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ABSTRACT

In developing countries such as Pakistan, bioethics has not been included in mainstream thinking in medical education. The authors' experiences suggest that current methods of teaching bioethics are problematic as students are unable to translate theory to practice. Alternative pedagogies, such as just-in-time learning (JiTl) using mobile devices, may be able to foster the development and implementation of ethical reasoning among nurses, doctors, and medical and nursing students. This research was conceived to determine the effectiveness of mobile JiTL – anytime, anyplace learning through mobile devices – for teaching bioethics. After obtaining ethical clearance, a participatory design (PD) approach was adopted to ensure input from all stakeholders for the design of 'EthAKUL', comprising a mobile app, five modules and just-in-time pedagogy. The name of the app is an acronym evoking ethics, learning and the university where the project originated. As a part of the design process, three PD workshops were held with junior doctors, nurses, nursing

students, medical students and bioethics teaching faculty, and five meetings were held with faculty members, to discuss functional specifications and user-acceptance testing of the app. The feedback related to the nature of common ethical issues encountered in clinical settings, the existing process of teaching and learning bioethics, and the requested features of the app were recorded. These data sets were analyzed and synthesized into functional and technical specifications for the mobile app. The software programmers developed the app with the close involvement of the stakeholders. The development of teaching content continued alongside this process. While this enabled EthAKUL's developers to incorporate needs of all stakeholders, challenges were encountered in the process relating to the pragmatic and conceptual aspects of JiTL, ML and PD. We discuss the implications of this research in bringing about transformative changes in higher education.

Introduction

Located in the global South, Pakistan is a country of paradoxes. While poverty (Hina, Whitney & Mahrt 2015) and illiteracy (UNESCO 2019) are widespread, the growth in the telecommunication sector is consistent and encouraging. For example, the penetration of mobile phones has improved steadily and is expected to facilitate economic prosperity and improve the quality of life of citizens (Groupe Speciale Mobile Association 2017). Access to healthcare may be facilitated through the telecommunication industry in the future but, for now, health inequities are rampant, in part due to weak sociopolitical and overburdened healthcare systems. Within this context, unethical practices abound in clinical care and the regulatory and legal mechanisms to address this are limited (Ghias *et al.* 2011). Some of the hindrances in the practice of ethical healthcare in Pakistan include the fear and respect of authority, the limited voice of women, low literacy rates with limited or no knowledge of individual rights, an inefficient healthcare system, and the patients' fear of hearing bad news (Khan 2008).

Given this reality, there is a critical need to incorporate the teaching of bioethics in medical and nursing education in Pakistan. However, a number of issues need to be addressed if ethical education is to be included, so that it has educational impact. The inclusion of bioethics in medical and nursing curricula is not uniform and, where it is included, didactic and theoretical teaching is problematic, as students struggle with the translation of theory into practice. In addition, a lack of learning materials addressing locally relevant bioethics issues is also a significant concern. Despite the use of case-based and various other active learning methods, students still struggle with converting abstract ideas into decisions and actionable practice. As has been documented in the literature (Passi, Johnson, Peile, Wright, Hafferty & Johnson 2013), this difficulty is exacerbated when students witness examples of unethical practices by individuals they otherwise consider to be role models.

Accordingly, we identified a need to create a learning environment that can facilitate students' learning in a non-coercive manner and can foster ethical reasoning and critical thinking by using contextually relevant examples of ethical dilemmas. In this context, in 2015, a project was

conceptualized by a group of faculty members at a university in Karachi, Pakistan, to create a mobile learning environment for the medical and nursing education community, where multiple groups of learners and faculty members could engage in a just-in-time learning (JiTL) experience (Novak, Patterson, Gavrín & Christian 1999), focusing on bioethics. JiTL refers to the “anytime, anyplace” learning approach facilitated by easier access to learning resources through information and communications technology (Riel 2000). The mobile JiTL environment could enable iterative, context-specific, responsive learning experiences; allow for application-based knowledge and skills; and reduce the disconnect between ‘taught’ theory and ‘observed’ practice in healthcare settings (Coppus *et al.* 2007; Davenport & Glaser 2002; Riel 2000). After receiving approval from the Institutional Ethics Review Committee, a three-phased research study was initiated to design and use a mobile JiTL approach for teaching bioethics, which included a mobile app, the content (comprising of five modules with quizzes, videos, cases, and links to the web resources) and JiTL pedagogy. It was named EthAKUL – an acronym evoking ethics, learning and the university where the project originated.

In this paper, the findings from the first phase of the study, regarding the design and development process for a mobile JiTL environment to be piloted at the university in Pakistan, are discussed with the overall purpose of sharing the lessons learned from the participatory design (PD) process.

