2019 and were uncontrolled before-and-after studies (24/34, 71%). Other study designs reported in the included studies were case studies (5/34, 15%) [4,36-39], controlled before-and-after studies (4/34, 12%) [19,40-42], and a quasi-RCT (1/34, 3%) [43].

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart for scoping reviews on digital health courses for medical students.



Digital Health Courses' Scope, Students, and Settings

Of the 34 included studies, 17 (50%) focused on medical informatics [4,18,37,39,40,42-53], 8 (24%) on EHR skills [3,19,41,54-58], 3 (9%) on computer literacy [59-61], 3 (9%) on telemedicine [36,62,63], 2 (6%) on basic programming [38,64], and 1 (3%) on mobile health (mHealth) [65]. Most of the studies (20/34, 59%) were conducted in the United States [3,18,19,39,41,44-47,51-58,60,62,63,66]. The remaining studies were conducted in Australia [37,64], France [40], Germany [48,49], Hungary [59], Canada [38], Croatia [4], Commonwealth of Dominica [50], Taiwan [61], the United Kingdom [42], the Philippines [37], and Romania [43].

Course Structure and Content

Most of the digital health courses (24/34, 71%) were integrated into existing courses [3,4,18,19,37,39-44,46-49,51-56,58,59,65], and only a few courses were reported as stand-alone courses (7/34, 21%) [36,38,45,57,61-63]. Similarly, most of the digital health courses were provided as elective (18/34, 53%) [3,18,36,37,39,42,45,48-52,55,59,60,62,63,65], and only a few courses were provided as mandatory courses (7/34, 21%) [40,43,44,46,53,54,56]. Of the 34 courses, 2 (6%) biomedical informatics courses were offered as both elective and mandatory depending on the year of the study [4,47].

The included studies evaluating medical informatics courses (17/34, 50%) focused on different areas of medical informatics, such as the use of a clinical decision support system, data privacy and security, medical image processing, biosignal analysis, basics of electronic medical records, patient management systems, basics of IT in medicine, community health information tracking systems, data management (eg, data storage and retrieval), information literacy (eg, formulating clinical questions, searching online bibliographic databases, and searching evidence-based resources), and communication technology [4,18,37,39,40,42-53]. The duration of the medical informatics courses ranged from a minimum of 1 session lasting 3.5 hours [44] to regular training over 3 years [39] (Multimedia Appendix 4 [3,4,18,19,36-65]).

Of the 34 included studies, 8 (24%) reported courses on EHR and mainly focused on knowledge and skills related to EHR use for first- to fourth-year medical students [3,19,41,54-58]. The courses focused on the general application of EHR in clinical settings lasting from 1 hour [41] to throughout the preclinical years of medical school [54]. Lee et al [41] reported a 1-hour lecture on patient-centered EHR use for second- and third-year students, and the course was integrated into the clinical skills course. Milano et al [56] reported a 2-week EHR course for first- and third-year medical students, which was incorporated into a third-year family medicine clerkship hands-on course, working on a simulated EHR using virtual patient simulation. Connors et al [19] presented an EHR course for first- to third-year medical students, in which the course materials, including laboratory and pathology reports, were provided as a case-based EHR course to familiarize the students with EHR skills. Wagner et al [54] presented an EHR course for medical students during their preclinical years of training and focused mainly on content associated with online health record submission tools for an EHR system. Ferenchick et al [3] also presented a short stand-alone online EHR course on the meaningful use of electronic clinical data for disease management and outcomes. The online course consisted of 15 online tutorials on applications of EHR and lasted 71 minutes in total. Gomes et al [57] presented a stand-alone EHR online video course for medical students through a blackboard platform, which mainly included a narrative video of PowerPoint (Microsoft Corporation) presentations on different functions of EHR and its applications. The remaining studies (2/8, 25%) focused on EHR courses for both third- and fourth-year medical students, and the courses covered topics on the overview of EHR, order entry, patient information review, chart documentation [58], and EHR-based patient communication skills [55].

Of the 34 included studies, 3 (9%) focused on computer literacy courses for medical students focusing on basic computer applications and skills in clinical practice, the use of social media tools for self-learning, and digital game-based learning in medical education [59-61]. The duration of the courses varied from 3 weeks [60] to 17 weeks [61]. Wan et al [61] reported a stand-alone entry-level elective course on basic computer concepts for medical students, in which the students are expected to spend 2 hours per week for 17 weeks in self-learning, cooperative learning from a book club, and game-based learning from online Jeopardy-like games. Similarly, Gibson and Silverberg [60] reported an elective computer literacy course that lasts for 3 weeks, in which the students receive 7 hours of hands-on training on computer literacy, followed by a test. Mesko et al [59] presented a 12-week digital or computer literacy course for medical students using social media tools and gamification approaches.

Of the 34 included studies, 2 (6%) reported a computer programming course for medical students [38,64]. Law et al [38] described a 14-month stand-alone elective computer programming course for medical students, which consists of introductory sessions (3-4 sessions depending on skill level) for the first 3 months and 11 sessions over a 11-month period. Liaw and Marty [64] presented a basic programming course consisting of software use, didactic workshops, and conversations (Multimedia Appendix 4).

Of the 34 included studies, 3 (9%) reported a telemedicine elective course for second- to fourth-year medical students [36,62,63]. The courses focused on the introduction of telehealth and telemedicine, lasting from 9 hours [63] to 1 full semester [36]. Of these 3 studies, 2 (67%) reported a single-semester elective course on mHealth [65] or telemedicine [36], and 1 (33%) reported a 1-month biomedical informatics course for first- to fourth-year medical students [47]. The biomedical informatics course was a compulsory core module course for first- to third-year medical students and an elective module for fourth-year medical students.

Delivery Approaches

Most of the courses (22/34, 65%) used a blended format of delivery (ie, a combination of online module or offline learning [eg, computer-based spreadsheet and presentation software packages, PowerPoint presentation, CD-ROM, or DVD] and traditional approaches such as small group discussions, lectures, and classroom interactions) [18,36,38,40-44,47,49-55,59-61, 63-65]. Learning content was delivered in full online mode in a few courses (7/34, 21%) [3,37,45,46,57,58,62]. Of these 7 courses, 2 (29%) were delivered as massive open online courses through a learning management system [37,45], 2 (29%) used mixed modalities of both online and offline learning [4,39], and 1 (14%) focused on stand-alone EHR simulation in offline mode [19], whereas virtual patient simulations were used in 2 (29%) courses (Multimedia Appendix 5) [48,56].

Educators Involved in Digital Health Courses

Of the 34 included studies, 14 (41%) reported on the trainers or educators involved in the development and delivery of digital health courses [18,38,39,41,44,45,50,51,53,54,56,57,63,65]. The educators mentioned in the included studies were mostly medical librarians and faculty members, including clinicians. Of these 14 studies, 7 (50%) reported the involvement of other staff in the digital health courses such as IT support teams [63], patients [41], patient educators [51], and student assistants [45,54,63,65], whereas 4 (29%) mentioned the required skills or training for the staff members developing or delivering digital health courses [38,54,63,65].

Digital Health Course Development

Of the 34 included studies, 17 (50%) reported course development processes, including expert consultations, piloting of the course, literature review, and review of other programs in the course development [4,18,37,41,43-45,47,49, 51,53,56-59,63,65]. Expert consultations used in the studies included seeking feedback from the EHR vendors, librarians, faculty members, clinicians, and researchers [18,37,41,44,45,47,51,53,56-58,63,65]. Of these 17 studies, 4 (24%) [18,45,51,56] used a literature review and expert consultations for the development of courses, 2 (14%) reported piloting of the course before being incorporated into a medical program [51,56], 7 (50%) used expert consultations alone [37,41,53,57,58,63,65], and 2 (14%) carried out a literature review only to design the course [4,59]. Of the 17 studies, 3 (21%) studies piloted the course with expert consultation [47], without expert consultation [43], or only after literature and curriculum review [49], whereas 1 (6%) study used both curriculum review and expert consultation methods [44].

Digital Health Courses' Learning Objectives

Learning objectives were presented as general or specific depending on the topics of the digital health courses. General learning objectives were mainly related to the improvement of medical students' medical informatics knowledge, skills, and attitudes. Specific learning objectives were presented as competencies related to a particular clinical or preclinical setting and focused on a specific aspect of the use of digital health technology in health care. The details of the learning objectives presented in each digital health course are presented in Multimedia Appendix 6 [3,4,18,19,36-65].

Of the 34 included studies, 11 (32%) reported the developmental steps for learning objectives, such as evaluation of other available digital health courses; inputs from content experts and faculty members; and following specified protocols, steps, or guidelines to develop learning objectives for the presented courses [18,39,44,45,47,51,53,56,58,60,65]. The remaining studies did not follow any specific guidelines or protocols to develop learning objectives for digital health courses.

The Use of Digital Health Course Frameworks

There was limited use of digital health competency frameworks in course development. Of the 34 included studies, only 6 (18%) reported that course developers used frameworks or guidelines to develop digital health courses [4,18,19,44,52,58]. Kern and Fister [4] reported that their medical informatics course was based on the International Medical Informatics Association Recommendations on Medical Informatics Education for IT users and adjusted to students' attitudes toward medical informatics and the position of the courses in the first and fifth year of the medical program. Connors et al [19] reported that the learning objectives of the EHR courses were based on the informatics competencies outlined in the 2001 report of the Institute of Medicine. Of the 6 studies, 3 (50%) developed their learning objectives for medical informatics courses based on the competencies specified in the Association of American Medical Colleges Medical School Objective Project [18,44,52], and 1 (17%) study by Pereira et al [58] followed Kern and Fister 6-step course design framework to develop an EHR course for medical students.

