Integrating eLearning to Support Medical Education at the New University of Botswana School of Medicine

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Abstract: Since the enrolment of its first cohort of students in 2009, the University of Botswana School of Medicine (UB SoM) has employed elearning as a key element to support and strengthen its model of decentralised medical education. Significant investments have been made in setting up the physical infrastructure, and in acquiring relevant expertise to develop and implement an elearning agenda in a context with practical challenges associated with medical education in decentralised setup. Following the enrolment of its first cohorts of medical students, and residents in Paediatrics and Internal Medicine between 2009 and 2010, the School also launched a Family Medicine training programme in 2011 at two rural sites. With the expectation of contributing to a positive teaching and learning environment for faculty, residents, and medical students in these remote areas, elearning is also seen as important for their retention, and thus for improved access to quality health care in rural Botswana. In this paper, the authors critically reflect on the strategies used to implement elearning at UB SoM over the past 18 months, and highlight challenges experienced while implementing elearning in a new medical school situated within an older university context. Strong relationships with partners were identified as a critical foundation for the long-term sustainability beyond the initial procurement and installation infrastructure. While confirming the obvious technical challenges in a setting like Botswana, the authors emphasise the need not to underestimate associated broader challenges in engaging a diverse range of users, partners and stakeholders; not to lose sight of the pedagogical goals that are meant to drive the choice and use of technology (rather than vice versa); and to ensure that the expected benefits of the technology can and will be shared and sustained by a range of partners in the long run.

Keywords: elearning, medical education, technology integration, mlearning, mhealth, tablets, ICT, sustainability

1. Introduction

1.1 Technology in higher education and medical education

The use of technology to enhance learning is not a new undertaking, and the potential benefits of technology integration (improved motivation, enhanced instructional methods, increased productivity, and information age skills) have been well documented (Roblyer and Doering, 2010). For example, Saettler (1990) notes that early references of technology integration in the United States date as far back as the early twentieth century. Over the decades, as information communication technologies (ICT) have emerged and come of age in the marketplace, many have sooner or later found their way into the classroom (e.g. radio, television, and personal computers). By the end of the twentieth century, educational institutions experienced an explosion of internet and networked computing combined with the use of personal hand held devices such as cellular phones, tablets and mini laptops (Reiser and Dempsey, 2007; Roblyer and Doering, 2010; Tiene and Ingram, 2001). Technology integration in medical education in developing countries including the University of Botswana School of Medicine (UB SoM) has followed a similar evolution to that of industrialised nations albeit behind the curve of these countries (Frehywot, et al. 2013; Sandars, 2012; Ruiz, Mintzer and Leipzig, 2006; Association of Medical Colleges, 2007).

Reference this paper as: Masego B. Kebaetse, Oathokwa Nkomazana and Cecil Haverkamp. Integrating eLearning to Support Medical Education at the New University of Botswana School of Medicine" *The Electronic Journal of e-Learning* Volume 12 Issue 1 2014, (pp43-51), available online at www.ejel.org

Medical schools pursue elearning to address a range of educational challenges including faculty shortages in rural settings, attrition of healthcare professionals, and learning in non-classroom settings (Frehywot, et al. 2013). The two most transcendent uses of ICTs in medical education are to improve access to resources, and to foster collaboration and communication among peers and between learners and experts (Chang, et al. 2012; Sargeant 2005; Valke 2006). For instance, a Makerere University (Uganda) study indicated that students and practitioners valued access to the internet and thought such access had educational value (Chang et al. 2012). This is consistent with the use of technology to improve the educational experiences of learners and educators especially in rural areas (Chang et al. 2012). Valke (2006) and Lam et al. (2012) highlight the use of ICTs to acclimatize trainee physicians to workplace tools given ICTs increasing importance to healthcare delivery. The purpose of this paper is to highlight strategies engaged by the University of Botswana school of Medicine and the challenges experienced in implementing an elearning agenda to support medical education.