The context

The vision of the university where this research was conducted is to provide excellence and innovation in education, and to ensure the professional, ethical, and moral development of students and trainees at all levels. The institution believes that ethics can and should be taught. Curricular time is devoted to teaching bioethics across undergraduate (UGME) and post-graduate medical education (PGME) programs and in the continuing education of professionals in the medical and nursing field. The ultimate goal of the bioethics curriculum in the UGME program is that the students learn relevant knowledge, skills and attitudes necessary for a medical graduate to appreciate and critically identify and process ethical dilemmas, and adhere to the highest standards of professional behavior (Ghias *et al.* 2011). Ethics is also taught as a mandatory, standalone course in the institution’s nursing education programs, and is integrated in clinical teaching as per the curriculum of the national regulatory body.

Pakistan is a patriarchal and hierarchical society where religion, and family-centered practices are common. Women do not have equal access to resources (Tarar & Pulla 2014). The patriarchal structure exerts a powerful influence on women’s gendered subjectivity. Men, generally considered superior, hold positions of power and authority and are the decision makers at both the social and familial levels. Therefore, men’s actions and words are considered to hold more value than women’s (Kandiyoti 1988). The problem becomes even more complex when gender cuts through social class. Women from low-income families, particularly those who are economically dependent on their male family members, are vulnerable to gender violence (Tarar & Pulla 2014) and lack a voice. Religion also plays a critical role in daily practices, and decisions are largely governed by religious beliefs. Concurrently, respect for elders in the family often results in younger people remaining silent even when they observe unethical practices. This patriarchal, hierarchical, age-centric, religion-conscious, and family-centered context also impacts a physician’s ethical decision-making process. For example, employed male members will make decisions, and women and other household members are

expected to follow their lead. Physicians are well-respected and are considered instruments of God (Khan 2008). In this context, a related challenge of teaching bioethics is to engage doctors and nurses in learning about bioethics in practice when it may not be their priority.

Theoretical perspectives

Educational design

Design can be both a process and a product (Smith & Boling 2009). Design, as a process, is a goal-directed, problem-solving activity (Rowland 1993), which results in the creation of something new and useful. As opposed to a positivist view of design, where well-formed problems are studied and solutions are found (such as in Simon 1969), Donald (1983) views design as a constructivist approach, which emphasizes reflective practice for dealing with uncertain, messy, and ill-formed problems. As such, design for messy real-world problems typically occurs within a complex conceptual space, involving both opportunities and constraints that must be resolved to accomplish desired, effective results (Cross 2007).

Traditionally undertaken by instructional designers with specialized skills to design educational programs, educational design has a long history. In recent years, with the increasing use of technology, design activities have gained prominence in higher education as a part of teachers' work (Conole 2012; Goodyear & Retalis 2010; Laurillard 2012). As Diana Laurillard (2008:527) argues, the role of teachers is "not to transmit knowledge to a passive recipient, but to structure the learner's engagement with the knowledge, practicing the high-level cognitive skills that enable them to make that knowledge their own". Teachers, therefore, need to adopt a designer's mindset where they understand who and where the learners are, and carefully craft pathways to help them explore, analyze, and construct knowledge using the range of tools available (Mor, Craft & Maina 2015). Educational practice is a process of design, as a goal-oriented and problem-solving activity (Mor, Craft & Maina 2015). The use of design approaches not only increases the relevance of educational experience to policy and practice but also blends experience and theory with student needs through the use of available technologies (Brown 2006; Van den Akker, Gravemeijer, McKenney & Nieveen 2006). In higher education, faculty members undertake design work (e.g. design and re-design of courses) either individually or with groups of professionals (Bennett, Thomas, Agostinho, Lockyer, Jones & Harper 2011; Goodyear & Retalis 2010). The design process often includes identifying and defining problems, developing and testing new ideas, and studying their impacts at the same time as dealing with competing priorities between expected learning outcomes, institutional academic and other policy guidelines, graduate attributes, students' needs and expectations, availability of resources, and faculty skills and motivation.

In designing technology-enhanced learning environments, participatory design approaches could enable designers to engage all stakeholders in making design decisions and ensuring the relevance of the final product for the users. Through PD approaches, students and teachers could be engaged as "knowledgeable participants" (Greenbaum 1991) to ensure that the end product (the technology-based learning environment) meets the needs of the users and their context. The use of PD can also help bridge the distance between the world of information technology (IT) professionals and the world

of teachers and students through “constructive discussion, dialogue, negotiation, and mutual learning” (Muller 2007).