Assessment and Evaluation of the Digital Health Courses

For the assessment of learning outcomes, the courses used paper-based assessments in the form of surveys, in-person observations (eg, objective structured examinations), and/or online assessment methods (ie, online surveys). Of the 34 digital health courses, 11 (32%) used paper-based assessments [3,4,18,38,41-43,47,52,64,65], 10 (29%) used online assessments [44-46,50,51,54,57,58,60,62], 3 (9%) used in-person observations [18,56,63], and 6 (18%) used both paper- and online assessment methods [36,53,56,59,61,63]. The remaining courses (7/34, 21%) did not assess student outcomes; thus, no assessment methods were reported [19,37,39,40,48,49,55].

Of the 34 included studies, 30 (88%) evaluated digital health courses that mostly used uncontrolled before-and-after design. Changes in learners' knowledge related to telehealth, EHR, or medical informatics were assessed in one-third (10/30, 33%) of these studies [36,41,45,47,50,51,53,57,58,63]. Of these 10 studies, 5 (50%) reported an improvement in learners' knowledge related to telehealth [36,63], EHR [41,57], and biomedical informatics [47]. Of the 30 studies, 9 (30%) reported digital health competency skills of the students before and after taking part in the digital health course [3,41,42,55,56,59-61,64], of which 89% (8/9) of studies reported that digital health courses were associated with an improvement in medical students' digital skills [3,41,42,56,59-61,64].

Of the 34 included studies, 16 (47%) assessed students' attitudes toward a medical informatics course [4,18,40,42,45,46, 48,49,52], EHR skills [41,54,57], mHealth [65], telemedicine [62], programming [64], and computer literacy courses [59]. Most of the studies reported positive attitudes toward digital health courses. Of these 16 studies, 3 (19%) reported students' satisfaction with medical informatics [43,52] and telemedicine courses [36], whereas 1 (6%) assessed students' engagement with learning content and reported that 65% of the students read more than 75% of their learning content [61]. Another study assessed the information-seeking behaviors of students and reported that the students showed a higher degree of use of information resources [44].

Challenges Related to Course Development and Implementation

Of the 34 included studies, 9 (26%) reported students' and educators' challenges related to digital health courses. Most of the reported challenges were associated with course development and implementation [4,43,45,47,48,60,62,64,65]. The challenges faced by students attending digital health courses included incomplete assignment submission owing to errors in the learning management system [45], limited participation rate [62], and a lack of perceived usefulness of the courses as part of preclinical training [43]. From the educators' perspective, the challenges included the demands for providing timely feedback to students [45], recording and producing lectures for optimum accessibility, mastering online learning tools [45], inadequate cooperation between IT support persons and health care professionals to deliver digital health courses [4], poor computing and typing skills [64], and a lack of clinically trained faculty for content creation and teaching [47]. Other challenges included the inadequacy of technological infrastructure such as software, hardware, IT systems issues [64]; implementation issues (eg, converting paper content to digital format) [64]; and design and development of the course (tailoring of the course content to real-life learning and teaching facilities within a financially constrained context) [65].

Discussion

Principal Findings

We found 34 studies that presented digital health courses for medical students. The included studies mostly focused on medical informatics, followed by EHR and telemedicine, and targeted medical students throughout their years of study. Courses were mostly delivered using online and blended approaches and integrated into curricula as elective courses. The duration of the digital health courses in the included studies ranged from a minimum of 1 hour to a maximum of 3 years. Only a few studies reported evaluation data for the courses, and these largely reported improvements in knowledge, skills, attitudes, satisfaction, and students' engagement with digital health courses. The courses reported in the included studies had a very diverse approach to course development. Only one-third of the included studies followed specified protocols, steps, or guidelines to specify the learning objectives for digital health courses. Similarly, most of the included courses did not refer to the use of a digital health competency framework during course development.

Most of the digital health courses were offered as elective courses. Given the need for a digitally competent health workforce, it is important that digital health courses become part of the core curriculum. In addition, studies focused on one area of digital health, mostly medical informatics, followed by EHR skills and computer literacy. Medical informatics courses within the included studies varied and ranged from the basic concepts of medical informatics, theories, and applications to details about health information management and systems. Many medical informatics courses focused primarily on information literacy and the development of evidence-based medicine skills. It is important to acknowledge the constant progress in digital health and the fact that studies published before 2010 could not have included training on more novel digital health applications such as the use of artificial intelligence or big data. In addition, digital health is a vast and growing field. As such, it may need to be incorporated into the medical curriculum in a stepwise, modular manner, with smaller courses focusing on individual and specific areas. Correspondingly, half of the studies included in our review focused on a particular digital health area. However, it is essential to have a comprehensive overview of all digital health competencies that the curriculum focuses on, and existing digital health competency frameworks may provide a useful guide in the development of courses. However, they were only mentioned in a small number of courses. Future digital health courses should focus on emerging technologies such as virtual consultation, mHealth, smart wearable devices, activity trackers, and other smart monitoring devices.

Most of the included studies were uncontrolled before-and-after studies; evaluated the effectiveness of digital health courses; and reported a number of learning outcomes, including changes in knowledge, skills, and attitudes toward the course. Although the findings related to the reported learning outcomes from the studies were in favor of a digital health course, there is a need for more robust evaluations of the effects that digital health courses have on learning outcomes, which was also highlighted in recent studies focusing on telemedicine [26,31,67] and clinical informatics courses [28,29]. Currently, there is only limited evidence, and more evaluation and implementation research is recommended.

Our review has several strengths, including the comprehensiveness of the search, covering major bibliographic databases; robust screening; data extraction; and data analysis. However, because this is a novel area of research, there may be some reports of digital health courses in gray literature that we may have missed. In addition, we included studies published from 2000 onward, and we may have missed studies published before 2000. However, because of recent advances in digital technologies within the last two decades, we decided to focus on the most relevant studies on the topic. Finally, the description of the design and implementation of digital health courses (eg, specific learning objectives or assessment approaches) in some studies was limited, precluding a more in-depth analysis and presentation of the findings.

Recommendation for Implementation and Further Research

To the best of our knowledge, this is the first attempt to comprehensively review studies evaluating digital health topics–related courses for medical students. One recently published study looks at medical students' training in eHealth from 2014 onward and lacks information related to curriculum design, developments, and assessments [68]. We identified several gaps related to digital health courses, such as the need for standardization of course design and development, course integration, assessment methods, studies from different settings, and evidence on the effectiveness of various course formats.

Most of the included studies focused on medical informatics courses. More research is needed on other areas of digital health, such as mHealth and telemedicine. In addition, most of the included studies were from high-income countries. There is a need for context-specific studies in diverse settings, including low- and middle-income countries. High heterogeneity in reporting in the included studies highlighted the need for standardized reporting guidelines and validated outcome assessment tools. Finally, more high-quality studies assessing the effectiveness of different forms of digital delivery approaches in improving digital health–related learning outcomes for medical students are needed because most of the included studies are uncontrolled before-and-after studies or case studies.

Conclusions

Current digital health courses for medical students that have been evaluated or reported in the literature are mostly elective and showcase diverse delivery, development, assessment, and evaluation methods. The limited evaluation data show improvement in students' knowledge, skills, and attitude toward digital health course outcomes. The COVID-19 pandemic has increased the importance of digital health, with a substantial increase in the use of remote consultation models and greater use of electronic prescribing [69]. Doctors and other health professionals need to be adequately trained to work in this new environment, where a greater proportion of health care is delivered by digital methods. Hence, further high-quality studies assessing the effectiveness of digital health courses on students' learning outcomes are needed. There is also a need for standardization and development of guidance specifying different digital health areas, terminology, learning objectives, optimal development and delivery approach, duration, assessment method, and structure of the courses.

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Authors' Contributions

LTC conceived the idea of the review. BMK and LTC wrote the manuscript. BMK and RSNP screened the studies and extracted the data. LTC provided methodological guidance. LTC, JC, RVDK, NC, and RSNP provided insightful feedback on the review.

Conflicts of Interest

None declared.

Multimedia Appendix 1
MEDLINE search strategy and keywords used for searching gray literature.
[DOCX File , 16 KB - mededu_v7i3e28275_app1.docx]

Multimedia Appendix 2
Inclusion and exclusion criteria.
[DOCX File , 17 KB - mededu_v7i3e28275_app2.docx]

Multimedia Appendix 3
Data extraction form.
[XLSX File (Microsoft Excel File), 35 KB - mededu_v7i3e28275_app3.xlsx]

Multimedia Appendix 4
Characteristics of the included studies on digital health training for medical students.
[DOCX File , 99 KB - mededu_v7i3e28275_app4.docx]

Multimedia Appendix 5
Digital health courses' delivery approaches.

[PNG File , 42 KB - mededu_v7i3e28275_app5.png]

Multimedia Appendix 6
Digital health course development process and learning objectives.
[DOCX File , 46 KB - mededu_v7i3e28275_app6.docx]

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Abbreviations

EHR: electronic health record
IT: information technology
mHealth: mobile health
PRISMA-ScR: Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews
RCT: randomized controlled trial

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Original Paper

Awareness, Views, Perceptions, and Beliefs of Pharmacy Interns Regarding Digital Health in Saudi Arabia: Cross-sectional Study

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Abstract

Background: Digital health technologies and apps are rapidly advancing in recent years. It is expected to have more roles in transforming the health care system in this era of digital services. However, limited research is available regarding delivering digital health education in pharmacy and the pharmacy students' perspectives on digital health.

