LEARNING IN A MOOC:

How People of Differing Backgrounds

Regulate their Learning in a MOOC

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PERSONAL STATEMENT

I certify that the research presented in this thesis is my original work and has not been submitted as part of the requirements for a higher degree to any other university or institution other than Macquarie University. I also certify that any assistance that I have received in the conducting of this research and the preparation of the thesis has been appropriately acknowledged. Additionally, I certify that all the information sources and literature used in this thesis are indicated. The research presented in this thesis was approved by the *Faculty of Human Sciences Human Research Ethics Sub-Committee* at Macquarie University, Sydney, Australia (5201300798) on 5th December 2013.

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ABSTRACT

The massive open online course, or MOOC, is a recent innovation in online learning. This new type of course has enabled millions of people worldwide to access content for free that had usually been restricted to fee-paying university students. Though there has been considerable research about the demographics of MOOC enrolees, their reasons for enrolling and their patterns of engagement, relatively little is known about how people actually learn in these environments. As MOOCs are predicted to continue to be a significant force for lifelong learning, it is important to understand how people learn in these environments, so MOOCs can better meet their needs. Also, understanding how people learn independently in online environments is growing in importance as universities increasingly require it of their students. Only through a detailed and nuanced understanding of how students learn online on their own can educators help them develop the necessary skills to succeed in their studies.

This study aimed to fill this research gap by using a *social cognitive* theoretical framework, which conceptualises human behaviour as the product of interlinked and reciprocally determining personal, behavioural and environmental factors, to investigate how people learned in a MOOC. Within this framework, the theoretical lens of *self-regulation* was used to study the internal and external factors that influenced learning. Two social cognitive constructs were also used to study aspects of motivation that are key influencers of learning: *self-efficacy*, which relates to a person's confidence in their own ability to perform a task in a specific domain, and *achievement goals*, which describe how people orientate their learning goals in achievement contexts. Within this approach, this study aimed to provide detailed accounts of how people learned in their own contexts.

The research context for this investigation was *Introduction to Biomedical Imaging*, a 10-week MOOC provided by an Australian university. The research adopted a mixed-methods sequential-explanatory design, in which data was collected in separate quantitative and qualitative phases. Phase 1 involved the collection of data through an online survey; Phase 2, which was assigned priority in the design, was a multiple-case study with 10 case participants purposively sampled from volunteers who had completed the Phase 1 survey. Findings from

both phases were then integrated to generate contextual accounts of how participants learned. Data was collected from multiple sources such as interviews, experience sampling, surveys and digital artefacts that related to each participant's learning in the MOOC. The data was analysed following a six-step procedure that accommodated quantitative and qualitative approaches and the mixing of findings.

Research findings are presented in the form of four manuscripts prepared for submission to academic journals. The first reports the findings of a statistical analysis of survey data, which aimed to determine the demographics and motivations of those who enrolled in the MOOC. The following three papers report the findings of the multiple-case study, which investigated how these individuals learned in the MOOC and what their outcomes were.

Results from an analysis of survey data (n=3,172, response rate: 22.3%) found that the majority of survey respondents were highly educated and from developed countries, which is consistent with the literature. Experience of the MOOC topic, however, was found to play a significant role in the respondents' motivational mindsets. Those who had formal experience of the MOOC topic (for example, from their professional work or formal studies) were found to be more confident about their general academic ability and more motivated to achieve than those whose experience came from informal sources, such as through a general interest in the topic. This finding was supported by the subsequent multiple-case study (n = 10), which found that participants who had professional experience of the MOOC topic were more effective at regulating their learning and achieved higher overall grades than others in this study. How participants used their MOOC study time was perhaps the most important determinant of effective learning. The results suggest that the most effective learners used strategies such as proximal goal setting, and rewards to make best use of the time they spent in the MOOC. Another key finding was that participants sought very little help from others in this MOOC. In the case of this MOOC, a combination of personal factors, such as prior knowledge of the topic, and environmental factors, such as the pedagogical approach of the MOOC, were found to be key influencers on how these participants learned.

This study contributes knowledge about how people learn on their own in online environments. In the context of lifelong learning, this may assist in improving the quality of MOOCs that

better meet the needs of different learners, which may in turn help to promote lifelong learning to new audiences. The findings from this study also have implications for higher education, as students are increasingly required to study independently using online environments.

Several ideas for future research are suggested. A limitation of this study was that the research participants were relatively highly educated. An investigation into how people without any experience of university study use MOOCs may aid understanding of the challenges these learners face in MOOCs, and of the design of MOOCs that develop and support learners' abilities to take control of their learning. Another gap in the literature is an examination of the influence of instructional design on learning in MOOCs. As the literature suggests that the instructional quality of MOOCs is quite poor, this kind or research is much needed if MOOCs are to become more effective instruments for lifelong learning.