Just-in-time learning

The concept of just-in-time learning (JiTL) can be a useful pedagogical tool for medical educators, especially if the aim is to bridge the theory-practice gap. In contrast to other technology-enhanced teaching and learning approaches (e.g. massive open online courses), JiTL relies on informal, incidental, learner-driven acquisition and application of knowledge (Weintraub & Martineau 2002). Based on constructivist learning principles, the JiTL environment typically has no structured process, but anticipates learners’ needs and focuses on real-time problem solving (Brandenburg & Ellinger 2003). Margaret Riel (2000) argues that the role of the teacher continues to be important in this learner-driven setting, as JiTL not only harnesses the power of technology for just-in-time delivery of learning resources, but also creates learning communities for deeper dialogues by facilitating easy access to peers and experts. Within medical education, the JiTL approach has been used for on-the-job training of evidence-based medicine (Coppus *et al.* 2007) and for improving professional practice through online access to up-to-date medical knowledge and patient information, and real-time detection and reporting of medical errors (Davenport & Glaser 2002).

Mobile applications for bioethics teaching

A review of the literature on mobile apps for bioethics teaching and learning revealed several examples of apps. For example, the Tuskegee Bioethics app (Fifty Pixels Ltd 2018) from the Tuskegee University National Center for Bioethics in Research and Health Care, and the Bioetica app (Inventia Plus 2015), provide a collection of material, including monographs, clinical cases and media files, to make the learning of bioethics more accessible. Similarly, the Ethical Decision Making app developed by the Markkula Center for Applied Ethics (Hanson 2015), the Healthcare Ethics app (UCLA Education 2015), and the MedEdEthics app (St George’s, University of London 2013) provide a collection of information, including legal and professional issues, clinical dilemmas, communication tips, and various ways of reducing moral stress for the users.

In 1956, the Indian Medical Council declared the professional conduct, etiquette and ethics regulations necessary for registered medical practitioners; therefore, several apps, including the Indian Medical Council Ethics (Appfever 2013) and the Indian Medical Council Act (Rachit Technology 2018), were developed in order to make these laws more accessible. Moreover, the Medical Ethics, Law and Secret (Top of Learning 2015) and Case Files Medical Ethics and Professionalism (Expanded Apps Inc. 2016) apps not only provide ethical principles and cases, but also readings, quizzes, and text materials to facilitate medical education. The AdvaMed app (IT Support AdvaMed 2015) was developed to help industry representatives and healthcare professionals perform within ethical standards in med-tech companies and industries.

Ethics teaching and learning

John Goldie (2000) heavily criticizes the teaching of only the major principles and theories of ethics, and proposes, as an alternative, the teaching of everyday cases. However, it is recognized that there is no single best model of teaching and learning of bioethics (El Tarhouny, Mansour, Wassif & Desouky 2017). While sharing their experiences of integrating bioethics curricula at the University of Glasgow,

Roger Downie and Henriika Clarkeburn (2005) reported that teaching can be either “embedded” or “specialist”, or a combination of these models. In an embedded teaching approach, the bioethics curriculum is integrated within different modules of the curriculum, whereas a specialist teaching approach results in teaching bioethics as a separate subject. While Goldie (2000) also favors an integrated (or embedded) approach to developing a bioethics curriculum, a subject-specific (specialist) approach is useful when content is complex, and the purpose is to gain a deeper understanding of key issues and concepts instead of getting an overview. The choice of embedded or specialist subject strategies is often based on the curricular circumstances.

A variety of teaching approaches have been used for bioethics, including mobile learning. Cristine Warmling, Fabiana Pires, Julio Baldisserotto and Martiné Levesque (2016) evaluated the use of the Virtual Learning Object (VLO) – Analysis of Ethical Situations – to teach ethics and bioethics in dental and speech therapy courses. The results showed that most students found VLO expanded their knowledge of bioethics by making concepts available in the form of videos and quizzes that can be accessed anywhere. The environment provided opportunities to analyze professional situations with possible bioethical conflicts. Learners were willing to take risks and discuss sensitive and controversial issues more openly. Discussions in online forums were generated so that everyone had sufficient time to interact. The authors highlighted, however, that training health professionals to use technology for this purpose was a challenge. The findings in this research suggest that the use of mobile devices to access learning material outside the classroom could enable practitioners to integrate bioethics content in their everyday medical practices.

Despite the strengths that mobile learning could bring to the educational process, there could be challenges due to hardware malfunction, difficulties with the installation of the app, low battery life, the lack of regular electricity to charge devices, and unstable internet connection due to unreliable networks (Qureshi, Ilyas, Yasmin & Whitty 2012; Walsh 2015). There could also be pedagogical challenges. For instance, a commonly stated challenge is that students use mobile devices for other purposes in class and therefore get distracted. Healthcare institutions are also reluctant to use mobile phones for teaching due to risks associated with interference of mobile signals with medical equipment, infection-control concerns, and reported patients’ complaints (Junk, Wallace, Mallett & Thompson 2018). In addition, literature also highlights the intrinsic and extrinsic factors creating a barrier to technology-enhanced learning (Naseem, Khoja, D’Cruze & Wallani 2011).