Objective: This study aims to assess pharmacy interns' awareness of digital health apps in Saudi Arabia and their views regarding the coverage of digital health in the education of pharmacists. In addition, we assessed the interns' perceptions and beliefs about the concepts, benefits, and implementation of digital health in practice settings.

Methods: A cross-sectional study using a web-based survey was conducted among pharmacy interns at Unaizah College of Pharmacy, Qassim University, Saudi Arabia. An invitation with a link to the web-based survey was sent to all interns registered at the college between January and March 2021.

Results: A total of 68 out of 77 interns registered in the internship year participated in this study, giving a response rate of 88%. The mean total score for pharmacy interns' awareness of digital health apps in Saudi Arabia was 5.66 (SD 1.74; maximum attainable score=7). The awareness with different apps ranged from 97% (66/68) for the Tawakkalna app to 65% (44/68) for the Ministry of Health 937 call center. The mean total score for attitude and beliefs toward concepts and benefits of telehealth and telemedicine apps was 58.25 (SD 10.44; maximum attainable score=75). In this regard, 84% (57/68) of the interns believed that telehealth could enhance the quality of care, 71% (48/68) believed that it could help effectively provide patient counseling, and 69% (47/68) believed it could improve patients' adherence to therapy. In this study, 41% (28/68) believed that the current coverage of digital health in the curriculum was average, whereas only 18% (12/68) believed it was high or very high coverage. Moreover, only 38% (26/68) attended additional educational activities related to digital health. Consequently, the majority (43/68, 63%) were of the opinion that there is a high or very high need to educate and train pharmacists in the field of digital health.

Conclusions: Overall, the interns showed good awareness of common digital health apps in Saudi Arabia. Moreover, the majority of the interns had positive perceptions and beliefs about the concepts, benefits, and implementation of digital health. However, the findings showed that there is still scope for improvement in some areas. Moreover, most interns indicated that there is a need for more education and training in the field of digital health. Consequently, early exposure to content related to digital health and pharmacy informatics is an important step to help in the wide use of these technologies in the graduates' future careers.

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KEYWORDS

digital health; eHealth; mHealth; telehealth; telemedicine; attitude; awareness; pharmacy interns

Introduction

Background

The use of technology to deliver health care services and health education has grown rapidly in recent decades. Moreover, the digital transformation of health care is gaining more attention with the recent major developments in information and telecommunication technologies, the Internet of Things, virtual care, remote monitoring, artificial intelligence, big data analytics, and digital platforms [1]. Digital health is defined by the World Health Organization as "the field of knowledge and practice associated with the development and use of digital technologies to improve health." It is a broad term and includes mobile health (mHealth), eHealth, telehealth, telemedicine, and other artificial intelligence applications in health care [1,2].

Digital health technologies have the potential to improve health outcomes, improve the efficiency of health systems, empower patients with knowledge, improve access to health care, and lead to cost savings. For example, telehealth, which involves the use of virtual technology to provide health information, awareness, consultation, monitoring, and many other forms of medical care, helps to improve access to health care while maintaining health expenses at a reasonable level. Moreover, in telemedicine, technology is used to deliver clinical practice services in a distance setting [3,4]. In telemedicine, health care providers can use video conferencing and other technology apps to exchange health information in clinical practice and interpret lab results. Telemedicine serves as an appropriate alternative for in-person visits to health care providers' offices. It can help to decrease the impact of physician workforce shortages and the lack of specialized care in some geographic areas [5]. Thus, patients can easily receive health care at acceptable costs and effective services [6].

It is evident in the literature with many studies from different countries that telehealth and telemedicine are effective tools for patient care, including for people with chronic diseases such as diabetes and mental health, and can provide critical care services for distant areas [7-9]. Moreover, digital health, including telehealth, plays a pivotal role during pandemics, disasters, and emergencies [10,11]. For example, during the COVID-19 pandemic, to decrease the transmission of the virus, many countries have implemented lockdowns and expanded the use of technology for many services, especially health care services and education. The acceleration of technology adoption to deliver health services during the pandemic provided physicians with opportunities to manage their patients and work with the latest technology to have safe and effective options to access health care services [11].

The global market size of telemedicine in 2019 was estimated at US $27.8 billion, with a promising growth rate in the next few years [12]. Telehealth expansion will require substantial restructuring of laws and regulations to protect both patients and providers [13]. Many governments and private health systems have invested in introducing telehealth services. Some have well-integrated networks, such as the Ontario Telemedicine Networks in Canada and telehealth services in Veteran Affairs in the United States [14]. The Australian government has encouraged the use of telehealth in medical consultations and introduced reimbursement for some services, including video-based consultations [14,15].

In Saudi Arabia, the initiatives to adopt eHealth and telehealth services date back to more than three decades. For example, the Center of eHealth was established at the King Faisal Specialist Hospital & Research Centre in Riyadh, which is considered a tertiary hospital and one of the leading institutions in the Middle East. The center has international cooperation via videoconferencing with other centers around the world, and it has telemedicine network centers distributed in many regions in Saudi Arabia to deliver health care and consultation to distant areas [16]. Recently, in 2017, as part of Saudi Arabia's Vision 2030, the implementation of the digital transformation plan for the public and private health sectors began. Consequently, the Saudi Ministry of Health (MOH) has created many mobile apps to facilitate administrative processes for patients and to allow them to obtain medical consultations and refill their medications [17]. For example, the Saudi MOH introduced *Mawid*, which acts as a national platform to book medical appointments and to manage referrals from primary care centers to specialized centers [17]. In 2019, the Saudi MOH launched *Sehhaty*, which provided personal health information and improved knowledge about public health and healthy lifestyles; it was subsequently used to book COVID-19 vaccine appointments [16]. Moreover, the Saudi MOH introduced a call center (937) that received calls and offered answer services for the patients and clients for any medical questions related to symptoms or medications [17]. During the COVID-19 pandemic, the government launched several mobile apps to prevent the spread of COVID-19. The government introduced *Tetamman* to guide and help people who were under isolation because of contact with infected persons or those returning from abroad. The *Tawakkalna* app was used to provide movement permission during curfew times and as electronic personal identification that included all national documents and provided information on the infection status of people, allowing them to enter restaurants, supermarkets, and governmental authorities. In August 2020, an app named *Tabaud* was used for contact tracing of infected cases [17].

As digital health grows rapidly with massive investment from the government of Saudi Arabia in line with Saudi Vision 2030, it is important to ensure all challenges and barriers for the wide adoption and use of digital health are addressed. The barriers reported in the literature include that digital health technologies and telemedicine could be perceived as technically challenging for some health care professionals [18]. In addition, it is of great importance to ensure that health care professionals are aware of the economic and clinical values of digital health technologies, to increase their acceptance of an effective method to deliver health care, and to ensure they have the necessary skills to use it in their daily work and teach patients how to access telehealth efficiently [18]. In addition, there is a good opportunity to cover the use of digital health in the curriculum of medical and pharmacy colleges. The earlier coverage of digital health in the initial education and training of health care professionals during their university studies has the potential to increase their comfort and familiarity with the use of the various digital health technologies, leading to wide and rapid use in their future practice and to help promote the adoption of this technology among the community as well [5].

Objectives

The objectives of this study are to assess the pharmacy interns' awareness of common digital health apps in Saudi Arabia and to assess their views regarding the need for the coverage of digital health in the education and training of pharmacists. Moreover, the study assessed the interns' perceptions and beliefs about the concepts and benefits of digital health and their beliefs regarding the implementation of telehealth in practice settings.

Methods

Study Design and Setting

This was a cross-sectional study that used a web-based survey. The target population of this study were PharmD interns at the Unaizah College of Pharmacy, Qassim University, Saudi Arabia. The PharmD interns were those who completed all the didactic curriculum (ie, 5 years) and were enrolled in the sixth year of the program (ie, the internship year). During the study period, the PharmD interns had already spent more than 6 months of training and clinical rotations in the hospital setting. All 76 PharmD interns were invited to participate in the study. Ethical approval was obtained from the Health Research Ethics Committee at Qassim University, Saudi Arabia (reference number 20-06-12).

Development and Administration of the Questionnaire

The questionnaire used in this study was developed based on previous studies [16,19-21]. The final questionnaire consisted of four parts. The first part assessed the interns' awareness of the digital health apps in Saudi Arabia. It examined whether the interns were aware of the seven common mHealth apps that are used in Saudi Arabia. The total awareness was calculated by giving 1 point if the intern was aware of the app and 0 if the intern was not aware. Consequently, the attainable score ranged from 0-7 points. The second part consisted of five questions that focused mainly on the interns' views regarding the need to cover digital health in the education and training of pharmacists. The interns were asked whether they attended any training course, conference, or educational activities related to digital health (the answer choices were yes or no). For the four remaining questions of this part, the interns were asked about their opinion regarding the current coverage of digital health in their PharmD program, the importance of education and training for pharmacists in the field of digital health, and their familiarity with pharmacy informatics in their practice setting. The interns were given a choice to express their views and opinions on a 5-point scale from very low (1) to very high (5). For the sake of comparison between male and female interns, the total score was calculated with a maximum score of 20.

The third part of the questionnaire consisted of 15 statements that assessed the perceptions and beliefs of pharmacy interns about the adoption of digital health, including telehealth and telemedicine in the health care system and its related benefits. It focused on the usability of telehealth apps in their work and the ability of these apps to support clinical decisions and facilitate good clinical practice. Moreover, it included statements to assess the beliefs of interns about whether digital health can provide psychological support for patients and whether it can be used effectively in patient counseling and can enhance patients' adherence and access to health services. The answers were rated on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The attainable scores ranged from 15-75 points. The fourth part of the questionnaire assessed interns' beliefs regarding the implementation and complexity of telehealth and telemedicine and consisted of six statements. The first three questions focused on implementation and were measured on a 5-point Likert scale ranging from *strongly agree* (5 points) to *strongly disagree* (1 point). For the remaining three statements that focused on the complexity of telemedicine, the Likert scale score was reversed and graded using 5 points for *strongly disagree* and 1 point for *strongly agree* as they presented negative views. The attainable scores ranged from 6-30 points.

