Challenges and tensions in the role of the LMS for medical education: Time for the "next generation LMS"?

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In the context of discussions of a "next generation LMS" and other contemporary challenges in higher education, this case study looks at the iterative process a team of educational designers and Medical School academics at Australian National University used in a review of the ANU's Medical School LMS sites. Adopting the framework of the actor network theory, this reflective process discovered the tensions, dynamics and issues involved, and worked to gain and maintain key Medical School staff engagement and support for the review and for any changes that might be recommended. This paper reflects on emerging possible models for technology-enhanced learning beyond our current institutional LMS while acknowledging the institutional constraints on learning innovation within the global higher education context. Next generation LMS models may provide a more flexible future solution that could be applicable not just to medical education, but to higher education generally.

Introduction

Universities rely on their learning management system (LMS) to deliver educational content online. However, as technology-enhanced learning and teaching (TELT) practices mature, questions have been raised about the suitability of the LMS to adequately meet the current and future needs of students and educators (Adams Becker et al., 2017; Brown et al., 2015; McGee & Green, 2008; Sclater, 2008). This is an especial challenge for medical schools that utilise an LMS to provide a single-sign-in, all-in-one portal not just for the provision of an integrated spiral curriculum but also a range of automated administrative, tracking and reporting functions (Back et al., 2016). Moving the focus of the LMS away from its primary purpose of constructing learning through interaction with multimedia and collaboration with peers and educators creates tensions between the LMS, the university, and the diverse needs of the users. Actor-network theory (Latour, 2005) enables the exploration of how people, ideas, processes, politics, cultural and historical factors, and technologies inter-relate and form the complex realities in which educational designers work. This paper theorises that in medical education the LMS is a site of tension that is not easily resolved, and it is into this site of tension that educational design projects function. It is beyond the scope of this paper to explore specific alternative models, although some reference is made to emerging visions of interlinked, flexible systems to meet higher education learning needs, for example in the 2016 Horizon Report.

Background

In 2016, the Medical Education Unit (MEU) of the Australian National University Medical School contacted the university's central educational design team to discuss revision of the online spaces used to deliver the four-year graduate entry medical program. These spaces existed in numerous sites, within the university's institutional instance of the Moodle-based LMS. This request was in response to student and staff dissatisfaction with the customised Moodle LMS design created for the Medical School to replace a previous bespoke platform known as 'MedOnline'. MedOnline was designed specifically for the Medical School in 2000. The platform was created to provide content management as well as communication and administration tools specific to the delivery of medical education. However, it was composed mostly of static resources with limited interactivity. Given that the remainder of the university utilised the institutional Moodle-based LMS, the MedOnline platform was unsustainable. Therefore, in 2012 all of the MedOnline functions were migrated to the university's LMS. Customisations were integrated to accommodate the unique communication and administration functions previously delivered by MedOnline. These customisations included tools for managing timetabling and recording the contact information and teaching participation of the vast number of educators, many of whom are clinicians external to the university. These functionality requirements pushed the LMS to its limits, making it difficult to navigate and manage. The result was a system which was more recognisable as a content management

repository and administration interface rather than an interactive and collaborative learning environment.

ANU Medical School professional and academic staff recognised that the prioritisation of administrative over pedagogical imperatives in the LMS customisation had resulted in negative feedback from students and staff. Thus there was an overwhelming desire for improvement. Nevertheless, there remained a strong cultural attachment to the provision of complex administrative and human resource management functions via the LMS.

To identify the issues causing dissatisfaction with the customised LMS, a team of educational designers from ANU Online, and members of the MEU, initiated a project to review the existing LMS and recommend improvements. This paper describes and reflects on the review process undertaken by the educational design team. In addition, issues specific to medical education that affect the design of an online learning environment are discussed. Finally, we reflect on whether these issues are confined to medical education alone or whether they expose widespread issues emerging around the limitations of a "one-size-fits-all", proprietary, institutional-based LMS platform in higher education.