The uniqueness of this project lies in its duality as both a product (an app) and a process (in facilitating JiTL), designed by students and faculty members. The literature search did not reveal any other examples of the design and use of mobile JiTL approach for the teaching of bioethics.

Methodology

The study reported here employs a participatory approach to designing a mobile JiTL environment (called EthAKUL) for bioethics at a medical college in Pakistan. Therefore, a qualitative approach was considered suitable as it allowed interpretation and re-interpretation of data to inform the design of EthAKUL. The PD approach was adopted to engage learners and teachers in designing EthAKUL to ensure its relevance for the teaching of bioethics at the university. The environment included a mobile

application (app), content and the teaching/learning process. The project was divided into three phases as follows (Figure 1):

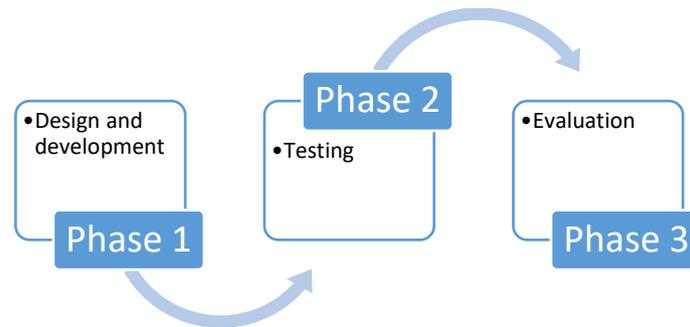


Figure 1: Study Phases in the design of EthAKUL

Phase one included the design and development of EthAKUL. The focus was to extract existing teaching and learning practices of bioethics at the university, and conceptualize the app and teaching process through user-engagement and development of the app content. At the time of writing of this paper, phase one was already complete; therefore, for this article, only the data from the design and development phase is reported and discussed. Phase two will involve the testing of the app with real students and faculty as online learning with no face-to-face input. It will be followed by phase three during which the efficacy of the app and the user experiences and perceptions will be evaluated.

Ethical clearance

This project was approved by the institutional ethical review committee (Approval number: 3892-2015). Informed consent was sought from all participants, whose participation was voluntary.

Participant selection

The participants for phase one were selected based on convenience sampling (Patton 2002). The research study was advertised on various Facebook groups by one of the team members. The groups included class groups, a general announcement group for medical students, and batch groups of nursing and medical students. Additionally, an email was sent to all the students, nurses and residents informing them about the study. The participation was completely voluntary. Altogether, four medical students, ten nurses and nursing students, ten junior doctors, and six members of the bioethics faculty participated in a total of three participatory design workshops. A mix of 12 team members (from the bioethics faculty, IT and the app research team) participated in the meetings for functional specifications. The content design was conducted by the authors.

Data collection and analysis

Table 1 outlines the data collection and analysis processes.

Table 1: Data collection and analysis method

Activity	Data collected	Data analysis techniques
Reflective meetings	Notes of the meetings	Line by line reading and generating themes by two members of the team; review and confirmation by other members
PD workshops	Detailed notes from the workshop; design diagrams; emails	
Meetings for functional specifications	Detailed notes of the meetings; emails; reflective conversations; specifications documents	
Content design	Emails; modules; discussion notes; reflective conversations	
User Acceptance Testing	Emails; notes of the meetings	

Reflective meetings:

Each meeting lasted one to two hours and was attended by bioethics faculty members. It included gathering data from the bioethics experts related to the teaching of bioethics (e.g. how is bioethics taught? How are teaching activities designed and implemented? What are the issues?) and how mobile learning might help in the teaching process.

PD workshops:

Three PD workshops were organized to gather data from medical and nursing students, residents and nurses concerning issues with the teaching and learning of bioethics, and to conceptualize the design and use of a mobile app for teaching bioethics. The duration of each workshop was between 90 minutes and two hours.

Meetings for functional specifications:

Five meetings were held between app developers and the bioethics teaching faculty to review and finalize the functionalities of the app. The duration of each meeting was one hour. Once the design specifications were agreed upon, the app was developed.

Content design:

Curriculum topics were identified during the interdisciplinary PD workshops. Each topic was assigned to a bioethics expert based on their area of expertise, such as informed consent. A module design template was developed (Fig. 2) for content authors. One person developed the first draft of the module. The whole team reviewed it, and appropriate changes were made. Feedback from students was also obtained. Most changes were related to making instructions clearer, and including relevant readings, cases, and other resources.