1.2 Rationale for Elearning at UB SoM

At its founding in 2009, UB SoM chose a problem-based learning (PBL) curriculum with elements of rural and community-based, socially accountable medicine to ensure that the curriculum would match with the health care needs and characteristics of medical practice in Botswana (Wood, 2003; Dolmans et al., 2005; Worley et al., 2006). In partnership with the Ministry of Health (MoH), UB SoM selected four clinical teaching sites: two rural sites in Maun (1000 km from main campus) and Mahalapye (200 km from main campus), which would also house the Master of Medicine (MMed) Family Medicine Programme; Sbrana Hospital (75 km from main campus), the nation's only referral psychiatric hospital based in Lobatse; and Princess Marina Hospital (1 km from main campus), the nation's largest tertiary referral hospital in Gaborone. The decision to provide rural exposure as a part of medical training was deemed important as a way to ground the training, research, and practice of the students and faculty in the varied health care needs of the community. Medical students' early rural exposure and the establishment of Family Medicine training complexes in rural sites have been reported to improve retention of health workers in these areas. This is especially so if the learning and service environment is positive (Wilson et al., 2009; Curran and Rourke, 2004).

At UB SoM, elearning has always been recognized as a necessary element to facilitate effective and efficient teaching and learning including the context of clinical practice – both on and away from UB campus by addressing three primary issues inherent in in the nature of UB SoM's curriculum. The learner driven PBL curriculum requires access to teaching, learning, and clinical resources in a timely and efficient manner regardless of location. Additionally, such a curriculum requires technologies that support and enhance active, engaged, and collaborative learning which are integral elements of the PBL learning process. Finally, the distributed nature of UB SoM clinical sites requires the use of ICT technologies that promote and enhance collaboration and communication in an attempt to reduce feelings of isolation and psychological distance amongst faculty and students across clinical sites. Collectively, the various technologies are employed to provide efficient and seamless access to learning resources, support communication and collaborative learning, as well as to enhance active and engaged learning.

2. Strategies for successful elearning implementation at UB SoM

Besides the distributed nature of UB SoM's clinical teaching sites, implementing elearning at a new schools existing within an older university was bound to present both opportunities and challenges. Additionally, in light cost of technology (human and financial) and the ever-changing ICT landscape, As such, to mitigate the challenges and draw a wide range of resources UB SoM sought a systematic approach to implementing elearning by engaging several strategies to ensure successful implementation of the elearning agenda: a) grounding technology choices in learning theory, curriculum values, and teaching practice; b) thinking critically about infrastructure needs; c) engaging relevant partners to provide support and expertise; d) providing training and support for faculty and students; e) intentionally engaging faculty and students; f) considering

sustainability early and throughout the implementation process; and g) integrating continuous evaluation as part of the feedback process.

2.1 Grounding technology choices in curriculum values, learning theory and teaching practice

Sandars (2012) argues that "the focus of any educational intervention should be the learner" (p. 534). In line with that thinking, UB SoM sought to select technologies that would have clear pedagogical benefits to the PBL rural-based curriculum. As a result, UB SoM primarily implemented technologies that would either support and enhance the teaching and learning processes, or mitigate challenges inherent in its context. There was much intentionality in selecting technologies to align with and enhance pedagogical approaches inherent in UB SoM's PBL based and rural curriculum. Video conferencing equipment was implemented to enhance communication and promote collaboration amongst learners, faculty and other practitioners, as a way to reduce the psychological distance between faculty and students at the various clinical sites. Equipped with databases of biomedical images, interactive boards were selected to support different learning styles and active collaboration during PBL sessions. The use of classroom response systems is expected to enhance active engagement in the plenary sessions by providing opportunities for embedded assessment and immediate feedback. Tablets were implemented to ensure efficient and timely access to electronic teaching, learning, and clinical resources across site. The availability of a closed user group (on the SIM card) is expected encourage organic development of communities of practice where learners and specialist collaborate on healthcare delivery. The closed user group allows all device users to place unlimited calls to each other at no extra cost beyond the flat rate already paid by UB SoM.

