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What did we flip? Exploiting technology for students to develop real-world perspectives in the classroom

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Many higher education institutions have implemented flipped classroom models for improving student engagement in the learning process. In this paper we present our experiment "Village Pharmacy", which uses technology assisted case-based approaches for students to learn pharmaceutics and associated professional skills in context. Using an auto-ethnographic approach we collected and analysed our experiences of designing and teaching this course, reflected on peer feedback, student learning experiences and responses. We present our design, reflection and analysis of how learning unfolded in a flipped classroom and the lessons we have learnt to make improvements for the future. We believe that our reflections will be useful for academics wishing to use technology to flip the classroom for students to develop key professional skills inherent to their discipline.

Keywords: flipped classroom; video animations; professional learning; auto-ethnography

Introduction

Pharmacists are health practitioners employed in the fields of community, hospital and industrial pharmacy. In addition to dispensing drugs there is a growing recognition of the importance of clinical pharmacy services in patient care and the associated acquisition and interpretation of knowledge required for the dissemination of information to patients (Ried & Posey, 2006). Pharmacists also provide information and advice to medical practitioners about optimal drug therapy and disease state management as well as educating allied health professionals on the quality use of medicines. A growing body of knowledge in Pharmacy has made it increasingly difficult to keep abreast of current knowledge and developments in the prevention and treatment of disease and illness. It has been suggested that in the face of this ever-changing knowledge environment, it is essential for students to develop professional capabilities within the disciplinary context (Blouin et al., 2009).

A unique aspect that pharmacists bring to the health care team is the knowledge and skills in the area of pharmaceutics, a discipline of pharmacy that particularly deals with the process of turning a new chemical entity into a medication, and the design of devices for the delivery of medications to patients. Pharmaceutics has previously been taught in a traditional model of lectures and tutorials with little opportunity for students to develop or practice professional

skills. Our intention with that approach to teaching was to provide students with the opportunity to comprehend and apply the content learnt through lectures in tutorial situations. However, we observed that most students struggled to demonstrate the ability to professionally communicate pharmaceutical knowledge, skills and attributes in context in later years during their study and during their intern training. That is, they struggled with taking various factors including age, cultural, ethical, social and economic situations that can have an effect on patient safety, into account, when providing patient centred care in a community or hospital pharmacy.

While professional communication is an important skill that pharmacy graduates have to demonstrate before obtaining a licence to practice pharmacy, we found that teaching and assessing many over-arching professional skills, including effective communication skills difficult and sometimes costly depending on the necessary resources. We also found it challenging to emulate sensitive situations that presented in the real world within the design of authentic learning and assessment activities alongside encouraging the learning of key professional skills including communication, teamwork, interpersonal, intrapersonal, problem solving and decision-making skills.

In this paper we present our experiment "Village Pharmacy", which uses technology assisted case-based approaches for students to learn pharmaceutics and associated professional skills in context. Using an auto-ethnographic approach we collected and analysed our experiences of designing and teaching this course, reflected on peer feedback, student learning experiences and responses. We encourage academics to exploit the potential of freely available educational technology to support and strengthen student learning of key technical and professional capabilities inherent to their discipline. In the next section, we provide a brief review of literature that underpinned our approach to the design of learning and assessment activities in the pharmaceutics course.

Challenges facing pharmacy education

In the last hundred years our world has changed steadily and more rapidly than it has in the preceding past. It has become a healthier, mostly safer and an extremely productive place, where advancements in education, health and technology have forged an irreversible imprint on our lives, identity and the society. In this increasingly globalised world, creativity has become critical to surviving, growing and thriving, because it enables a person to identify appropriate problems unnoticed by others and solve them.

Craft (2006) argued that globalisation of economic activity has brought with it an increased competitiveness for markets driving the need to raise the levels of educational achievement of their potential labour forces. Accordingly, what is required in terms of academic achievement is changing. It is no longer enough to have depth and grasp of knowledge. Graduates are required to develop the skills not only to create brilliant new ideas, but also to transform those ideas into new realities thus adding value to the society.