Topic:	
Authors & reviewers	
Date:	

Learning Outcomes
In this module, you will:

- 1.
- 2.
- 3.

Definitions/description

Cases/stories (text, audio, video, animation, pictures)*

Case 1:
Questions

Case 2:
Questions

Essential readings*
Read the following article and respond to the questions:

Reading #1
Questions

Reading #2
Questions

Recommended (advanced) readings

- 1.
- 2.

Self-assessment post quiz
Five MCQs for the topic preferably at different levels of Bloom (Recall, comprehension, application, analysis, synthesis and evaluation)

References

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Figure 2: Module design template

User Acceptance Testing (UAT):

The UAT of the app was conducted by members of the research team (coded as n=8) and feedback was shared with the app development team. Two cycles of UAT were held: in the first phase, the Android version of the app was tested for a week in July 2018, and in the second phase, the iOS version of the App was tested for a week in October 2018.

The data gathered during the design phase were stored as Microsoft Word or email files in a secure place. All identifiable information was removed at the time of analysis. The qualitative data were analyzed using content analysis by two members of the research team to reduce bias. Themes were identified independently and then compared for agreement.

Challenges encountered

A prerequisite for participation in the design process was to obtain consent from students, residents, and nurses. Finding an appropriate number of students, residents and nurses for the workshops, at a time mutually agreeable to all groups, was a challenge. Also, when the design drawings or the content needed to be reviewed, students/junior-doctors had exams or other commitments, which made it difficult to involve them in the process. Because of the convenience-sampling process, those who participated in the design workshops were already either knowledgeable about technology or interested in bioethics. As such, in the design process, students, nurses, and residents who were not advanced in their knowledge of technology, or were not interested in bioethics, were not represented.

Findings and discussion

In this phase of the study, the research team designed and developed a mobile JiTL environment through participatory design approach. The purpose of this phase of the research was to describe the process and findings to illustrate 'lessons learned' about the design process and the mobile JiTL approach.

Participatory design process: engagement, prioritization and ownership

The users were involved in making decisions about the design of the app, the content, and the teaching and learning process. The details of how the design process was structured and carried out are explained in the subsequent sections.

Workshops

In the first workshop, the participants included medical students (n=2), practicing nurses (n=2), medical and surgical resident doctors (n=2), and bioethics faculty (n=6). The research team explained the purpose of the study, sought informed consent, and asked the participants to share examples of ethical dilemmas encountered during their clinical experiences. Each participant was given a sheet of paper with markers to make notes as they thought about their experiences. The participants were invited to share their examples. The bioethics faculty facilitated the discussion by asking questions or offering alternative perspectives. This was followed by a discussion on whether and how a mobile app could be used to help develop the skills needed to understand and resolve ethical dilemmas. Each participant was asked to draw the features of the visual display of the app and explain why they had included specific features. This was the only workshop where faculty members teaching bioethics were available to attend the meetings due to scheduling conflicts.

For the second workshop, a member of the research team posted a call for participation in the workshop on three Facebook batch groups, and of the 21 people who indicated interest, 16 people participated. The participants included nursing students (n=7), a medical student (n=1), medicine residents (n=4) and surgical residents (n=4). Participants were encouraged to form groups and to

propose and discuss the features of the app that they thought would be useful. Although no explicit instructions were given about the nature of the group formation, the participants chose to work in groups based on their specialties. This resulted in three groups, as medical students chose to work together with nursing students, and there was one group each of medical residents and surgical residents. The workshop was facilitated by a medical doctor with an understanding of bioethics. Individual and collaborative sketching was used as a strategy to elicit users' concepts of what the app would look like, which was helpful in encouraging meaningful engagement and conversations around the design of the app. As a concluding activity, the group drew their collaborative vision of the app and presented them to the other groups, along with their rationales. The facilitator encouraged debate and critique as the presentations were being made.

To invite participants for the final workshop, messages were posted on the Facebook groups. The workshop was attended by nursing (n=1) and medical (n=1) students only. Both these participants had attended the second workshop. The research officer presented the features of the app proposed by the participants of the two previous workshops, which were critiqued and fine-tuned. There was a discussion on the features that were essential to retain and associated rationales for each.

After the workshops, the bioethics faculty, in the reflective meetings, reviewed the examples from the first workshop to identify topics for the content and the process of teaching. The examples were also dissected to identify the specific ethical issues raised and how best to address them in the content being developed. A functional specifications document was compiled and shared with the team of app developers. Overall, the workshops were valuable in eliciting participants' experiences related to bioethics teaching at the university, including issues and challenges of practicing bioethics in clinical settings, and the implications of this for the design of EthAKUL.