2.2 Thinking critically about infrastructure needs

Beyond typical pedagogical considerations, there was need to think holistically about infrastructure, including thinking creatively about designing teaching and learning spaces where complementary coaching and mentoring can occur as an extension of bedside learning. This underscores the importance of local context considerations for successful implementation of the elearning programmes (Miner and Missen, 2005). Availability of adequate appropriate infrastructure is important for effective mobile and elearning strategies (Nartker et al., 2010; Frehywot et al., 2013).

Information technology (IT) infrastructure: Internet access at clinical sites is an essential backbone for the integration of video conferencing technologies, interactive boards, and tablets necessary to provide connectivity for communication, collaboration, and access to teaching, learning, and clinical resources. Over the past year, all four sites have had new connections to the internet or an expansion if limited access already existed. The expansion was to cover additional allocated spaces that originally did not have internet access. To date, all four clinical sites have wired and wireless high speed internet access. Three connect to main campus through a wide area network whose speed is dependent on the internet service provider (ISP). They converge to main campus and share bandwidth with the main campus. The fourth site (1000 km away from main campus), connects to the internet through a dedicated line.

Non-ICT infrastructure: The unique opportunity of working at existing clinical sites was that while government ownership of hospitals guarantees opportunities for continuous provision of clinical care, the hospitals were not designed as teaching hospitals and, as such, lacked the basic facilities and infrastructure conducive to other forms of teaching and learning beyond the bedside. At the tertiary hospital there is limited space has been availed at the library, the paediatric ward, and across a few places in the wards for lockers. Over the past year, each of the other three clinical sites has been outfitted with a small library, a teaching room, a storage room, resident/ undergraduate study room and lockers. The small library is fitted with networked computers that are connected to the internet, the University of Botswana Library's (UB Library) databases, a limited collection of books, and quiet study areas. The teaching room is equipped with an interactive board and video conferencing equipment in addition to necessary furniture. Small closets are also available to secure

equipment (e.g. laptops, projectors, and cameras) that academic staff and learners can use for academic and professional work outside technology enabled spaces at clinical sites. The lockers are for students and residents to secure personal belongings while on ward rounds.

Personnel infrastructure: In addition to spaces and technology there needed to be strategic consideration about the skills, expertise and resources needed to implement the elearning agenda. UB SoM projects were analysed to determine the relevant skills and resource support needed to implement the elearning agenda. Based on these analyses, internal and external partners were sought to provide relevant support and expertise. The roles of the partners will be discussed in more detail in the partnership section. Additionally, SoM hired an instructional design specialist, and contracted a consultant on a temporary basis as an implementation specialist prior to the arrival of the instructional design specialist. The instructional design specialist was tasked with leading the technology integration process, supporting students and faculty in matters of teaching and learning with technology, ensuring that technology procurement continues to be grounded in curriculum values, learning theory, and teaching practice, as well as ensuring continuous engagement with internal and external partners. The consultant worked with the instructional designer for several months in order to accelerate the necessary procurement as well as develop relationships with key partners outside the university. The library has also recently hired a librarian for each of the clinical sites. Conversations are under way for each hospital to complement the UB Librarian with hospital personnel to ensure continuous coverage of the library.

2.3 Engaging relevant partners to provide support and expertise

From the beginning of the implementation process it became clear that a range of partners would need to be involved at all stages of the implementation process. The team developed strong working relationships with partners situated within the University of Botswana, experts and service providers (nationally and internationally), and hospitals hosting the medical training of UB SoM students and residents.

Partners within the University of Botswana: Being part of an older university has presented opportunities in that some of the partner department bring a wealth of experience and resources to support new initiatives. The IT department, UB Library, and Campus Services were some of the UB units that UB SoM actively engaged with this past year. The relationship with the IT and UB Library is expected to be a long term relationship, whereas the relationship with Campus Services is expected to be short-term and on an 'as needed' basis.