Increasingly, as employers favour graduates who possess discipline-specific and generic knowledge, skills and attributes, it is critical to incorporate active and experiential learning methods to promote the learning of key professional skills. Additionally, the ever-increasing evolution of knowledge in Pharmacy makes it increasingly difficult to keep abreast of current knowledge and developments in the prevention and treatment of disease and illness. It has become apparent that it is essential to help students develop professional skills including

critical thinking, problem solving, communication and lifelong learning in the classroom. Recent emphasis on ensuring qualification compliance regulated by the Tertiary Education Quality Assurance and Standards Agency (TEQSA) and the shift towards assuring graduate threshold learning outcomes has brought the discussions around teaching and assessment of many such key professional skills in many professional disciplines, including pharmacy, once again to the fore.

Besides, students entering pharmacy courses are very similar to the ones entering other higher education fields – they are diverse. Recent experience indicates that an increasing number of students have varied interests and engage in paid part-time or fulltime work. They are characterised by a high-level of diversity including age, ability, educational background, socio-economic status, language background and ethnicity. Such diversity is both a challenge and an opportunity, especially as academics focus on strategies to improve student engagement in activities associated with high quality learning. As Krause (2005) identifies, one way of overcoming this challenge is by designing courses that are inclusive.

Shift in thinking - empowering learners

University courses are evolving and are becoming more inclusive, providing students with the opportunity to develop, progress and apply knowledge and skills, in a variety of learning and teaching contexts. The shift in thinking from lecture-centred to more student-centred approaches to learning and teaching empowers students to develop capabilities for life-long learning and ensures the quality and employability of graduates (Barr & Tagg, 1995; Biggs & Tang, 2011). Advancements in education technology and the opportunity for providing practice-based and work-integrated learning opportunities has helped improve graduate capabilities and promote work readiness.

Despite such advancements, a number of disciplines of study, including medicine, physiotherapy, pharmacy, nursing and midwifery, and allied health indicate difficulties in accommodating an ever increasing student body in work-integrated learning – a most crucial part of professional training before graduates enter the workforce (Patrick, Peach, & Pocknee, 2008). These challenges are often because of economic reforms impacting number of in-patient days in hospitals and therefore less patients available for teaching and assessing student performance.

Problem-based, practice-based, scenario-based, case-based and numerous such active approaches to instruction provides some respite by allowing students to actively participate in learning and solving authentic real-world problems in the classroom (Barrows & Tamblyn, 1980). Problem-based and case-based approaches to learning are particularly designed to help students develop key competencies in the classroom that will serve them throughout their professional lives. Learning activities typically involve students identifying their learning targets, learning individually and in groups, and applying their learning in solving structured problems or clinical cases (Dupuis & Persky, 2008).

These instructional approaches empower students to be self-directed, interdependent and independent learners (Evensen & Hmelo, 2000). Lifelong competencies engendered by problem-based approaches to learning include the ability to adapt and participate in change, deal with problems and make reasoned decisions in unfamiliar situations, reason critically and creatively, adopt a more universal or holistic approach, practice empathy, and appreciate others' perspectives, collaborate productively in groups, identify personal strengths and

weaknesses, and undertake appropriate remediation such as self-directed learning and meta-cognitive reflection (Newman, 2005).

Assessment of student learning in these settings involves moving away from traditional means of assessing knowledge and skills acquisition, to assessing the application of knowledge and skills in the students' actual performances (Boud, 1985; Robertson, 1999). A number of initial studies indicate that student performance was inferred from secondary outcomes for example, paper-based case scenarios, student case presentation, discussion of experience, review of case notes and students' role-plays. While student learning of the process of clinical performance may have improved as a result of such assessment methods, previous research indicates that students often summarise content, rather than reflect on the process of how such data was obtained, interpreted and integrated for further communication – implying their lack of ability to apply knowledge and skills in practice (Levett-Jones, 2011).