Functional specifications meetings

To finalize the functional specifications of the app, a series of meetings were held between the bioethics faculty and the app developers. Not all members were able to attend all the meetings. A summary of each meeting is provided in Table 2.

Table 2: Summary of functional meetings

Meeting I	There was a guided discussion to elaborate precisely the details of the features to be included in the app. Aspects discussed were related to the user roles, login details, and content moderation on the discussion forum.
Meeting II	Further discussion took place regarding the user roles in the app. Other aspects, which were discussed included: user profile registration, discussion, live streaming, and learning materials.
Meeting III	Discussion on the user roles in the app, discussion board, live streaming, learning materials, and quizzes.
Meeting IV	Quizzes were discussed at this meeting.
Meeting V	The software team shared a detailed functional specifications document with the bioethics faculty. The registration process, discussion statistics, and the nature of learning content were discussed.

A variety of strategies were used in the workshops to engage participants, such as the extensive use of the national language (Urdu) to allow participants to explain their ideas with ease, and discussions

which were held through face-to-face and email communication to develop a consensus on what the app would eventually look like. Yet, stakeholder participation in the design process varied across a range of activities. For example, there was greater faculty and student engagement in the design workshops and content development-related activities. In the content design activities, while one faculty member developed the first draft of the module, all other faculty members reviewed it and provided their input, at that time. Several face-to-face discussion and review sessions were organized to finalize the content. As compared to this, user participation in determining technical specifications of the app was limited. In addition, the specification meetings were led by a member of the information technology services (ITS) where app functions were presented and the faculty members' role was limited to either agreeing with the function or proposing a different idea, primarily in nontechnical language. The ITS team recorded and interpreted the information for final development.

The difference in the nature and level of participation observed in the two activities was most likely a result of the comfort level of the stakeholders with one activity as compared to the other. The faculty members were more familiar with the content and pedagogy of bioethics; therefore, they were more engaged in the process of creating and co-designing the content and the teaching process. However, as the faculty members' knowledge of the technical aspects of mobile app was not extensive, their engagement in the process of app development was limited. This finding affirmed that co-designing a technology-based learning environment requires capabilities beyond the scope of the faculty participants alone. Therefore, the presence of at least one member on the research team who understands both IT and education would help in the communication process.

During the design workshops, it became apparent that medical students preferred individual learning as opposed to group discussion. Also, residents wanted to have quick answers to their questions regarding ethical issues, while the nursing students wanted the app to include content to improve their knowledge of bioethics. Therefore, EthAKUL had to cater to the varying needs of different groups.

Due to a limited budget, it took longer than anticipated to develop the app. As a result, some participants who were enthusiastic in the beginning become involved in tasks other than this project. Therefore, the differing priorities of the users had to be carefully managed throughout the process. The ITS team took the lead on prioritizing which functionalities of the app would be built in the various phases. For example, during the first UAT, the ITS team did not include the content within the app. The team believed that including the functionality of content within the app would delay completion of the first iteration of the app. Despite several discussions to explain the fundamental importance of the content in the teaching/learning process, the developers were reluctant to delay their timelines. It was decided that in the first iteration, the content would not be hosted on the app; instead it would be placed within the university's Virtual Learning Environment with a link provided in the app. This meant that students would need to be connected to the Internet to access the content. In the second UAT, though some content was included in the app, it lacked the required functionalities as the app developers had to meet the project deadlines. Upon discussion with the team, it was noted that due to limited knowledge of the technical aspects of the app, faculty members ended up giving priority to other commitments, which eventually contributed to slower response time from faculty in the second UAT phase and more ownership of the app functionalities by the app development team. When the

app is used in the second phase, the question to be considered is the extent to which the functionalities in the app are aligned with the functionalities identified by the users.

Rosemary Luckin, Sadhana Puntambekar, Peter Goodyear, Barbara Grabowski, Joshua Underwood and Niall Winters (2013:67) have argued that “the process of design is the point at which theory meets practice and the partnership must be operationalized in order to enable implementation”. Thus, a good educational design is centered on teachers’ understanding of the context, which includes, among other things, the learners’ experience and strategies suitable to teach the subject matter. Designing a good learning environment requires skills, experience and time.