The IT team assumed a leadership responsibility in the selection and installation of our major ICT infrastructure. This included assessing teaching and learning spaces at various clinical sites, reviewing specifications, advising on appropriate solutions, and taking the lead on the tendering process. To date the IT department has overseen the successful installation of a) internet infrastructure at all four clinical sites; b) four video conferencing systems; and c) access control systems to secure equipment at two of the clinical sites.

The UB Library has been an essential partner in support of the mLearning Initiative (tablet project), in particular. In collaboration with Botswana University of Pennsylvania Partnership (BUP), UB Library led the process of identifying and testing research databases, and medical applications for the tablets. Both the senior librarian and the technical librarian have been instrumental in developing and facilitating the necessary training for tablet users as well as being actively engaged in the configuration of the tablets. To date, with active engagement of the UB Library, UB SoM has distributed 215 tablets to students, faculty and residents. At the time of tablet allocation, users received training on the general use of the device and the use of the medical and research resources.

The Campus Services department has been primarily responsible for assisting with furniture installations. They evaluated furniture from the old UB SoM building, and other used furniture stored across campus to determine which could be re-used at the clinical sites. They reconfigured and installed some of the old

furniture and as well as set up new furniture. To date, Campus Services has assisted with outfitting four library spaces, three teaching rooms, three undergraduate and graduate study spaces, and faculty offices at three of the four clinical sites.

Partners outside the University of Botswana: Experience elsewhere has demonstrated north-south and north-east partnerships can be invaluable especially when effectively grounded within the local context (Miner and Missen, 2005; Frehywot et al., 2013). In addition to UB partners, BUP has been a crucial partner in providing mobile health expertise, specifically in offering f strategic and initial operational leadership for the mLearning Initiative. The relationship with BUP is a long-standing one in which BUP led collaborative research with UB SoM, UB Library and Orange Botswana that provided the basis for the upscale of the abovementioned tablet project. Based on the result of the pilot studies, UB SoM was able to identify the appropriate mobile device and data package for the mLearning Initiative (Goldbach et al., 2013). BUP continues to provide strategic leadership and partner engagement for the mLearning Initiative.

Through the partnership with BUP, UB SoM also acquired support partnerships with Orange Botswana and Mangoes Mobile. Orange Botswana is a telecom company providing UB SoM with a highly subsidised SIM card package. Mangoes Mobile, a mobile consulting company, led the configuration of the initial 170 tablets. They developed processes and documentation for subsequent configuration, and continue to provide troubleshooting and strategic support for the mLearning Initiative. They also developed a user analytics platform that creates reports on usage of applications on the tablet.

Another non-UB partner has been the team of superintendents at the four clinical sites who have become untiring champions for the UB SoM. In the midst of sometimes paralysing Ministry of Health and UB bureaucracies, they have found creative ways to provide invaluable space for UB SoM learners and faculty members at hospitals where space is a rare commodity. Besides making space available, another important aspect of support from the hospital superintendents has been their willingness to make provision for IT staff at their institutions to provide limited support to UB SoM where the university does not have IT personnel on the ground. At two of the hospitals where UB IT has no daily presence, Ministry of Health (MOH) IT personnel act as the first line of support for technology support. Overall, hospital superintendents have been active facilitators of UB SoM elearning strategy through the services they have provided and the opportunities they have made possible.

Working with partners has enabled SoM to go beyond what could have been achieved independently. Overall, partnerships have borne much fruit as evidenced by the number of functional projects in just eighteen months. It has become apparent that it is not enough to engage partners initially, but that the relationships need to be continually nurtured. One has to move beyond initial engagement to managing relationships with service units in ways that move the process forward. As such, there is need to navigate institutional dynamics and systems with wisdom and discernment by engaging service departments with patience and respect. Additionally, being educated about policies and procedures of supporting departments has proved necessary.