To ensure the validity and applicability of the questionnaire in our setting, it was sent to 2 reviewers with expertise in both digital health and questionnaire-based studies to comment and provide feedback on the questionnaire. Their comments and feedback were incorporated, and minor modifications were made. Then, it was given to 3 interns to check the clarity, applicability, and suitability; then, the questionnaire was finalized and made ready for web-based distribution.

The questionnaire was distributed on the internet via WhatsApp (Facebook Inc), and all interns were invited to participate in the study. The interns were provided with a brief overview of the survey, including its aim and the fact that their participation was voluntary, and they could withdraw at any time during the study.

Analysis of the Data

SPSS version 20.0 (IBM Corp) was used to analyze the data and to summarize the responses of interns. Descriptive statistics, which included frequencies and percentages, were used to summarize the responses of interns to the survey questions. Inferential statistics (ie, Student two-tailed t test) were used to examine whether there were significant differences in the mean scores between males and females. Statistical significance was set at $P<.05$.

Results

Demographic Data

Of the 77 interns, 68 completed the survey, giving a response rate of 88%. In terms of gender, 29% (20/68) were male and 71% (48/68) were female. In terms of age, the mean age (SD) was 23.68 years (SD 0.87), ranging from 23 to 26 years.

Pharmacy Interns' Awareness of Digital Health Apps in Saudi Arabia

Overall, the mean total score for pharmacy interns' awareness of mHealth apps in Saudi Arabia was 5.66 (SD 1.74; maximum attainable score=7). As shown in Table 1, almost all interns 97% (66/68) were aware of the Tawakkalna app. In addition, most of the interns were aware of other apps, including Sehhaty 88% (60/68), Mawid 88% (60/68), Tabaud 79% (54/68), and

Wasfaty 75% (51/68). However, only 65% (44/68) of the interns were aware of the 937 call center services provided by the Saudi MOH. There was no statistically significant difference in the mean score of pharmacy interns' awareness of digital health apps between male interns of 5.45 (SD 1.98) and female interns of 5.75 (SD 1.65; *P*=.52).

Table 1. Awareness of pharmacy interns of digital health apps in Saudi Arabia (N=68).

Digital health apps	Yes, n (%)	No, n (%)
Sehhaty	60 (88)	8 (12)
Mawid	60 (88)	8 (12)
Wasfaty	51 (75)	17 (25)
Tawakkalna	66 (97)	2 (3)
Tabaud	54 (79)	14 (21)
Tetamman	52 (77)	16 (24)
Saudi MOH[a] 937 call center	44 (65)	24 (35)

[a]MOH: Ministry of Health.

Pharmacy Interns' Views Regarding the Need for the Coverage of Digital Health in the Education and Training of Pharmacists

In this study, 38% (26/68) of the interns participated in additional educational activities or training courses on telehealth and eHealth. Among the interns, 41% (28/68) believed that the current coverage of telehealth and telemedicine was average, while only 18% (12/68) believed it was high or very high coverage. Furthermore, 63% (43/68) of interns were of the opinion that there is a high or very high need to educate and train pharmacists to be able to use digital health apps in their practice. Furthermore, more than two-thirds 68% (46/68) were of the opinion that training on the use of pharmacy informatics and digital health was necessary for the internship year (high or very high need), as shown in Table 2. There was no statistically significant difference in the mean score of responses of pharmacy interns regarding the need for the coverage of digital health in the education and training of pharmacists between male interns of 14.95 (SD 1.90) and female interns of 14.50 (SD 3.18; *P*=.56; maximum score for the four statements is 20).

Table 2. Views of pharmacy interns regarding the need for coverage of the digital health in the education and training of pharmacists.

Question	Pharmacy interns (n=68), n (%)				
	Very low	Low	Average	High	Very high
What do you think of the current coverage of telehealth and digital health in the PharmD program?	6 (9)	22 (32)	28(41)	10 (15)	2 (3)
To what extent is training in the use of telehealth necessary for pharmacists?	1 (1)	4 (6)	20 (29)	24 (35)	19 (28)
To what extent you are familiar with electronic health and drug information apps and databases (eg, UpToDate)?	1 (1)	8 (12)	17 (25)	19 (28)	23 (34)
To what extent do you believe the need for training in the use of telehealth apps and pharmacy informatics is necessary for the internship year program?	2 (3)	4 (6)	16 (24)	26 (38)	20 (29)

Pharmacy Interns' Perceptions and Beliefs About Telehealth and Telemedicine

In this study, 72% (49/68) of interns agreed that telehealth could help reduce medical errors, and 84% (57/68) agreed that telehealth could enhance the quality of care. In addition, 75% (51/68) of participants believed that telehealth and telemedicine could reduce the number of physical visits, and 65% (44/68) agreed that they could overcome the inconvenience of going to a physician or a pharmacist. Moreover, 72% (49/68) of participants agreed that telehealth can enable pharmacists to accomplish tasks more quickly, and 63% (43/68) believed that telehealth can improve clinical decisions. In terms of patient education and counseling, 71% (48/68) of participants believed that telehealth and telemedicine can help provide effective patient counseling, and 69% (47/68) believed that telehealth apps can improve the adherence to therapy of patients, as shown in Table 3. Overall, the mean total score for attitude and beliefs toward telehealth apps and telemedicine was 58.25 (SD 10.44; maximum attainable score=75), with no statistically significant difference in the mean score between male interns of 59.8 (SD 8.25) and female interns of 57.6 (SD 11.78; *P*=.45).

Table 3. Perceptions and beliefs of pharmacy interns regarding telehealth and telemedicine.

Statement	Pharmacy interns (n=68), n (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Telehealth can reduce medical errors.	32(47)	17 (25)	14 (21)	4 (6)	1 (1)
Telehealth can enhance the quality of patient care.	29 (43)	28 (41)	8 (12)	1 (1)	2 (3)
Telehealth can facilitate diagnosis and treatment.	12 (18)	23 (34)	19 (28)	10 (15)	4 (6)
Telehealth can increase communication among health care providers.	26 (38)	23 (34)	15 (22)	2 (3)	2 (3)
Telehealth can reduce the number of physical visits to health care centers.	23 (34)	28 (41)	13 (19)	3 (4)	1 (1)
Telehealth can enable pharmacists to accomplish tasks more quickly.	23 (34)	26 (38)	16 (24)	2 (3)	1 (1)
Telehealth can improve clinical decisions.	17 (25)	26 (38)	16 (24)	7(10)	2 (3)
Telehealth can provide more comprehensive health care services.	19 (28)	29 (43)	16 (24)	2 (3)	2 (3)
Telehealth is convenient and can overcome the inconvenience of going to a physician or a pharmacist.	14 (21)	30 (44)	18 (26)	5 (7)	1 (1)
Psychological support to patients can be provided effectively through telehealth.	14 (21)	23 (34)	22 (32)	7 (10)	2 (3)
Health education and patient counseling can be provided effectively through telehealth.	25 (37)	23 (34)	17 (25)	2 (3)	1 (1)
Virtual consultations allow prompt interventions.	11(16)	33 (49)	19 (28)	3 (4)	2 (3)
Telehealth can help in saving time.	24 (35)	30 (44)	7 (10)	3 (4)	4 (6)
Telehealth can enhance access to health care services.	24 (35)	30 (44)	7 (10)	2 (3)	5 (7)
Telehealth and electronic apps can improve adherence to therapy of patients.	19 (28)	28 (41)	16 (24)	3 (4)	2 (3)

Pharmacy Interns' Beliefs Regarding the Implementation and Complexity of Telehealth

More than two-thirds (48/68, 71%) of the participants believed that telehealth apps are compatible with pharmacists' duties, 56% (38/68) reported that they fit well with the way they liked to work, and 74% (50/68) thought that telehealth apps could be implemented through several devices and digital platforms. Regarding complexity, 35% (24/68) disagreed that digital health and telehealth required a lot of mental effort, whereas 34% (23/68) were neutral toward this statement. In this study, 46% (31/68) thought that digital health and telemedicine could increase workload, and 54% (37/68) reported that it could threaten patient privacy, as shown in Table 4. Overall, the mean total score for pharmacy interns' views regarding the implementation and complexity of telehealth use was 19.77 (SD 3.16; maximum attainable score=30). There was no statistically significant difference in the mean score of views regarding the implementation and complexity of telehealth use between male interns of 19 (SD 3.07) and female interns of 20.10 (SD 3.17; *P*=.19).

Table 4. Beliefs of pharmacy interns regarding the implementation and complexity of telehealth.