We suggest that the existence of the LMS within a complex network of technology, people, policies, educational needs, institutional factors, and information technology services impacts any changes to technology or pedagogy within a given curriculum. Actor Network Theory (ANT, Latour, 2005) has been used to understand technological change and the shifting interdependent and influential relationships between technology and people. It is a theoretical framework which "savours mess, contradictions, the local rather than the universal, and close noticing…" (Bleakley, 2012, p. 466). In this paper we apply ANT to capture the reflective process LMS-review participants experienced, which led to new understandings and awareness of and relationships with the LMS.

Methodology and data collection

A mixed-methods approach was used to evaluate the LMS and included: (1) a survey, (2) focus groups, and (3) interviews. Ethics approval for this study was received from the Australian National University Human Research Ethics Committee. An electronic survey using Qualtrics (Qualtrics, Provo, Utah, USA) was distributed to all Year 1-4 medical students (N=400) via mailing lists and electronic bulletin boards. The survey was composed of closed and open-ended questions to obtain demographic data and determine student use of the LMS, including identification of what they found worked well or not well and suggested improvements. In addition, students were asked to rate their experience of the LMS using a five-point Likert scale. All analyses were performed using Qualtrics.

At the end of the survey, students had the opportunity to volunteer to participate in a focus group. Full-time academic and professional staff who regularly use the LMS (N=49), based on recommendations from the MEU, were invited to attend an interview. Semi-structured questions were used to explore student and staff views on and experience with the LMS and its impact on their teaching and learning activities. All interviews and focus groups were recorded, with the consent of each participant, before being transcribed coded, classified and analysed using Dedoose (Hermosa Beach, California, USA). Thematic analysis method was used for qualitative data collected from survey open-ended questions, focus groups and interviews.

In total, 121 students (30% of total students) responded to the survey, and 33 students (6 Year 1, 4 Year 2, 11 Year 3, and 12 Year 4) and 20 staff (6 academic, 14 professional, 41% of total staff) participated in the focus groups and interviews.

Results

Dissatisfaction with the LMS was the overwhelming response from the Medical School community. Students found the LMS confusing and difficult to use, and it hampered rather than supported their ability to study effectively. Navigation problems were the main source of complaint, with resources and assignments difficult to find and use, and many course sites filled with dense information that was hard to extricate. Overall, students rated their experience with the Medical School LMS sites as average to poor. In response to the question, "What three words would you use to describe your experience with the LMS, students indicated they found it 'confusing', 'frustrating', 'difficult', and 'slow' (Figure 8).

Figure 8: Student-reported experiences of the LMS

Students commented that they weren't sure what the LMS was supposed to be delivering for them:

> *"As a student I get a bit confused about what the LMS's ultimate aim is - is it an uploading centre? It is a resource information* [site]*? Or is it a resource provider itself?"* - Year 3 student, survey response

"Keep the LMS streamlined and organised, focussed on the resources/communication provided by/from the MEU (don't try to make it a 'one-stop shop' with other services that third-parties do a better job of providing)." – Year 1 student, survey response

There was evidence of a lack of understanding of how the LMS works, with staff often unsure how to improve it as they did not feel they received adequate support or training in its use. When asked about difficulties in using the LMS, an academic staff member responded in interview:

"In the end you should be able to fix it but I just can't be bothered. And the [student] *groups constantly say, I'd prefer to use Facebook. And I as the academic say, well I don't want any patient details going on Facebook, so we'll just do an email group."*

This sentiment resonated with many staff and students. Rather than try to "make" the LMS meet their needs, which they felt the system could not do or that it would be too difficult to try, they would rather just use a third-party platform. The survey revealed that students regularly use external systems such as Facebook for communication and Google Docs for sharing documents and collaborating:

"All have mobile support, but that is not why I use them over the LMS. The LMS would be too limited and clunky for collaborative work. G[oogle] *Drive and Facebook have 1,000s of developers working on updates and software improvements, so I don't see myself shifting those activities to the LMS. The LMS development is likely to be far slower and the software less flexible compared to other services."* - Year 2 student, survey response