2.4 Intentionally engaging faculty and students

Beyond making technology available and acquiring the relevant support for projects, there is a need to provide training and support for faculty and learners to maximise the adoption and integration of technology effectively. Training ensures they have the requisite skills to take full advantage of the technology and minimise frustration (Nurjahan et al., 2002, Nartker et al., 2010; Frehywot et al., 2013). Moreover, faculty and students are important stakeholders to engage around developing a shared vision and receiving feedback since elearning integration is implemented for the benefit of their teaching and learning (Erah and Dairo, 2008; Maio and Ferreira, 2001).

The notion of intentionally engaging faculty and students meant involving them at the input a well as the training stages of the process once the technologies had been implemented.

Providing training and support for faculty and students: In the past year, limited training was provided on the use of tablets, video conferencing, and interactive boards. Currently UB SoM is articulating a plan to outline a strategy for faculty and learner support and development. For faculty, support will include both pedagogical and technological support and development. For students, support and development will include technological and pedagogical training to ensure that their learning is both effective and engaged. In particular, students need to acquire and/or improve self-directed metacognitive skills that will enable them to be successful in a learner-driven PBL curriculum and flourish as lifelong learners.

Feedback from faculty and students: The elearning team has provided opportunities for students and faculty to provide input both prior to and following implementation about how the use of technology would be most beneficial for their learning and teaching needs. For instance, residents at one of the clinical sites expressed preference for the use of video conferencing to support collaborative learning instead of tele-lecturing. They have also alerted the team to gaps in support and infrastructure availability which the team expects to correct in this fiscal year. For example, UBSOM's undergraduate students provided feedback on the mLearning Initiative which prompted us to commit to allocating individual tablets to third-year students instead of loaning them tablets only when they were on rural rotations as we thought at the time. A team of six third year students acted as ambassadors and assisted with the tablet setup. They also gave feedback on the process and ideas on distribution.

2.5 Early and Continual Consideration of sustainability during Implementation

Even as we implement UB SoM's elearning agenda, sustainability has been a major consideration in light of the lifespan of the grant funding the agenda. First, engaging with university partners, especially the IT department, to ensure a shared vision and understanding has been crucial. Cresswell, Bates and Sheik (2013) argue that this process of consensus building is necessary to ensure commitment and co-ownership of projects. Ultimately, grant funded development (e.g. internet infrastructure) should be supported and maintained centrally by the IT department. Beyond the university departments taking responsibility for continued maintenance and support of technologies, there is a need for university departments to take responsibility for projects that were initially managed and supported by outside partners, i.e. capacity building. Finally, it has also been important to think creatively about funding technologies that need continuous replenishment, in particular our mLearning Initiative (Erah and Dairo, 2008).

UB SoM's elearning agenda is primarily funded by a five year United States Government grant, the Medical Education Partnership Initiative. This funding has provided UB SoM with a unique opportunity to support medical education innovation without the financial constraints that most new schools, especially in resource limited settings, experience. Due to the limited life cycle of the MEPI grants, conversations and strategic planning at UB SoM and university support units (e.g. IT, Centre for Academic Development) is on-going to ensure that the investments made during the current grant become a stable part of the University processes beyond the grant's lifecycle. The University IT has taken ownership of the procured technologies and taken responsibility for maintaining and supporting installed ICT infrastructure.

The UB SoM and UB Library are assuming many of the roles originally played by the technical assistants, BUP and Mangoes Mobile in the mLearning Initiative. The senior librarian for the Faculty of Health Sciences completed a 6 months internship at University of Pennsylvania Biomedical Library and consequently brought invaluable expertise on mobile medical resources to UB Library and UB SoM. An intern in the Distance Learning Unit and an Assistant Librarian have taken responsibility for the day-to-day operational aspect of the project.

In the near future, it is expected to assemble a team of undergraduate students, residents, and faculty members to function as an elearning advisory team. This team will work with the distance learning specialist on elearning planning, implementation, and support including issues of sustainability. Among other things, the team is expected to propose a viable model for funding tablet acquisition for the 2014-15 academic year.