Growing emphasis on client and community safety, including the protection of possibly vulnerable members of the community from unnecessary harm, has led to several studies on the appropriateness and effective use of simulated / standardised patients. Consequently, developing students who can claim effective oral communication skills among their attributes before they undertake internship and on graduation is critical. This implies the need for developing effective oral learning and assessment activities conducted in ways that allow judgements that are consistent, defensible and transparent allowing students the opportunity to obtain and provide feedback on their learning.

However, both learners and educators can find integrating communication skills with other clinical skills challenging. Kurtz et al. (2003) argue that the conflicting nature of existing communication training models that isolate content from process not only results in confusion, but also exacerbates and interferes with learners using communication skills training to advantage in real-life practice. Accordingly, a comprehensive method that explicitly integrates traditional clinical method (content of communication) with effective communication skills (process of communication) adds value for both learners and teachers in marrying content and process. It helps students with developing a structure and building working relationships with patients alongside gathering information to explore a patient's problem from their perspective as well as a biomedical perspective, and explaining the planned treatment for shared decision making. This model enables the practice of a "truly comprehensive approach to clinical skills teaching and practice that translates readily from clinical coursework to practice settings" (Kurtz et al., 2003, p. 808).

The use of simulation role-play (with simulated patients) for instruction is now commonplace in all health professional education courses, providing students with the opportunity for practicing communication, consultation, patient examination, patient education and counselling skills in a safe and ethical environment. Standardised simulated patients are commonly used for assessment and research purposes. Proponents claim that the use of simulation role-play provides an authentic student learning experience that is systematic, unbiased and broad. It is proven to improve ethical and cultural awareness of students and provides them with an opportunity to obtain feedback from the simulated patient while they are still learning (Levett-Jones, 2011; Newby & Jin, 2011). Students not only develop generic skills but also master the application of discipline-specific skills in simulated environments. Evidently, simulation role-play can be used in a variety of formats across a range of professions, offering the choice and opportunity for those who want to start using them. This mode of teaching allows students to make errors and mistakes in a safe and ethical

environment and learn from the feedback prior to entering community practice. Academics and institutions can ensure students are well prepared to enter the workforce and able to handle complex scenarios that they could experience in their profession.

Literature suggests that a variety of methods is used in the design of simulated and standardised learning environments including the following six simulated patient methods commonly used in Dutch and Flemish medical schools: start-stop method, training on the job, dramatic role-play, carousel model with role rotation, individual simulated patient encounters, standardised simulated patients for assessment (Rethans et al., 2012). The use of simulation role-play provides the opportunity to assess student learning in more authentic ways including mini-clinical examination (mini-CEX), and Objective Structured Clinical Examinations (OSCEs).

We identified an armada of expedient teaching strategies and high fidelity techniques including manikins to simulate patient care in the classroom. Without doubt, these teaching strategies and techniques will be beneficial for teaching and assessing student performance of key professional skills in pharmacy. In fact, we were tempted to try a few and adopt the ones that were most cost and labour effective. But instead, we reflected on two critical questions that we started with: if we want our graduates to succeed in a professional situation where they are expected to engage in effective communication, are we preparing them for that in the classroom? How can the learning that takes place in the classroom be transferred into other rough-and-tumble situations?

Given that a series of three pharmaceutics courses offers foundation within our pharmacy degree program, we decided to evaluate its pros and cons and available resources to make decisions about the way these courses were designed and the teaching and learning activities within. To commence this process we started with the first of the three courses. By flipping the classroom and introducing complex problems, we introduced students to technology-assisted simulated patients early on in the program, preparing them for work readiness. In this paper we explore the potential of our approach in helping students develop high-level cognitive skills in a safe environment, where they can make mistakes and obtain constructive feedback. This way we hope to ensure that our graduates are prepared to provide ethical and safe professional service. In the next section, we present our approach to data collection and analysis that allows us to describe the pharmaceutics course, its strengths and vulnerabilities in terms of supporting student learning from our perspective as well as the perspectives of our students.