Furthermore, both academics and students expressed a desire for more interactive learning opportunities such as videos and formative quizzes with feedback. To compensate, students accessed a range of external sites such as YouTube, Wikipedia, and Khan Academy as well as medicine specific sites like MedScape, Toronto Notes, and quiz databases for the U.S. Medical Licensing Examination (USMLE). This practice is common: medical studies are increasingly turning towards more user-friendly technologies to meet their educational requirements (Hollinderbäumer et al., 2013). However, these approaches are not without their flaws and it is evident that educator input is required to ensure relevancy and accuracy (Azer, 2015).

There was a pervasive sense that the LMS was a constraint to usability and educational outcomes:

"Medical people don't think in silos or boxes, we need resources that are holistically arranged, not overly prescriptive, available across all years and sites, easily searchable." – Academic staff member, interview

"I hadn't even considered the LMS as a learning tool. I think of it as an administrative tool." – Year 2 student, focus group

"I make slides available to students on the LMS, and I provide descriptions of teaching sessions on the LMS, but I don't really think in any meaningful sense I deliver education via the LMS." – Academic staff member, interview

Many of these problems stem from the same issue: Moodle is a learning management system, designed for interactive teaching and learning tasks. However, from this review it was apparent the Medical School primarily used the LMS for administrative and organisational purposes. Students had to access new information and announcements from a large number of possible communication channels over several different sites, but there were limited opportunities for interaction with their peers or academics. It became evident to the educational design team that medical education is complex, with specific requirements both educationally and administratively, that had resulted in the Medical School using the LMS as a "one-stop-shop" to meet these complex needs.

The outcome of this design was an LMS that students found challenging to use, with confusing navigation and seemingly impenetrable to search and access learning materials. This subsequently impacted professional staff to whom students would turn to complain or seek assistance to access information and materials. It was obvious that the course sites needed significant revision to improve the user interface design. An updated, more visually appealing design was envisaged by the educational design team as these issues emerged. However, it was evident this would be difficult to achieve with the layers of administration functions imposed on the sites and the limitations this placed on the extent to which the course sites could be changed. It was also clear that any new designs would need to factor in mobile accessibility, as 90% of students reported using their mobile devices to access the Medical School course sites but the user experience was very poor.

Additional complexities that became apparent during the analysis of the data included the following:

- The ANU Medical School must interface with a range of external bodies such as hospitals and other medical institutions, relevant regulatory bodies, government departments and medical research repositories.

- Substantial student learning occurs in clinical locations external to the university – both for practicums as well as lectures, tutorials and assessment.
- Medical education is profoundly vocational and involves rostered rotations in a variety of clinical settings, combined with attendance at formal teaching sessions. Students and their teachers need to be linked into the very latest medical information that may make a difference to the health of individuals and populations.
- Medical education is based on an integrated spiral curriculum composed of multiple disciplines, rather than just a single course.
- Many staff teaching into the medical program are clinicians, general practitioners, or hospital staff who do not hold positions at the university, meaning they are unable to access the university-only LMS.

Within this multifaceted environment, the institutional LMS struggled to meet the needs of staff and student. While the plug- in met these needs for a period of time, albeit in a way that was not particularly user-friendly, it became apparent that the plug-in is not sustainable, and we need to explore other alternatives for integrating all of the Medical School needs into a coherent, user-friendly set of digital environments.

Discussion

Actor-network theory (ANT) is ideal for exploring the complexities of relationships and inter-dependencies of information and communication technology (ICT) projects within education (Tummons, J., Fournier, C., Kits, O. & MacLeod, A., 2017)). As a framework, ANT avoids linear understandings and focuses instead on revealing complexity (Bleakley, 2012), and problematizes the idea that only humans have agency within a network (Sayes, 2014). When we expand the definition of agency beyond just human action, and include "things [which] might authorize, allow, afford, encourage, permit, suggest, influence, block, render possible, forbid, and so on" (Latour, 2004, p. 226), we are able to explore how every entity in the network (human or otherwise) can have an effect on that network. "How to make someone do something" is the central concern of ANT (Latour, 2005, p. 59).