2.6 Integrating continuous evaluation

Throughout the implementation process, user feedback has been received through informal focus groups, as well as meeting with the student body and the faculty. A study of the tablet project is under way and currently surveys and focus groups are being conducted. Data collection is expected to conclude by March 2014. A follow-up study that targets faculty is needed since the current study only focuses on medical students and residents. Faculty are encouraged to conduct research around the technologies they are using in order to gain a deeper understanding of the best strategies for using such technologies. Since UB SoM learning spaces at clinical sites are relatively new, a proposal is under way to explore learner satisfaction with infrastructure resources available to them at clinical sites.

3. Challenges faced during implementation

This section discusses three specific challenges that were experienced, thus far, during the during the implementation process so far: *managing the process, managing user expectations, and managing partner expectation.*

3.1 Managing the process

The procurement process has taken much longer than we expected. Although Business Services has been very supportive, both in working against tight deadlines and accommodating UB SoM needs in the midst of rigid university procedures, the process has at times been painfully slow, and time-consuming for all parties involved. Besides the slowness of the procurement process, challenges were also experienced in securing transportation in a timely manner to move equipment and furniture to clinical sites once delivered to main campus.

The tablet project ended up being much more time-consuming than was anticipated. Despite a robust team composed of two consultants, several staff members from UB and BUP, and volunteer students, the setup of the original 170 tablets lasted close to two months. Even with this experience and well documented processes, subsequent set-up is still time-consuming. The configuration process is generally complex and requires strong organisational skills.

3.2 Managing user expectations

While there are tangible developments targeted to improve the learning environment (e.g. lockers, desks, study spaces, and most significantly internet access), undergraduate students have tended to focus exclusively on the mLearning Initiative. Realising that there were not enough tablets to go around, they seemed to overlook all other developments and lobbied the mlearning implementation team tirelessly to ensure that they would receive tablets. To diffuse a potentially distracting and destructive situation, mlearning implementation team opted to engage the stakeholder (students) with honesty, openness and active listening. A meeting was requested with the undergraduate students and the team articulated the implementation process. Ultimately both parties were able to move forward together.

3.3 Managing partner expectation

In addition to delays with the setup of tablets, there were also some delays in securing SIM cards in a timely manner. The package created by Orange Botswana for the School of Medicine is unique and in some ways cutting-edge for Botswana's context. In the end, the project required more testing from both parties than was

originally expected. In retrospect, it might have helped both parties to start the project with well-articulated benchmarks and clear time expectations on deliverables from both sides.

4. Conclusion and Future Plans

Technology continues to make inroads in medical education, despite the considerable technical challenges, financial and time costs around technology selection, procurement and installation. A multi-faceted systematic approach is crucial to the successful planning and implementation of an elearning agenda. Additionally, navigating challenges to achieve intended goals warrants being reflective, flexible, adaptable and intentional about nurturing strong strategic partnerships and relationships to ensure ownership and support for projects. Although the progress of University of Botswana School of Medicine's elearning agenda is promising, the implementation process is still in the early stages. Therefore robust evaluation of efficacy, effectiveness and cost-effectiveness of the elearning agenda is important. It could be beneficial to explore how learners and faculty are utilising the various technologies and if technology is facilitating a positive learning environment as envisaged. Sustainability remains a concern despite deliberate steps to make it an inherent part of the implementation process. Moving forward, there are plans to develop a robust training plan to ensure that faculty and learners are engaging with technology beyond surface use. Ultimately, technology integration is not just about the tools one needs to use; it is a costly complex process that includes people, processes, securing and managing instructional and non-instructional resources, and analysis of learning and performance problems, among others (Reiser and Dempsey, 2007).

Acknowledgements

The University of Botswana School of Medicine's elearning agenda is supported by the President's Emergency Plan for AIDS Relief's (PEPFAR) Medical Education Partnership Initiative (MEPI) through the Health Resources and Services Administration (HRSA).

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