Consistent with similar projects (Mor, Craft & Maina 2015), the PD process in this project was a tedious and resource-intensive approach to designing the educational environment. The findings presented here are consistent with Peter Goodyear and Symeon Retalis’ (2010) assertion that educational design is a cognitively demanding and time-consuming activity that requires experimental thinking, imagination, weighing options and possibilities, and access to resources and tools to enable the designers to do the technical work. As noted previously, various stakeholders had different levels of input and participation throughout the design process based on their understanding, expertise and priorities. The learners participated in the design workshops to help identify the app functionalities; the faculty took the lead in the development of the content and pedagogy, and the ITS team played a critical role in interpreting learner and faculty needs to develop the app. It was challenging to negotiate a shared understanding of good pedagogical practices and infrastructure readiness across participant groups. The ITS team, as participants of the educational design process, were more concerned with what was expedient, and prioritized project timelines rather than the messy and evolving nature of designing for teaching and learning. At the end, a large part of the design process was about “finding workable compromises” and “resolving tensions” (Goodyear, Markauskaite & Kali 2009:17).

Conceptualizing the pedagogy of mobile JiTL for bioethics

The pedagogy of EthAKUL is centered on the constructivist approaches to learning where knowledge is neither fixed nor resides outside the learner. In fact, constructivism calls for an active engagement of the learner in constructing knowledge by engaging with new experiences and concepts, commonly known as a process of meaning-making. Lev Vygotsky and other proponents of constructivism (Brown, Collins & Duguid 1989; Lave & Wenger 1991; Papert 1980; Vygotsky 1978) have acknowledged the importance of interaction, and the use of language, activity, and the presence of more knowledgeable peers and community to support the learning process. The learning environment, therefore, needs to be such that it encourages reflection, dialogue, and construction of new knowledge. This approach is different from the traditional teaching also known as the “banking concept” (Freire 2000) where learning is seen as the transfer of knowledge from the expert to the novice. The meaning-making approach is fundamental to the teaching of bioethics, which is about developing moral reasoning skills through actively involving learners in identifying ethical dilemmas, making sense and co-constructing their lived realities with a deeper intention of bringing change in those realities (Zittoun & Brinkmann 2012). The teacher, in such contexts, is a catalyst who facilitates the process of co-construction (Botel & Paparo 2016; Clegg 2015; Nash & Jang 2014). Besides sources of learning such as readings, the learners’ experiences serve as tools stimulating individual and collective learning. Teaching strategies

such as dialogue and discussions play an important role (Laurillard 2012). Accordingly, the content and pedagogy of EthAKUL is guided by the following principles:

- *Centrality of the learners during the learning process.* People learn best when they are able to drive the learning process and experience the freedom to learn (Rogers & Freiberg 1994).
- *Centrality of learners' experiences in content development.* Learning is about meaning-making and is optimized when learners relate what is learned with their experiences and construct knowledge from their own observations and encounters in life (Dewey 1938; Kolb 1984).
- *Role of teachers as facilitators.* Teachers are facilitators of the meaning-making process and are guided by learners. Their role is to stimulate the learning process by posing problems and questions to the learners rather than providing them with ready-made answers (Freire 2000). A good facilitator enables learners to discover what they want to discover during the learning process.

Acknowledging the different needs of various groups as identified during the design workshops, the pedagogy of EthAKUL also draws on the concept of Communities of Practice (CoP), proposed by Jean Lave and Etienne Wenger (1991), to enable a relationship between experts and novice to go beyond mere examination of the ethical issues and their theoretical underpinning. During the teaching phase, the faculty members may experience resistance from students who may not be willing to share their experiences on the discussion forum for open critique. In this situation, if learners do not share examples from their experience, or do not offer analysis of the cases shared by others, faculty members will need to encourage analytical conversation through a variety of cognitive and motivational scaffolding (Flick 2000; Mackiewicz & Thompson 2014; Wood, Bruner & Ross 1976).

Designing bioethics content for mobile JiTL

The content within the app included five modules on topics which were identified during the design workshops from the examples shared by students and residents; therefore, these were directly relevant to the learners' context. The topics included: informed consent, resource allocation or distributive justice, harassment, medical errors and conflicts of interest. Communication was a theme that was relevant to all the examples. Though the topics identified were similar to those found in bioethics curricula in Western countries, as clinical ethics issues are universal, there were differences in the way ethical issues were addressed in Pakistan, largely due to cultural beliefs and practices. For example, in a Western country, consent can be obtained from the female patient or their spouse, whereas in the Pakistani context, consent is often obtained from the in-laws and other members of the extended family. Therefore, real cases from the Pakistani context were included in each module, making it relevant to the learners' context.