Question	Pharmacy interns (n=68), n (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I believe telehealth is compatible with the professional duties of pharmacists.	9 (13)	39 (57)	15 (22)	3 (4)	2 (3)
I think telehealth fits well with the way I like to work.	13 (19)	25 (37)	19 (28)	9 (13)	2 (3)
I think telehealth can be implemented through several devices and digital platforms.	16 (24)	34 (50)	8 (12)	5 (7)	5 (7)
I believe using telehealth requires a lot of mental effort.	3 (4)	18 (26)	23 (34)	12 (18)	12 (18)
I think telehealth increases staff workload.	9 (13)	22 (32)	12 (18)	18 (26)	7 (10)
I think telehealth threatens information confidentiality and patient privacy.	9 (13)	28 (41)	14 (21)	10 (15)	7 (10)

Discussion

Principal Findings

Digital health technologies and apps are rapidly advancing and have gained importance as they play a vital role in facilitating access to health care. They have multiple features that can save time for patients and clinicians in a low-cost and convenient manner. Moreover, telehealth has gained more importance in the education and training of health care professionals in recent years [22]. This study assessed pharmacy interns' awareness of digital health and their views about adopting this technology and its usability for their work. The interns showed good understanding of common apps used in Saudi Arabia. Approximately all participants were aware of the Tawakkalna app, which represents the highest percentage among the apps. In May 2021, the Saudi press agency reported that the Tawakkalna app had a high number of users, reaching more than 20 million users in Saudi Arabia, which is considered the highest number of users among all telehealth apps. This app was developed to show the health status or users and is required to enter markets, public, or governmental buildings [23]. In addition, it is a GPS-enabled app, which is used to control and limit the movement or residents during the curfew time implemented in the COVID-19 pandemic. In addition, it is used to issue permissions for exceptional situations to move during the curfew time. Moreover, it is connected with another app, *Tabaud*, which sends alerts to the users of the app to inform them that they are in close contact with confirmed cases of COVID-19 [24].

The interns showed positive views regarding the inclusion of digital health in the education and training of pharmacists, with the majority being aware of the current drug information apps and digital databases. As reported in previous studies conducted across different communities, the participants in this study showed interest in telehealth. They reported that it was necessary for their education and training and that it provided knowledge and opportunities to develop their skills, which could encourage students to use eHealth techniques in the future [25,26]. Although the interns showed good awareness of digital health apps and positive views regarding the inclusion of digital health technology in their education and training, many of them did not attend additional training in telehealth. Consequently, many believed that telehealth coverage in their PharmD program needs to be increased. Only 38% (26/68) of the interns attended training or workshops on digital health. In addition, 41% (28/68) believed that digital health and pharmacy informatics coverage in their PharmD program was low or very low. These findings are similar to those reported by a previous study conducted at the end of 2020 among medical students. The study concluded that only 17.4% of medical students had prior exposure to telehealth despite having a high level of interest in using telehealth in the future [26].

In the literature, there is a very limited number of studies related to the delivery of digital health education and training [14]. As reported by Edirippulige and Arm field [14], there are two main types of telehealth-related education and training. The first type is a traditional university course, whereas the second is continuing professional development, which focuses on professional skills [14]. As digital health has gained more importance in recent years, more education and training opportunities were recently integrated into our PharmD curriculum at the Unaizah College of Pharmacy, Qassim University. These include adding and integrating more topics related to digital health, pharmacy informatics, and automation in some pharmacy practice courses. In addition, an elective course in pharmacy informatics was added for additional training. Moreover, further opportunities were made available in the internship year for training in digital health, including pharmacy automation and digital drug information resources. This is particularly important for increasing knowledge and acceptance of this technology of the students. Several studies have indicated that telemedicine adoption is affected by the knowledge and perceptions of health care providers [20,27]. Other studies have shown that early exposure to telehealth and telemedicine practices early in health care education greatly impacts the knowledge and views of providers regarding their use in future work [25,26,28,29].

Most students showed positive perceptions and beliefs regarding telehealth apps. Approximately 72% (49/68) of interns agreed or strongly agreed that telehealth and telemedicine could help reduce medication errors compared with nearly 69.5% of health care professionals in an Ethiopian study [21]. In addition, 75% (51/68) of respondents believed that telemedicine reduces the need for physical visits, compared with 76.2% of respondents in the Ethiopian study [23]. Approximately 69% (47/68) of interns believed that telehealth apps help improve patient adherence to treatment, which is comparable with the findings of a study conducted among health care professionals and medical students in Saudi Arabia that reported that patient adherence might be improved with the help of technology [30]. A total of 65% (44/68) of interns agreed or strongly agreed that telehealth apps are convenient and can overcome the inconvenience of attending physicians or pharmacists, which is comparable with the 65.2% reported by Peprah et al [31] among university students.

The majority of interns showed positive views about the implementation of telehealth and indicated that telehealth is compatible with their professional duties. However, 31% (21/68) of interns agreed or strongly agreed that digital health requires more mental effort, and 46% (31/68) believed that telehealth could increase their workload. The findings related to the complexity of telehealth use in this study are consistent with the findings reported in previous studies [21,30]. A study conducted in Saudi Arabia by Thapa et al [30] reported that students perceived that the use of eHealth would increase work-related stress and could delay responses to patients' needs. In addition, this study found that more than half of the interns 54% (37/68) believed that telehealth might threaten the information privacy of patients, compared with 66% reported by Birukand Abetu [21]. The privacy of patient information is generally one of the challenges that has been assessed in many previous studies and should be considered when adopting telehealth services [32,33]. Many recent studies have revealed that data protection regulations are among the critical factors limiting the adoption of virtual software apps used in remote health care [34]. Easy accessibility and sharing of information may raise concerns regarding data confidentiality and misuse. However, in Saudi Arabia, huge investments have been made to ensure data protection and cyber security. In addition, through the National Health Information Center, it is required that all telemedicine practices follow Saudi Health Information Exchange Policies, which are well secured and highly consider patient rights and health information privacy [17,34].

Strengths and Limitations

This is one of the few studies in the literature that explored digital health from the perspective of pharmacy interns. In addition, a high percentage of the target population responded to the survey (68/77, 88%). However, this study has some limitations. First, it was conducted at one pharmacy college in Saudi Arabia; therefore, the findings might not be generalizable to other institutions in Saudi Arabia. However, given the limited literature in this field, we believe that this study provides useful insights and guidance for educators and policymakers in pharmacy education.

Conclusions

The use of digital health has gained importance and is expected to have greater roles today and in the future. It can help patients and clinicians in a low-cost and convenient manner to provide an acceptable level of health care. In addition, digital health can support clinical decisions through consultations and the exchange of information and experiences through technology. Telehealth and telemedicine can help in making health care more accessible to remote areas and during pandemic situations. Overall, the interns showed a good awareness of common digital health apps in Saudi Arabia. In addition, the majority of the interns had positive perceptions and beliefs about the concepts, benefits, and implementation of digital health. However, the findings showed that there is still scope for improvement in some areas. Moreover, most interns indicated that there is a need for more education and training in the field of digital health and pharmacy informatics. Consequently, early exposure to content related to digital health and pharmacy informatics is an important step to help in the wide use and apps of these technologies in the future careers and practices of graduates.

Conflicts of Interest

None declared.

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Abbreviations

mHealth: mobile health
MOH: Ministry of Health

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Original Paper

Medical Students' Perception and Perceived Value of Peer Learning in Undergraduate Clinical Skill Development and Assessment: Mixed Methods Study

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Abstract

Background: The effectiveness of peer learning in clinical skill development is well recognized and researched, given the many benefits gained such as enhanced learning, alleviation of the burden on faculty, and early development of teaching skills for future doctors. However, little is known in terms of its effectiveness as an assessment tool and the extent to which peer assessment can be relied upon in the absence of faculty support.

Objective: This study was conducted to assess medical students' perception toward peer learning, which is based on self-regulated learning as a tool of assessment, and to compare peer evaluation with faculty evaluation of clinical skill performance.

Methods: A cohort of 36 third-year medical students were exposed to peer learning (same-level) in clinical skills education for 3 months. A convergent mixed methods approach was adapted to collect data from 3 sources, namely, students' perception of peer learning, performance scores, and reflective observational analysis. A 5-point Likert-type scale was used to assess students' (n=28) perception on the value of peer learning. The students were asked to assess their peers by using a preset checklist on clinical skill performance, and scores were compared to faculty assessment scores. Reflective observational data were collected from observing video recordings of some of the peer learning sessions. The findings from all 3 sources were integrated using joint display analysis.

Results: Out of 28 students, 25 students completed the survey and 20 students perceived peer learning as valuable in clinical skills education. The mean score of peer assessment was higher than that of faculty assessment. There was a significant difference in student performance between supervised teaching and peer learning groups (P=.003). Most students focused on the mastery of skill with little attention to the technique's quality. Further, students were unable to appreciate the relevance of the potential clinical findings of physical examination.

Conclusions: Peer learning in clinical skills education, based on self-regulated learning, empowers students to develop a more responsible approach toward their education. However, peer assessment is insufficient to evaluate clinical skill performance in the absence of faculty support. Therefore, we recommend that peer learning activities be preceded by supervised faculty-taught sessions.

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KEYWORDS

peer learning; assessment; empowerment; undergraduate; medical students; self-regulated learning

Introduction

Peer learning is defined as "people from similar social groupings, who are not professional teachers, helping each other learn, and by so doing, learning themselves" [1]. Peer learning can be categorized into (1) same-level peer learning where students at equal academic levels discus and study the materials together and (2) cross-level peer learning where students' academic levels diverge [2]. Peer learning is rapidly gaining acceptance and there are supporting evidences for peer learning in clinical skill development worldwide. An objective structured clinical examination is a complex competency assessment that assesses the cognitive knowledge as well as the psychomotor skills of clinicians. The clinician needs to recall all the steps in the correct and most efficient order and thereafter skillfully perform each step of the investigation. Finally, the clinician needs to cognitively interpret the findings of each step independently as well as all of them together to reach a better understanding of the patient's condition. Peer learning has various benefits in clinical skill settings, including enhanced learning, cost-effectiveness [3], and alleviation of the burden on the teaching faculty [4], where some have even proposed that it might offer a solution to the global increase in the medical student numbers in the face of faculty shortage [5]. Peer learning fosters self-regulated learning. A recent study showed that students' ability to learn with peers has a significant positive impact on their academic achievements and significantly influences their self-regulated learning strategies [6]. This study also highlights the importance of facilitating the development of students' self-regulated learning and peer learning competencies in blended learning courses.