CHAPTER ONE

A significant innovation in online learning to emerge in recent times is the massive open online course, or MOOC. The MOOC has proven to be a force in lifelong learning by attracting many millions of people to enrol in courses consisting of content usually restricted to fee-paying university students. Though there has been considerable scholarly research into who is enrolling in MOOCs and their reasons for enrolling and patterns of engagement, little is known about how people actually learn in them. MOOCs provide a context for studying how people learn independently in online environments. In fact, the need to direct and control one's learning is amplified in MOOCs, as one-to-one teacher support is not provided. Being able to learn independently is becoming more crucial for university students, as they are increasingly expected to engage with this mode of study. It is therefore important to investigate how people learn independently in online contexts and what factors contribute to their successful learning.

This chapter begins with a brief account of the MOOC and how it emerged and evolved into the MOOC phenomenon we know today. This is followed by a review of what is known at a scholarly level about who enrols in MOOCs, why they enrol and how they engage in these courses; this chapter also presents the problem that this study addresses – *that little is known about how people actually learn in MOOCs*. This is then followed by a brief outline of the theoretical framework used to investigate this problem and the research questions that guided this study. The chapter then briefly presents the methodology for this research and its approach, design and methods. The chapter concludes with a definition of some of the key terms used and a description of how this thesis is structured.

1.1 Background

The first MOOC appeared in 2008. Two Canadian scholars, George Siemens and Stephen Downes, opened *Connectivism and Connective Knowledge* (CCK08*)*, an online course, to anyone interested in participating. Over two thousand people enrolled, a massive number to be in a course at the same time. This gave rise to the acronym MOOC, coined by Dave Cormier, a Canadian educator close to CCK08, to describe the four characteristics of this type of course. It was *open* to anyone who wanted to enrol; it was *online* and accessible

by the Web; it was a *course* with a start and end date; and it was *massive*, in that it required a large number of participants to create a viable connected learning environment (Morrison, 2013). Massiveness, and the possibilities of networking and connecting to others to learn, was central to this kind of MOOC. CCK08 was the first of a number of MOOCs that were underpinned by *connectivism*, a theory of learning that acknowledged the transient nature of knowledge in the digital age (Siemens, 2005). This theory proposed that a new type of learning was required in this context, which resided in the connections a learner makes to human and non-human sources of information. CCK08 and the connectivist MOOCs that followed were driven by a desire to depart from traditional pedagogical approaches in online learning (McAuley, Stewart, Siemens, & Cormier, 2010). These MOOCs aimed to maximise social connections amongst learners, favouring this over top-down content.

Though CCK08 attracted a massive number of learners, the appeal of connectivist MOOCs was mostly limited to educators interested in novel approaches to online learning. The limited appeal of these connectivist MOOCs may have been due to the somewhat chaotic experience of being in an ill-defined environment with thousands of other people, but no real course or assessment structure. One study of CCK08 learners found that the very principles of a connectivism (autonomy, diversity, openness and connectedness) combined with a lack of structure and substantive support were not conducive to positive experiences (Mackness, Mak, & Williams, 2010). However, a very different type of MOOC emerged three years later, attracting much more attention than the connectivist MOOCs.

In 2011 two academics from Stanford University, Sebastian Thrun and Peter Norvig, decided to put their highly regarded, campus-based *Introduction to Artificial Intelligence* course online and open it to anyone. This course offered video presentations in place of traditional classroom lectures, along with automated online assessments. It attracted 160,000 enrolees; of these, 20,000 met the course requirements (Rodriguez, 2012). The extraordinary number of enrolees and the significant number of completers from one instance of a course captured the attention of the higher-education sector and the education media alike.

The next year, entrepreneurs rushed to set up MOOC platforms. Coursera, Udacity and edX were established, hoping to repeat the success of the Stanford University course. These platforms began to provide MOOCs on a wide range of topics from established universities.

In these early days, the interest in MOOCs was such that the *New York Times* coined 2012 "The Year of the MOOC" (Pappano, 2012). As the number of offerings on MOOC platforms started to grow, Stephen Downes proposed prefixes to the word MOOC to differentiate between the original connectivist MOOCs such as his own CCK08, which he termed *cMOOCs*, and the more recent Stanford University-style MOOCs, which he termed *xMOOCs*. Though these terms still exist and appear sproradically in the literature, the word MOOC is typically taken to refer to the xMOOC. From this point on in this thesis, this convention will be followed; the word MOOC without a prefix refers to xMOOCs.

As the number of MOOCs and people signing up for them grew, stakeholders and commentators took positions over what this phenomenon meant in the context of lifelong learning. Lifelong learning is a concept that describes "all forms of learning undertaken by adults after having left initial education and training" (COM, 2006, p. 2). It is assumed to be central to individuals' ability to lead fulfilling lives (Faure et al., 1972); more broadly, it is viewed as providing a wide range of societal benefits including social inclusion and citizenship (Department of Education and Science, 2000). In media presentations, Coursera founders framed MOOCs as offering "education for everyone", and highlighted examples of disadvantaged people who had used MOOCs to improve their lives by finding a pathway into higher education, getting a job or starting a business (e.g. Koller, 2013; Koller & Ng, 2013). However, the findings of one study of Coursera learners suggested that MOOCs were reaching the advantaged in much larger numbers than the disadvantaged in both developed and developing countries (Christensen et al., 2013). Rather than democratising education, MOOCs could be widening the gaps between the haves and have-nots (Hansen & Reich, 2015).