Methodology for reflection

Contemporary education research in sciences is dominated only by a few methodological approaches. Common data collection and analysis methods include interviews, surveys and multivariate analysis (Pitman, 2013). By contrast, studies that have used qualitative methodologies such as auto-biography, ethnography, phenomenography, case study and grounded theory provide the opportunity to present rich naturalistic accounts, perceptions of stakeholders and differences in their experiences or view points (Tight, 2011). Researching teaching and learning, like all forms of research requires commitment, resources and time. It requires knowledge about 'the nature of knowledge' and what constitutes 'good knowledge' (epistemology), data as evidence to support and justify claims, analyses and findings, an over-arching research strategy (methodology) and an inquiry lens (theoretical framework) through which a phenomenon or reality can be observed, generalised and theorised (Norton, 2009).

Mixed methodologies and qualitative methodologies are more prominent among researchers who focus on situational perspectives in higher education. Research takes place in situ and reflects on assumptions that knowledge is constructed within specific contexts and pertinent situational affordances; that is, the relationship between learners and the properties of specific environments. While experts claim that quantitative methodologies are better than qualitative methodologies and vice-versa, it is only when we step back from these arguments and scratch beneath the surface by performing a realistic appraisal of what it can and cannot achieve, we come to realise the relative benefits of these methods.

We used autoenthnography – a form of qualitative research to analyse and documented self-reflection of the researcher's personal experience connecting it with wider culture, meanings and understandings inherent within the context of the course enhancement. Our approach to research design aligns with the theoretical frameworks of constructive alignment and situated cognition (Biggs & Tang, 2011; Brown, Collins, & Dugid, 1989). These theories provide the insight that student learning in higher education involves more than merely being taught, but is an active collaborative process situated in communities of practice where knowledge and realities are co-constructed through critical reflection and action, in turn informing the way we think about student learning.

Data for this study was collected in the form of critical reflection, documented as a narrative. The process of critical reflection is an integral part of teaching practice and involves reflection in action (thinking on your feet), reflection on action (thinking retrospectively) and reflection for action (thinking and planning future teaching practice). For this study, we analysed self-reflection of teaching experiences in the pharmaceutics course, reconsidered our decisions and questioned our understanding by connecting self-reflection with further data collected through student feedback, tutor evaluation of the course and peer feedback. As Meerwald (2013) points out, this approach positions the researcher and the researched on the same platform for the critical analysis of juxtaposed experiences.

Autoethnography allows the researcher and the researched to become social actors as it moves them from the inward to the outward, from personal to the other and vice-versa, in a dialogue that negotiates meanings and ultimately change. Our experiment "Village Pharmacy" was conceived while analysing critical reflective narratives. We moved from being the insider to the outsider as we evaluated and examined ways to improve the quality of student learning using "the course improvement flowchart" (Morgan, 2009). In the next section, we narrate our experiment and its evaluation, that is, what we did to improve student learning and whether or not it had any effect. In the final section, we discuss the valuable lessons we learnt and plans we have for enhancing student learning, highlighting the transformation in our practice (Taylor, 2008).

What did we flip?

Students in our Master of Pharmacy program are required to undertake three pharmaceutics courses in their first year of study over three trimesters. The first two pharmaceutics course focus on development of core knowledge for example, ingredients used in medication, manufacturing process involved in developing and quality testing medication, and the design and development of drug delivery devices. The final pharmaceutics course allows students to apply this knowledge to provide patient care.

As discussed in the introduction section, this course was initially offered through a traditional approach – lectures followed by tutorials, where students applied the content learned during the lecture in pre-prepared workbooks around various products. This method allowed for students to investigate a product, describe its design and evaluate its use in various situations. While most students developed product knowledge in this approach to instruction, we found that learning happened in isolation from the context and its inherent sensitivities.

Structured this way, the course contained a lot of information that students needed to assimilate. There was uncertainty from students on what they needed to learn and students were often worried that they could not remember / memorise each product. Such comments indicated that the key aspect of the course, which is to allow students to apply core pharmaceutics knowledge learnt, was not realised. Feedback from academics in the later year indicated that students were struggling to problem-solve, apply pharmaceutics knowledge and effectively communicate with patients in clinical situations.