Self-regulated learning is defined as the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning processes [7]. There are many validated theoretical models that conceptualize self-regulated learning, an example of which is the "dual processing self-regulatory model" formulated by Boekaerts and colleagues [8], which describes the various purposes of self-regulated learning, namely, (1) expanding one's knowledge and skills, (2) protecting one's commitment to the learning activity, and (3) preventing threat and harm to oneself. Another example is the "triadic social cognitive model" described by Zimmerman [9] where he introduces the interplay between the environment, behavior, and person. He also conceptualized the virtuous cyclical phases of self-regulated learning that start with forethought, followed by performance, and finally, self-reflection. By fostering self-regulated learning, peer learning provides the students with a sense of ownership [10]. This offers them an opportunity to develop the skills and professional attributes needed for teaching, assessment, and feedback. These skills and attributes are essential to nurturing a life-long culture of learning and teaching that is vital to their future roles as clinicians, especially if they decide to work in academic contexts [5,11].

Although peer learning in formative settings has been widely explored in the literature, there has been less focus on peer assessment. Despite the benefits that peer assessment offers, in terms of the development of self-regulation and self-monitoring in lifelong learning [10], it is still unclear to which extent it can be relied upon in the absence of faculty support. Accordingly, this study investigates, from the self-regulated learning perspective, the experience of undergraduate medical students concerning the application of peer learning in acquiring clinical skills. The research questions in this study are as follows:

1. How does students' assessments of their peers compare to that of faculty?
2. How does the performance of the students receiving supervised learning compare to that of the students receiving peer learning (as assessed by the faculty in both cases)?
3. How do students perceive peer learning?
4. How does faculty perceive peer learning and what constitutes outstanding observations, from their perspective, in terms of students' individual level attitudes and behaviors and interactions among each other?
5. What were the highlights and limitations of the intervention under investigation and how can other similar health profession educators leverage the lessons learned to effectively integrate peer learning?

Methods

Context of This Study

The Foundations of Clinical Medicine is a 2-credit course offered to undergraduate medical students at the Mohammed Bin Rashid University of Medicine and Health Sciences (MBRU). It runs horizontally across the first 3 years of the Bachelor of Medicine, Bachelor of Surgery degree (MBBS), complementary to the basic sciences courses. This course introduces students to history taking, physical examination, and communication skills that are necessary to conduct a successful patient investigation, where simulation is the mainstay of learning and teaching. This study focuses on a specific intervention that was implemented in the third course of the respective horizontally integrated module. The third-year MBBS students attend a class for the corresponding course every Thursday for a duration of 15 weeks covering the first semester of the respective academic year. The cohort is usually divided into 2 groups. One group would receive supervised teaching in the morning while the other would undertake a self-study session with the option to consult from a selection of relevant resources available on their learning management system. The two groups would then switch for the alternate arrangement in the afternoon, each session lasting for a 2-hour duration.

Ethical Considerations

The MBRU institutional review board approved this study (Reference# MBRU-IRB- 2019-017). Participation in this study was voluntary with written consent in accordance with the general regulation of the College of Medicine-Human Research

Ethics Committee. The survey utilized to capture the perception of the participants was anonymous.

Intervention

The Foundations of Clinical Medicine course delivery was modified for this study where some of the self-study was substituted by peer learning sessions. The rationale for this modification was based on the feedback received from previous cohorts that self-study sessions were not of much benefit, and most of the students would rather dedicate the time toward more practice of the clinical skills. Accordingly, the core of the learning and teaching in the respective course was modified with the objective of enabling and empowering students to leverage peer learning for practicing and, in turn, improving their clinical skills. These modifications were in alignment with the 3 phases of the cyclic model of self-regulated learning proposed by Zimmerman [12], and therefore, these peer learning sessions were designed in a way to foster self-regulated learning. Table 1 compares the old and postintervention arrangements of the course delivery for a given group of students.

Table 1. A comparison of the preintervention and postintervention teaching arrangements for the foundations of the clinical medicine course.

Timing	Old arrangement	New arrangement
8 AM-10 AM	Supervised teaching	Peer learning
11 AM-1 PM	Break	Break
2 PM-4 PM	Self-study	Supervised teaching

All students were initially exposed to a video demonstration of the physical examination in the form of flipped learning material. The cohort was then randomly assorted into 2 groups. The first group initially underwent peer learning as the primary modality for 1 physical examination session, which was recorded using camera videos already installed in the simulation center where the intervention was conducted, after which the first group received traditional supervised teaching. As for the second group, they initially received traditional supervised teaching, and thereafter, they underwent peer learning as the secondary modality.

Research Design

A convergent mixed methods approach [13-15] to research was adapted with triangulation of quantitative and qualitative data from 3 sources: performance scores, students' perception of peer learning, and reflective observational analysis (Figure 1). The integration was conducted through joint display analysis [16].

Figure 1. Research design. Data are triangulated from 3 sources to increase the reliability of the findings.

Data Collection and Analyses

Performance Scores (Quantitative)

A preset checklist was used where students provided quantitative scores to assess the performance of their peers (Figures 2 and 3). The checklist is composed of 2 sections: (1) patient centeredness (to assess soft skills, including confidentiality and communication), and (2) technique performance consisting of a list of psychomotor steps to be performed by the students in the sequence outlined, including systematic reporting of findings by using appropriate medical terminology. The students were asked to assess their peers' performance against a dichotomous variable (done or not done). Two researchers, SAZ and MN (referred to as Faculty 1 and Faculty 2, respectively), used the same checklist to evaluate the students' performance both for supervised learning and when the students were undergoing peer learning as the primary modality (the same researchers did the latter, each independently, while observing the abovementioned recordings each at their own pace over 2 weeks). One of the researchers is an Internal Medicine physician and a faculty member at MBRU, and she coordinated and led the learning and teaching of the course under investigation. The other researcher is an Emergency Department physician who is specialized in the continuous learning and development of health care professionals. The scores were collated and analyzed using SPSS statistics version 25 (IBM Corp) to address the abovementioned research questions. Kruskal-Wallis test was used to compare faculty and peer assessment scores, and a two-tailed t test was performed to compare traditional supervised teaching method and peer learning method. A P value less than .05 was used as the level of significance in both tests.

Figure 2. Tutor checklist for gastrointestinal examination.

Physical examination checklist				
Patient centeredness:		**0**	**1**	**2**
Privacy (knocks before entering, ensures privacy by using screens, and draping)				
Infection control (sanitizes hands before and after examination)				
Respect (introducing self, seeks patient consent, explains procedure, asked if there were any questions, thanks the standardized patient)				
Technique: (patient in supine position)				
Inspection	▪ General (jaundice, abdominal distension) ▪ Hands (clubbing, palmar erythema, Dupuytern's contracture, asterixis/flapping tremor) ▪ Eyes (icterus, pale conjunctiva) ▪ Abdomen (scars, asymmetry, distension, dilated veins, visible peristalsis)			
Auscultation	▪ Auscultate for bowel sounds in all 4 quadrants			
Palpation	▪ Superficially palpate all quadrants ▪ Ask about pain, start away from pain and look at patient's face while palpating ▪ Deep palpation of all quadrants ▪ Test for rebound tenderness ▪ Palpate edge of the liver ▪ Palpate for splenomegaly ▪ Palpate both kidneys ▪ Assess for costovertebral angle tenderness ▪ Palpate for ascites by shift dullness and fluid thrill			
Percussion	▪ Percuss all quadrants			
For completion	▪ State that to complete your abdominal examination, you will also need to: **(do not perform)** - Examine the external genitalia - Perform a rectal examination			
Reporting	▪ Systematic ▪ Used medical terminology			

0: Not done **1**: Partially done >50% but < 100% **2**: Completely done 100%

Figure 3. Tutor checklist for endocrine examination.

Physical examination checklist				
Patient centeredness:		**0**	**1**	**2**
Privacy (knocks before entering, ensures privacy by using screens, and draping)				
Infection control (sanitizes hands before and after examination)				
Respect (introducing self, seeks patient consent, explains procedure, asked if there were any questions, thanks the standardized patient)				
Technique:				
General	▪ Inspection (agitation, anxiety)			
Hands	▪ Inspection (tremors, dry skin, palmar erythema) ▪ Palpation (pulse, rate, and rhythm)			
Face	▪ Inspection (diaphoresis, loss of lateral one-third of eyebrow)			
Eyes	▪ Inspection (lid retraction, exophthalmos, extra-ocular movements-need to ask patient to report double vision)			
Neck	▪ Inspection (scars, masses, test for movement with swallowing) ▪ Palpation of thyroid gland and cervical lymph nodes, assess for tracheal deviation ▪ Percussion for retrosternal dullness ▪ Auscultation of thyroid gland for any bruit			
Special tests	▪ Inspection of lower limb for pretibial myxedema ▪ Brachial reflex (assessing for delayed relaxation of deep tendon reflexes)			
Reporting	▪ Systematic ▪ Used medical terminology			

0: Not done **1**: Partially done **2**: Completely done

Students' Perception of Peer Learning (Quantitative)

A 5-point Likert-type scale (1: strongly disagree, 2: disagree, 3: not sure, 4: agree, and 5: strongly agree) survey composed of 8 components (Table 2) was used to anonymously assess students' perception on the value of peer learning in clinical skills education. Quantitative analyses of the data collected using the respective questionnaires were performed using SPSS statistics version 25. Cronbach alpha was used to test the reliability of the questionnaire. Factorial analysis was used to test the validity of the questionnaire. The score of the agreement was assessed by cross bonding calculation. Interitem correlation with the percentage of agreement was calculated. Mann-Whitney *U* test was used to compare the mean scores between the 2 groups. *P* values less than .05 were considered significant.