> A network can be established through persuasion, inducement, coercion or any combination of these. And a network can break down at any point or link: consequently, the social project can be slowed down, misdirected or even lost, whether the broken link is an object (e.g. a rule or regulation that has been forgotten or misinterpreted), or a person (e.g. someone who has decided for whatever reason

not to act in the way that the network requires). Both people and objects can make (or fail to make) other people do something; that is to say, both people and objects are granted agency within ANT. (Tummons et al., 2017, p. 3)

Using new technologies in educational contexts is often fraught with difficulties, and liable to breakdown or fail, but this is often not solely the responsibility of the technology, nor solely of the people set to use the technology. Speaking of the difficulties involved in making changes to an institutional LMS, Mewburn et al. (2014, p. 646) writes:

> Our paper draws attention to the source of trouble originating in humans and non-humans working together - it was rarely the problem of one or the other 'standing in the way of progress'. Most of the non-human actants in our technology actor-network, while cheap, available and easy to engage with, operate within a complex policy and legal environment - full of other actors with the ability to influence at a distance in complex and perhaps unintentional ways.

Below, we examine the connections between human actors (teachers, students, clinicians, executives, and educational designers) and non-human actors (such as the LMS, computers, mobile devices, human resource systems, internet access) in the context of ANU Medical School. When depicted as an actor-network, it becomes very clear why it is so challenging to "just change things".

The first issue at work in the ANU Medical School is that a large percentage of the staff who teach into the program are not employed by the university, and access to the LMS and all institutional systems are not available to them. Many of these individuals may only teach one or two sessions in a year in a volunteer capacity, and they rotate rapidly: it was too onerous a task to organise HR credentials for them. This has a flow-on effect where clinicians were not engaged with the LMS, and are reliant on professional staff in the School to upload documents for them. The clinicians are also unable to see what had been taught by others, and cannot create learning activities for students. The resulting student dissatisfaction led to the initiation of the review process described above, but until the HR issue is dealt with, this issue cannot be easily resolved. As an inherently vocational program, direct contact with clinicians and clinical environments is essential to the program.

Another issue is the historical factor of MedOnline, the previous LMS, and how Moodle was customised with a bespoke plug-in in order to match the functionality of MedOnline. This influences how the LMS sites look and function, and these cannot be substantially changed as it

would cause the plug-in to break down. First created in 2011, the plug-in is static, and has begun to degrade in functionality as the university updates the LMS on a yearly schedule and new features and themes are introduced. The use of the LMS is, in one sense, "locked down". In order to deal with this, students frequently rely on external sites such as Facebook (for communication) and Google Docs (for collaboration). The educational designers hope to replace the plug-in using a combination of Office365 collaboration tools and a digital content repository, though this cannot occur until the university progresses through a procurement process to select a repository product and integrate it with the LMS. However, most of the staff and students in the School are not aware of these "behind-the-scenes" processes, and only experience the outcome: poor user experience. This has led to dislike of the LMS, and unwillingness to use it as a result (see Figure 2, below).
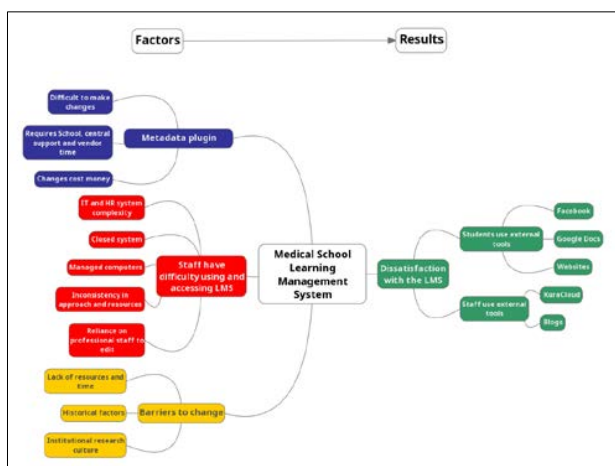