In reasoning these issues, we realised that it was important for students to assume a professional role right from the beginning. In realising this need, we also pondered, how we could achieve that with minimal available resources without radically changing the curriculum. The two key questions we considered as mentioned earlier were: if we want our graduates to succeed in a professional situation where they are expected to engage in effective communication, are we preparing them for that in the classroom? How can the learning that takes place in the classroom be transferred into other rough-and-tumble situations? Hence, we decided to modify our approach and flip the classroom based on the adaptation of Edgar Dale's cone of learning (Hackbarth, 1996).
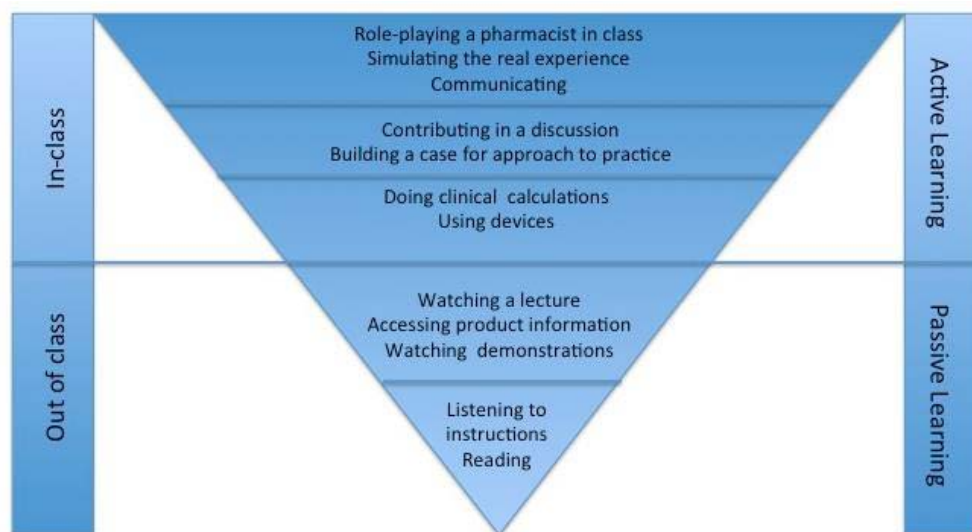

Figure 1: Our model of the flipped classroom

Clearly, the modified approach needed to take into consideration key professional skills that can be realistically taught and assessed in classroom. The "Village Pharmacy" was thence conceptualised. It involved flipping the cone of learning by pre-recording lectures and creating short video animations using a Crazytalk® software to provide information to students. These videos were posted on the course learning management site. Students were advised to watch the pre-recorded lectures that contained key pharmaceutical concepts, before coming to tutorials each week. These concepts were discussed in-context during tutorial time

using short scenarios, to prompt the learning of a number of concepts that were incorporated through complex characters portrayed by inhabitants in a village.

Figure 2: An example character in the "Village Pharmacy"

The inhabitants of the "Village Pharmacy" were characterised by diverse age, cultural, ethical, social and economic situations. Complex issues including patient education, counselling and dealing with sensitive ethical problems were included in the course to help students develop professional skills for their practice. For example, the case of an imaginary family with parents, children and uncles were incorporated into various case scenarios at different points during the course to imitate what pharmacists may encounter in the community. Students played the role of a community pharmacist, discussing medication and the devices used for its delivery. They were also given the opportunity to reflect upon and learn how to manage patients of different age, handle confidentiality of information and communicate professionally while providing patient-centred care.

Effects of flipping the cone of learning

Although the design of this course looked intact on paper, a number of issues arose during the course of its implementation. It was apparent from student feedback data on the course that students were unprepared and felt unsettled when they were asked to take responsibility for their learning. They indicated a preference for learning through lectures, an approach that they were most familiar and comfortable with. We also discovered that some students did not watch the pre-recorded lectures, meaning they were unable to draw and apply key concepts when role-playing a pharmacist delivering patient-centred care. Evidence of student learning outcomes that is, their work-samples illustrated a surface approach to learning. Following student comments implied that they were generally unhappy.