The template (Fig. 2) provided consistency in the learning materials written by the various authors. Each topic included detailed notes on the topic, at least one video, two exemplary cases followed by questions for reflection and at least two articles to read with guiding questions. Each module also included a self-assessment quiz to determine changes in students' knowledge. Initially, the plan was to link the quizzes with the learning material so that the option of completing the modules at the learner's pace, or without completing a quiz, would not be available. A pre-/post-test model for the content in the app might have been a more robust model to determine changes in students' learning. However, it was decided to give students more flexibility in how they organized their learning as it was

more aligned to the JiTL approach, and all modules were made available to the learners at the same time without a restriction of completing a pre-module quiz. It is expected that this would enable students to refer to a module as and when the need arises. The results of the end-of-module self-assessment quiz are available immediately, as the purpose is to provide instant feedback to students on what they have learned. There was also some discussion on incorporating learning resources created by other institutions into the app, but this could not be implemented due to potential copyright restrictions.

A conceptual challenge related to designing the content for JiTL was that the team could not identify, in advance, all the necessary resources for bioethics dilemmas that learners may encounter. However, the bioethics issues raised by the learners during their clinical encounters will eventually become a part of the bioethics curriculum and offer an opportunity for learners to be co-creators of the curriculum. New content may, therefore, be added during the teaching phase.

Features of the mobile app

The participants identified a range of features to be included in the app. Some of the features included:

- Having multiple levels of rights and privileges based on the roles of the users to ensure a smooth flow of communication. For example, the users with the teacher's role had the right to edit and delete students' posts; but students did not have the right to delete the post, although they could edit their own posts;
- Integrating the app with the university's email system to ensure that all staff and students can log in to the app using their university login credentials and do not have to remember different usernames and passwords for the app;
- Enabling the posting of anonymous messages on the discussion board to allow students to feel safe in group conversations, although the superadministrator of the app will be able to track the original user of the post, and inappropriate posts will be deleted by the administrator. An inappropriate post is one that may include confidential or identifying information, offensive language or discussion of personal matters. Before a post is submitted, the submitter will be asked to specifically reconfirm that the post is related to a clinical ethical dilemma, and that no confidential or identifying information is included. Despite this, if a post is still inappropriate, the super administrator will remove it and provide feedback to the submitter so that a revised version can be posted. The effect of this process on learning, if any, will be assessed during the pilot. It is anticipated that this feature will provide a safe space for users to hone their ability to identify, present and discuss an ethical dilemma with maturity;
- Allowing large group-threaded discussion forums with options for learners to attach media files and self-initiate, generate, and moderate as many discussion threads as they need;
- Sharing the rules of appropriate and ethical communication with students, and the consequence of the termination of access if the rules of ethical communication are violated. For example, if a post reveals or compromises patient identity, it will be deleted or edited, and the learner will be warned;
- Including live-streamed talks by bioethics experts with options for follow-up discussions;
- Ensuring the availability of usage statistics to gauge learner participation patterns (e.g. how many times a student accesses a module or resource);
- Providing video files or links to videos;

- Being able to find content through a keyword search;
- Including icons for easy recognition of different sections and activities.

From the features listed above, it appears that both teachers and students envision the app as a means for establishing regular communication with each other and bioethics faculty, which is not possible in traditional face-to-face teaching contexts. The emphasis was also on maintaining the confidentiality of information shared, with consequences for violating the rules of ethical communication. While not all the above-listed features have been included in the first iteration of the app due to time constraints, changes will be made in the second round of design iteration based on the results of the pilot testing and evaluation phases.

Conclusion

The first phase of the three-phased project described in this paper has identified issues of the design process for creating a mobile JiTL environment for bioethics. To a large extent, issues faced in the design process have been consistent with the literature, such as the time it took to design the app and the content, and sustaining user engagement and interest in the process in the context of limited funds and resources. Although beneficial in including users' 'voice', the findings have implications for implementing PD design approaches to creating technology-enhanced learning environments, as universities in the global South may not have the resources to implement a tedious and resource-intensive PD process. In addition, the process of participatory design to create learning environments where people from multiple disciplines can teach and learn together is an innovation, and for such innovation to be adopted, as Naseem *et al.* (2011) note, fundamental changes in academic processes are needed in which creativity and innovation in learning and teaching are part of the fabric of the institution, and are not treated as projects with finite start and end dates.

Finally, moral dilemmas are deeply entrenched in societal practices, and issues such as gender inequalities require change in belief systems and actions. Although technology cannot erase deeper social inequalities, a wider engagement with ethical issues is possible through the process of mobile JiTL. The authors believe that users having constant access to the learning environment (i.e. the app) in their pockets could be a step towards creating a sense of immediacy for learning and engagement with ethical dilemmas. This could, eventually, encourage them to examine their own practices and generate a discourse with peers on the learning and practice of bioethics in clinical settings. This study could well be a pioneering one from the developing world and could contribute to the use of mobile JiTL for teaching and learning bioethics.

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