Figure 2: Actor-Network of effects of technology on user experience

The technology and access to it substantially affects the behaviour of staff and students within the School. In fact, it could be said that the customised database plug-in is a dominating actor, repressing and thwarting the drive from academic actors to rejuvenate their learning environment and improve the learner experience. A common refrain is that "the LMS is terrible", and this narrative has led to a general unwillingness to use it at all. Despite these factors, there has not been a major breakdown in the use of the LMS and it is still very much central to the delivery of the program. While the LMS may not be adaptable, the actor-network is: staff and students are persistent, dedicated, and "hack" their own solutions when one is not readily apparent. Several academics have begun using other Moodle sites, external blogs, eBooks or adaptive learning tools such as KuraCloud to meet their desire for user-friendly and innovative uses of technology.

Limitations

Whilst 30-40% of students and staff participated in the survey and interviews, all staff and students were given the opportunity to view the results and provide feedback. This ensured that the results were representative of the key stakeholders. Though it may be argued that the limitations of the plug-in are a weakness of the study, the role of the plug-in and its contribution to the complex organisation and functionality of the LMS were not readily apparent at the study outset and emerged as a major limiting factor during the course of the study.

Emerging challenges to the role of the LMS

Dissatisfaction with LMSs, as they are currently delivered in higher education, is not unique to the Medical School in this case study, but is expressed by many scholars (McGee & Green, 2008; Garcia-Penalvo et al., 2011; Herold, 2014; Vogten & Koper, 2014; Adams Becker et al., 2017, Watters, 2014). A theme among these authors is that the LMS is extremely limited in comparison to far more flexible tools on the open internet, in the form of Web 2.0 communication, social networking, collaboration and research applications.

There is a lack of comprehensive empirical data on the use of LMSs for medical education (Back et al., 2016). Previous studies have focussed on individual disciplines, rather than integrated spiral medical curricula, or investigated elements of TELT rather than focussing on the role of the LMS (Zakaria et al., 2013; Kukolja-Taradi et al., 2008; Childs et al., 2005). One study investigating 505 undergraduate medical students´ utilization of and problems with a LMS has been conducted (Back et al., 2016). The results were consistent with the findings of our study: Back et al. found that medical students primarily use the LMS to acquire information about curricular content, access teaching resources and prepare for assessments; the importance of the LMS for communicating with other students or teachers was minimal (2016).

Consistent with our student cohort, primary complaints about the LMS concerned inadequate content integration and structure, problems locating resources, and a lack of interactivity. Medical schools also frequently encountered issues with clinicians and access to the LMS, and found that the level of support required to enable clinical educators to use non-intuitive interfaces should not be underestimated (Gray & Tobin, 2010).

The strengths of the LMS are also its weaknesses. They provide closed "walled gardens" (Garcia-Penalvo, F. J., Conde, M.A., Alier, M., & Casany, M.J.,2011) of learning and activities that are protected from theft of intellectual property, the dangers of the open internet in terms of security and personal safety, and the intrusion into

proprietary interests of universities in a competitive global higher education market. But it is this very security and safety that also restricts access, flexibility and innovation. The specific issues causing a restlessness among those confined to the LMS platform have been identified as:

- Lack of interoperability between tools that are part of the LMS package being purchased and tools that might belong to other providers or are open source (Sampson & Karampiperis, 2006; Brown et al., 2015)
- Lack of interoperability between SCORM learning objects within an LMS and other functions of the LMS, limiting the ability to share and re-use such objects (Sampson & Karampiperis, 2006)
- Inflexibility and inability to customise and personalise learning (Sclater, 2008; Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall, Giesinger, C., and Ananthanarayanan, V. 2017)
- Inability to partner with other higher education institutions due to proprietary LMSs (Sclater, 2008)
- The structure of LMSs around institutional norms and rules, implying an inherent conservatism and lack of innovation (Watters, 2014)
- Complexity and difficulty of navigating current LMS sites and using the tools (Zanjani, N, Edwards, S. L., Nykvist, S. & Geva, S.,2017)