> "I didn't think self-directed learning would work for me because it requires self-determination without having to go to lectures, but in the end it did work – it gave me more flexibility in terms of time and more time for me to learn on my own."

> "Change the self-study modules to lectures. No very good at self-study and summarising."

> "The self-directed learning part was a big chunk of the course, I found this hard to keep up as there were no lectures to attend. It's challenging to keep up when its

easy just to keep track of other subjects that had the lectures running and forget about this course until closer to the examination."

Clearly, we needed more information about how students engaged in tutorials and how well they connected pharmaceutical concepts. Data collected from tutor evaluation of the course painted a rather positive picture. Reflections on tutorials indicated that the sessions enabled the tutor to engage with the students, motivate/prompt them toward achieving their learning goals. Evidence suggests that students quickly learned to form questions and supported each other during group discussions. As the course progressed, there was a noticeable improvement in student questions and the way they communicated concepts and ideas during case presentation. Data from peer feedback on teaching also indicated noticeable improvements in students' abilities to analyse a case, discuss the implications and propose solutions to problems during group discussions. Students appeared to enjoy the role-play scenarios, counselling and educating the use of devices. Given that both tutor evaluation and peer feedback were affirmative, uncertainty around students' level of unhappiness was distressing - what went wrong was mysterious!

Discussion

Our analysis revealed that the pharmaceutics course in its traditional form appealed better to students. From this, many educators may be tempted to ask - why change the approach to teaching? However, from a pedagogical perspective it was evident that students were not developing the professional skills relating to critical thinking, communication and being able to apply their knowledge in the clinical setting. As educators, we have a responsibility to reflect on the learning achieved and when this does not meet what is required, we need to consider strategies to improve student learning.

A major challenge was to shift the student focus from approaching learning at a surface level to one where they develop new skills by applying core knowledge to solve problems and practice being a pharmacist through role-playing. We flipped the classroom to change this focus and allow for more active learning. That way real world experiences can be simulated in the classroom, preparing students for work, where they are no longer under the guidance of the lecturer.

When educators change their approach to teaching, they will invariably find that students are uncomfortable. Students discomfort was evident from the feedback they provided us about the course and teaching. Student concerns about learning portfolios and not knowing how to study for the exam was not surprising. It indicated that they were focussed on doing well in the course. We assumed that students completing this Pharmacy degree would have developed and adopted learning strategies as they all come to the degree after completing an undergraduate degree.

Although this may be the case, as Biggs & Tang (2011) identifies, we think that students are more likely to feel comfortable in familiar situations and often change their approach to learning based on the affordances of the situation. That is, a student who usually approaches learning at a deep level may change their approach in a new situation or when they know that a surface learning approach can yield them the more or less a result they are going to be happy with. If we want our students to approach learning at a deep level, then we must necessitate that rather than simply encourage.

Reflecting on the assessment activities in the course, we encouraged them to document their learning journey through a learning portfolio. This was a new concept for our students and one that most students may not have encountered before. While, most students produced a portfolio at the end of the course, their work samples indicated that they had lot more questions than answers. While this may have contributed to their unhappiness quotient, we think that it is only good that students have more questions about what they need to know. We say this in agreement with Kruger & Dunning (1999) who argue that students who know less also know less about what they know.

Conclusion

By flipping the classroom, we have learnt that it is important to support and guide students in adapting new approaches to learning. Also, it is important to cater for different learning styles and wherever possible offer both audio-visual and printed material to support student learning needs. Developing the online material and animation videos does require an initial investment of time but, once developed, these resources would be reusable for a number of years. It is important to remember that the information supplied to students should not just be a replica of an entire face-to-face lecture recorded or written. There is a temptation as a lecturer to try and tell students everything they need to know to solve scenarios and problems. As lecturers we need to consider carefully what information needs to be provided and what students should develop on their own.

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