Table 2. Assessment of students' perception on the value of peer learning by their ratings on survey questions on a 5-point Likert-type scale.

Questions	Likert scale score				
	1	2	3	4	5
Question 1: The objectives were covered in the peer learning sessions	☐ Strongly disagree	☐ Disagree	☐ Not sure	☐ Agree	☐ Strongly agree
Question 2: Peer learning has improved my clinical skills	☐ Strongly disagree	☐ Disagree	☐ Not sure	☐ Agree	☐ Strongly agree
Question 3: Peer learning sessions created a safe learning environment	☐ Strongly disagree	☐ Disagree	☐ Not sure	☐ Agree	☐ Strongly agree
Question 4: I feel peer learning is useful for my Objective Structured Clinical Examination preparation	☐ Strongly disagree	☐ Disagree	☐ Not sure	☐ Agree	☐ Strongly agree
Question 5: Time allotted for the peer learning sessions was adequate	☐ Strongly disagree	☐ Disagree	☐ Not sure	☐ Agree	☐ Strongly agree
Question 6: Content and quality of the handout was good	☐ Strongly disagree	☐ Disagree	☐ Not sure	☐ Agree	☐ Strongly agree
Question 7: I recommend the continuation of the same method in the following years	☐ Strongly disagree	☐ Disagree	☐ Not sure	☐ Agree	☐ Strongly agree
Question 8: I recommend using the same method for other courses	☐ Strongly disagree	☐ Disagree	☐ Not sure	☐ Agree	☐ Strongly agree

Reflective Observational Data (Quantitative and Qualitative)

This component of the study relied on an ethnographic approach to research by using direct and unobtrusive observations. Along with quantitatively rating each student against the checklist (referred to in the quantitative performance scores), the abovementioned researchers also evaluated the students' performances and noted down all outstanding observations (ie, qualitative data), including the attitudes and behaviors of the students on an individual level and their interactions with each other. After the completion of the data collection, quantitative data were analyzed descriptively using SPSS statistics version 25. As for the qualitative, data, researchers adapted the 6-step framework for thematic analysis initially introduced by Braun and Clarke [17]. It is recommended to use this technique in research on health professionals' education [18], and it is frequently put into practice in this realm [19-21]. Accordingly, the researchers (independently) familiarized themselves with the data and then generated the initial codes. Thereafter, the researchers convened 2 consecutive 1-hour meetings to present the noted observations to each other, reflect upon them, and develop a common ground (in relation to the surfacing codes), which enabled effective collaboration around the searching for themes and their review. The researchers then defined and named the themes and reported upon them.

Joint Display Analysis

Findings from all 3 concurrent analyses were merged using joint display analysis [16]. The findings from those analyses were compared (and contrasted). The areas where those findings confirmed or built upon each other were identified. The integration also created the space for contradictory findings in any one area to be highlighted and considered in conjunction with each other when undergoing meta-inferences to weave a consistent narrative out of this study's findings [22,23].

Results

Performance Scores (Quantitative)

Comparison of Peer and Faculty Assessment

A comparison of peer assessments with faculty assessments of clinical examination skills showed that the mean score of peer evaluation was significantly higher at 18.05 (SD 2.15) out of 20 compared to 12.67 (SD 2.63) for Faculty 1 and 11.89 (SD 4.80) for Faculty 2. Both faculty members had comparable means.

Comparison of Supervised Teaching and Peer Learning

There was a significant difference between the assessment scores of students who received traditional supervised teaching compared to those who received peer learning as the primary teaching modality. Scores were significantly higher in the supervised groups compared to the peer learning group with a mean of 17.33 (SD 2.57) for the former and 14.20 (SD 3.25) for the latter (P=.003).

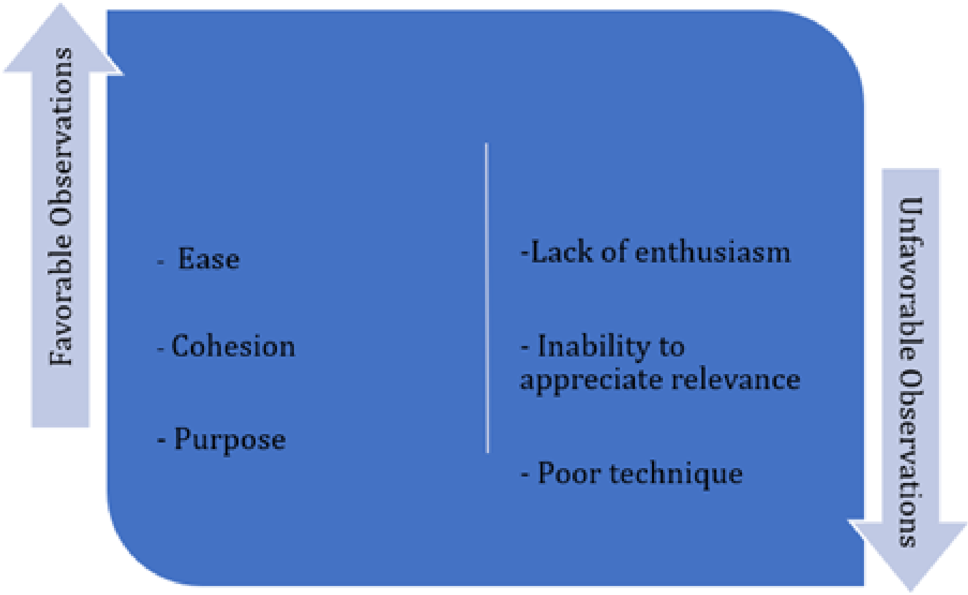
Students' Perception of Peer Learning (Quantitative)

Of the total student population, 89% (32/36) completed and returned the questionnaire. The participants were third-year medical students aged between 19 and 29 years, and there were more female participants (24/36, 67%) than male participants (8/36, 22%). Around 47% (17/36) of the cohort's grade point average lay between 3 and 4. The questionnaire was reliable at a Cronbach alpha score of .895. The mean score of the agreement calculated by cross bonding calculation was 31.56 (SD 6.58), corresponding to a total score of 79%, which shows "agreement." The majority of the items' score means were high, ranging from 3.91 to 4.22 toward "Agree," except for question 5: "Time allotted for peer learning sessions was adequate" (Table 2) demonstrating the lowest mean at 3.03 (SD 1.492), voluntarily elaborated upon by some students with comments such as "…2 hours is too long a time for peer learning sessions…" In addition, question 8 "I recommend using the same method for other courses" had the second lowest mean at 3.75 (SD 1.136). The average interitem correlation for questions 1, 2, 3, 4, 6, and 7 (Table 2) were between 0.338 and 0.853. However, question 5 "Time allotted for the peer learning session was adequate" displayed a consistently low correlation with most questions having an interitem correlation at or below 0.300. Question 8 "I recommend using the same method for other courses" correlated poorly only with question 4 "I feel peer learning is useful for my Objective Structured Clinical Examination preparation" while correlating well with the rest of the questions. Factorial analysis of the questionnaire confirmed construct validity across all items.

Reflective Observational Data (Qualitative)

The qualitative analysis conducted by the 2 abovementioned researchers resulted in a conceptual framework (Figure 4). This conceptual framework consists of 2 themes: favorable and unfavorable observations.

Figure 4. Conceptual framework of reflective observation.



Theme 1: Favorable Observations

This theme includes the researchers' observations that explain students' attitudes and behaviors and ways of relating to one another that were desirable for attaining the intervention's objective (Table 3). This theme consists of 3 categories: noticeable comfort or ease, high level of cohesion and teamwork among the students while undergoing the intervention, and urge to master skills, where students appeared to be purposefully revisiting the checklist (in a repetitive manner).

Table 3. Explanation for theme 1.

Observation	Interpretation
Ease in pinpointing personal and team shortcomings	Learning in a safe and relaxed environment
Evident cohesion and seeking support	Willingness and capacity to work in a team
Purposeful revisiting of the checklist	Proactiveness and urge to master skills

Theme 2: Unfavorable Observations

This theme includes observations that were counterproductive to attaining the objective of the intervention (Table 4). This theme encapsulated 3 categories: an overall lack of enthusiasm, inability to appreciate the relevance of potential physical findings, and poor technique while performing the set of skills.

Table 4. Explanation for theme 2.

Observation	Interpretation
Lack of enthusiasm	Students do not appreciate the value of these peer learning sessions
Inability to appreciate relevance	Cases where students struggle to interpret potential findings of physical examination
Poor technique	Incidences where students appeared to perform the examination, but the quality of the core technique is suboptimal

Integration Results

The output of the 3 concurrent analyses generated findings that were all holistically considered in the iterative process of joint display analysis. Most of the findings complemented each other (as illustrated in Figure 5). To start with, in terms of highlights of the experience, the students expressed appreciation of this particular peer learning experience. Along these lines, the instructors observed that the students appeared comfortable and seemed to appreciate the safety and comfort of the encapsulating environment. The instructors also perceived that students exhibited teamwork and proactiveness. As for the limitations of the experience, the students seemed to overrate each other. Further, the students expressed dissatisfaction with the allotted time; they perceived it as too long for the purpose of the exercise. Despite their self-reported positive perception toward the exercise, the students highlighted that they would not like to replicate it in other courses. Moreover, the instructors developed the impression that the students were not enthusiastic during the experience, and (in some instances) there were aspects that seemed to challenge the students. These aspects include the core technique and the interpretation of findings.