Using Actor Network Theory, it could be said that LMS technology is an actor favoured by higher educational institutional actors, as a unified solution to problems that are largely financial, administrative, and the outcome of the impact of globalisation and global competition for universities. These global forces act on universities and result in the use of a form of technology that may belong in a previous era, rather than in a new age of open resources, open learning and a highly connected world. The continued use of an outdated form of technology could be seen to create tension as students and teachers bypass the LMS for newer technology that is more suitable for contemporary communication and learning needs. It is this tension between the different actors that perhaps will drive the LMS towards a newer iteration of its model.

A vision of something beyond the unified "one size fits all" of an institutional LMS is emerging expressed in language like "learning ecosystem", "digital learning system/environment", and "Personal Learning Environment" (Dahlstrom et al., 2014; Adams Becker et al, 2017) to enable lifelong learning. Rather than the "walled garden", the future digital learning environment will function as a portal to a series of interconnected systems. The cloud is frequently mentioned as a cheaper and more flexible option to university-based proprietary

IT systems supporting an LMS (Lal, 2015). Technavio predicts that by 2020, 80% of all organisations will adopt a cloud-based LMS (Technavio, 2016). However, given the competitive global model that has been adopted by most universities, institutional self-preservation and self-promotion may continue to mandate that learning occurs behind digital walls with limited bridges and portals into and out of the external, connected world. While teaching and educational design staff may be motivated to design integrated learning environments that incorporate external applications and sites, global university competition and proprietary attitudes, and security concerns, also form as actors in the network, putting a brake on developments, or perhaps steering developments towards a particular outcome.

Conclusion

The primary discovery of this review was that user dissatisfaction has arisen as a result of the incompatibility between the multi-faceted requirements of the ANU Medical School and the limitations of a "one size fits all" institutional LMS platform. This may be an early warning sign that the model for technology enhanced flexible learning using a single, central LMS platform is inadequate for a medical school, and possibly for teaching and learning throughout higher education. This model, which is still largely limping along as the only viable solution for most universities, may have reached its use-by date. The 2017 Horizon Report published by Educause includes "next-generation LMS" as a mid-term trend in its list of "six trends accelerating higher education technology adoption" (Adams Becker, 2017, p. 3), and asserts that:

> Learning ecosystems must be agile enough to support the practices of the future. In using tools and platforms like LMS, educators have a desire to unbundle all of the components of a learning experience to remix open content and educational apps in unique and compelling ways. (Adams Becker et al, 2017, p.2)

The developing trend is for "next-gen" LMSs that are modular in nature, interoperable with a range of applications that are able to be customised to include open educational resources and practices. With its multiple components needing integration into its delivery and curriculum, a new model for the LMS is certainly needed for the Medical School in this case.

The requirements of medical schools, ascertained in this review, highlight many of the features desired in a "next gen" LMS. The model of learning is founded on the acquisition of real-world skills and current knowledge on a wide range of medical issues overseen by a large number of clinical teachers and supervisors. This requires a system that can cope with the meaningful integration of technology to support skills-based training, access to

voluminous e-libraries and e-resources and the rostering of staff and students together with effective communication channels. A modular system that has good interoperability between different applications and can make use of open education resources and communication platforms together with rostering applications would be ideal.

The reflective approach of the ANU Online educational design team and Medical Education Unit staff led them to recognize the particular needs of delivering an integrated spiral blended learning medical curriculum within the constraints of an institutional LMS. In trying to solve the problems and issues discovered in the review, the team and the collaborating Medical School staff may need to link in to the wider discussion advocating a modular and flexible virtual learning environment rather than the unified, walled LMS solution, perhaps becoming part of a technological evolution in the making. As part of this evolution, the constraints imposed by globalising university institutional requirements might result in a new alternative as a hybrid solution.

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Note: All published papers are refereed, having undergone a double-blind peer-review process.