Figure 5. Joint display analysis based on mixing and matching of the key findings derived from the output of the concurrent analyses (each represented with a differing primary color: red, yellow, and blue). The metainferences derived are placed in a brown box to represent the mixing of the three primary colors.

Discussion

Overview of This Study

In this study, we described the implementation of peer learning as an assessment tool in clinical skills education for undergraduate medical students. The findings of this study showed how the peer learning experience under investigation is characterized by certain highlights and limitations in relation to self-regulated learning. The concept of social and cognitive congruence underlies the dynamics of peer learning and is explained by the similarity of thinking, reasoning, and social roles, which account for the successful outcomes of peer learning [5]. While participating students had an overall positive perception of peer learning, they were less objective (relative to their instructors) when evaluating their colleagues' performance. In addition, students' clinical skills and quality of performing the clinical examination were better under faculty supervision. However, there was clear evidence that peer learning in clinical skills fostered self-regulated learning through creation of a safe learning environment in line with the "scaffolding strategy" described by Zimmerman [9].

Accordingly, the findings of this study recommend other similar programs to integrate peer learning into undergraduate clinic skills education. Such an intervention should be designed in a way to leverage this technique's highlights while circumventing its limitations.

Principal Results

Performance Scores

Comparing peer learning with faculty assessment of clinical skill performance is essential for establishing the concurrent validity of peer assessment. Our results showed that the mean score for peer assessment was higher than that of faculty assessment. This lack of alignment between peer and faculty evaluation could be due to the assessment of a different dimension even when using the same checklist where students tend to assess recall of steps while the faculty consider the techniques in the execution of every step of the skill set to be of equal importance. The peer assessors considered the face value of the checklist, where it solely outlined the steps. As for the instructors, their expertise automatically sets them at an advantage where they "look beyond the obvious." From this perspective, the simplistic structure (ie, design) and content of the checklist, where there is no emphasis on the expected quality of the technique, might partially account for the occurrence of this discrepancy. Another possible explanation for this misalignment could be due to the potential bias associated with students taking on the assessor's role [24]. Moreover, our results demonstrated that students subjected to supervised teaching as the primary modality attained higher scores than the peer learning group. This was evident from the scores recorded by the faculty through direct observation of the former group and observation of video recordings for the latter group. This was further supported and can be explained by 2 unfavorable observations noted from the qualitative analysis of peer learning, namely, suboptimal quality of technique and inability to interpret the potential findings of the examination. These findings highlight the need for the faculty to support and guide students on appropriate techniques when conducting physical examinations as this is the key to eliciting physical signs in real life patient encounters. In addition, even though feedback from peers is anticipated to be much more efficient if a checklist was used [6], we believe that students require proper training before they develop the necessary competency in assessing and guiding one another. This is consistent with findings from previous studies, which show that students cannot be reliable assessors unless they receive sufficient "training and familiarity with rating criteria, resulting in higher rater agreement and internal consistency" [25]. Accordingly, it is recommended for such interventions to be designed in a way where learners go through the supervised teaching offered by experts in the subject matter and thereafter engage in peer learning. As such, supervised teaching will precede peer learning, and the benefits of peer learning, in terms of practicing and refining clinical skills, can be leveraged after covering the technical bases.

Perception of the Students With Regard to Peer Learning

Findings from the questionnaire demonstrated that most students had a positive perception toward peer learning, which is in line with most research findings [2,26]. However, it seems that the benefits of peer learning were limited as most students were reluctant to recommend implementing peer learning in other courses. This may be due to the students perceiving 2 hours as too long of a duration for the exercise. Another possible explanation is that all other courses are knowledge-based, and therefore, such a peer activity may not be relevant or of much benefit.

Reflective Observations

A general lack of enthusiasm was observed among students during the peer learning sessions. A possible explanation could be that there is not much at stake as this team activity was considered part of their formative rather than summative assessment. This attitude toward formative assessments is most probably accounted for by the lack of maturity in terms of self-regulated learning skills among our preclinical students, which is one of the many disadvantages of an exam-oriented culture [26]. Moreover, this explanation may justify the students' underappreciation of the time dedicated to the peer learning sessions, as highlighted from their comments in the questionnaire. Pintrich [27] highlighted the importance of motivation in self-regulated learning. He perceives the steps of self-regulated learning to be (1) forethought, planning, and activation, (2) monitoring, (3) control, and (4) reaction and reflection. Each of those steps, in his opinion, has 4 different areas for regulation (cognition, motivation, behavior, and context). From this perspective, a possible solution to the observed lack of enthusiasm among participating students in this study could be to dedicate some time at the beginning of the course to better orient students to the short-term and long-term benefits of peer learning as a way of motivating them (ie, increase the perceived benefits of engaging in the exercise).

A selective learning approach dominated students' learning behavior during peer learning sessions. The majority focused on attaining a sequential mastery of the examination steps, regardless of the quality of performance. This behavior is consistent with the predictions of the cognitive load theory [28]. The differential use of the checklist, however, between students and faculty was evident as students would tend to use it as a learning tool while the faculty would consider it more of an assessment tool. This reflects the cultural norms here in the United Arab Emirates, where there is a high level of cooperation and uncertainty avoidance. This trait was further demonstrated by competent students supporting others through repetition of skills toward mastery, which is in line with the social learning theory that describes the cooperative nature of students' learning from each other through "modelling, instructing, and feedback" [29]. Moreover, Hadwin et al [30] discuss self-regulated learning in the context of collaborative learning, where they differentiate between coregulation and socially shared regulated learning. In the former, the regulatory actions are guided by a particular group member. As for the latter, regulatory actions emerge through a series of transactive exchanges among group members, which were clearly observed during our peer learning sessions. Another interesting observation was that the importance of relevance of any potential clinical finding did not seem to be a priority of the learning experience to most students. Consequently, despite the efforts some students invested into interpreting potential findings of the physical examination, they still, on many occasions, ended up providing misguided peer correction.

Given these findings, we feel that a subject matter expert in clinical skills education is essential for assisting students in executing the correct clinical techniques, for enabling them to appreciate the potential findings of a physical examination, and for attending to their questions and uncertainties. On a positive note, it seems that peer learning creates a safe environment for the students, which is in line with evidence from studies where students reported comfort in interacting without the pressure of competition [31] and simply feel more at ease with a peer [5]. This kind of safety in learning falls under the scaffolding strategy described by Zimmerman [9], which he considers to be a key factor in the performance phase of self-regulation, and he elaborates on the fact that "it may also help to enrich the learning experience by allowing students to dig deeper into the content and further explore."

Strengths and Limitations of This Study

Our study's strength lies in 3 main features: (1) performance of the study in a live educational setting, (2) integration of data through the use of a convergent mixed methods approach to research, and (3) randomization in the cross-over part of the study.

One of this study's main limitations is that the generalizability of the findings is limited due to the small sample size of the participants. Another limitation is that the peer assessment scores obtained were not a pure reflection of performance as students mostly used the checklist as a learning tool rather than as an assessment tool. This is, of course, in addition to the fact that peer assessment may lack objectivity due to the abovementioned potential bias, which questions its reliability in terms of assessment. Moreover, although decided for simplicity purposes, the score divisions of 1 for "done" and 0 for "not done" on the evaluation checklist did not reflect the quality of performance that is usually assessed in a broader spectrum. Finally, this intervention's outcomes were limited to step 1 "reaction" and to a lesser degree, step 2 "learning" of Kirkpatrick's model of evaluation [32].

Comparison With Prior Work

Our findings of students' positive perception toward peer learning are in line with findings of most research studies in this area [2,26]. However, it seems that our decision for students to undertake peer learning as a primary modality with no previous training might have been miscalculated as most studies ensured that peer-assisted tutors were subjected to some amount of training [33]. This might, in part, account for the misguided peer correction mentioned earlier and perhaps even the misalignment between peer and faculty evaluation of clinical skill performance. In addition, most peer learning studies focused on cross-level peer learning. In contrast, in our study, we investigated same-level peer learning to make use of advantages such as informality and practicality in terms of timetabling compared to cross-level peer learning [33]. With regards to the comparison of outcomes of clinical skill teaching by peers compared to faculty as a primary modality, the evidence in the literature is controversial as some studies reported no significant difference [2] while others concluded that students in the faculty-led teaching group required lesser time to reach the desirable outcomes [5].

Further Work

The long-term effects of peer learning in medical education are poorly understood [5]; therefore, more robust outcome measure tools need to be developed that would go beyond the first and second levels of Kirkpatrick's model of evaluation [18]. Moreover, we recommend future studies to tackle a larger sample size of participants for a more reliable statistical analysis and more representative findings.

Conclusions

Our study's findings provided evidence of acceptability and benefits of peer learning in the clinical skills education of undergraduate medical students that includes but is not limited to promoting interactive social learning. The intervention under investigation also constituted a safe learning environment for students to exercise self-regulated learning. However, peer learning is insufficient as a standalone strategy. Therefore, it needs to be preceded by supervised teaching provided by a subject matter expert for the maximum benefit to be gained. In summary, we recommend incorporating peer leaning as a secondary modality into the design of medical curricula to empower students to exercise self-regulated learning and enable them to acquire teaching and assessment skills early on in their learning trajectory that will foster a lifelong culture of teaching [26].

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Conflicts of Interest

None declared.

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Abbreviations

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