Other concerns about MOOCs centred on the opportunity or threat that MOOCs posed to higher education. An infinitely scalable course was portrayed in high-level reports as a means to reduce costs in a sector that was increasingly forced to rely on self-funding (see Austrade, 2013; Barber, Donnelly, & Rizvi, 2013). This rhetoric extended to MOOCs being described as the "forcing function" that would bring about a "revolution in higher education" (Gallagher & Garrett, 2013, p. 4). Some commentators went so far as to say that the model of higher education was "broken" (Shirky, 2013), and that the MOOC would replace traditional on-campus courses in the same way that MP3s had replaced CDs (Shirky, 2012). Others portrayed MOOCs as a threat to higher education. The

standardisation of courses would lead to a dumbing down of education, and the privileged position of elite universities would be bolstered by enabling them to broadcast their offerings to the world, thus diminishing diversity in the sector (Lane & Kinser, 2012). Teachers' jobs were also said to be at risk, as the scale at which MOOCs could operate would make paid teachers who gave support and feedback to classes of students redundant.

There were concerns, too, about MOOCs' pedagogical value. In contrast to the radical pedagogy of cMOOCs, the Stanford University-type MOOC adopted a top-down, behaviourist approach (Daniel, 2013), which was regarded as a step backwards. Critics argued that though MOOCs may offer access to content from established universities, what they were actually delivering was pre-packaged and standardised (Lane & Kinser, 2012). These concerns had some merit. A recent review of empirical studies of MOOCs found that most could be classified as "content systems without tutors" (Bartolomé & Steffens, 2015, p. 97), as they provided little interaction between learners and teachers. These findings were echoed in a review of 76 MOOCs, which found that the instructional quality of nearly all MOOCs was low, focusing on the presentation of content rather than supporting interaction and feedback (Margaryan, Bianco, & Littlejohn, 2015). Based on this evidence, MOOCs seemed to offer an inferior learning experience compared to participation in traditional university courses.

As with the many new instructional technologies that emerged in the last century, claims around the MOOC's potential to save or destroy education were overstated. They have done neither, but nor have they disappeared. Interest and participation in MOOCs continues to grow. According to one report, the number of people who enrolled in MOOCs doubled to 35 million in 2015, and this trend is predicted to continue (Flamig, 2016). Also, the number of available MOOCs is increasing. In 2015 approximately 1,800 new MOOCs were announced, for total of 4,200 available MOOCs (Shah, 2015). MOOCs are a significant new instrument for lifelong learning, and understanding how to improve their quality is of value. Central to understanding how to improve these offerings is understanding what people want to achieve in them and whether they are satisfied with the outcomes of their experience (Hood & Littlejohn, 2016). This study afforded such an investigation, and has implications for how to improve the quality of MOOCs.

Much has happened since the arrival of the first cMOOC in 2008 and the emergence of a significantly different kind of MOOC in 2011. Only time will tell if MOOCs endure in the long-term, if they remain "MOOCS" of if they evolve into other forms of online courses that offer content from universities for free or at a low cost. As well as the public interest that this innovation has attracted, MOOCs have also been the subject of considerable educational research.

MOOCs for everyone?

MOOCs are open to anyone with an Internet-connected device and a desire to learn. However, some kinds of people are more likely to enrol in them than others. According to a 2013 survey of 34,779 learners enrolled in at least one Coursera MOOC at the time, the people who enrolled in MOOCs tended to be young, male, well educated, in a full-time job and from a developed country (Christensen et al., 2013). This study also found that the disparity between the education levels of MOOC learners and those of non-enrolees from the same country was greater in developing[1], rather than developed, countries. In other words, people from poorer countries who enrolled in MOOCs were from the educated minority in their societies. These findings suggest that the people who are benefitting from MOOCs are those who need them least. Even though MOOCs are free, people of less advantage are not taking advantage of them.

In contrast, another study arrived at different conclusions about who was benefitting from MOOCs. A report (Zhenghao et al., 2015) of 52,000 learners who had completed at least one Coursera MOOC confirmed the findings from Christensen et al. (2013) that the majority of enrolees were highly educated, employed full-time and from developed countries, but when examining those who enrolled in MOOCs for career-related reasons, this study came to some surprising findings. In developed countries, people of lower socioeconomic status and with less education were *just as likely* to report general career benefits as their more advantaged counterparts. And in developing countries, less advantaged people were *more* likely to report tangible career benefits, such as finding a new job, getting a promotion or starting a new business, than their more advantaged counterparts. These findings tentatively suggest that the benefits from learning in MOOCs

[1] This disparity was greatest in Brazil, Russia, India, China and South Africa (BRICS), developing countries with emerging national economies.

are not confined to the most advantaged: though fewer in number, the less advantaged also derive benefits from MOOCs.

Although there is a consensus in the literature about the demographics of people who enrol in MOOCs, less is known about their motivational profiles. An understanding of what motivates people to enrol in MOOCs would have implications for how MOOCs could be designed to meet these learners' needs.

Highly personal reasons for enrolling

The people who enrol in MOOCs do so for a wide range of reasons. The reasons they give range from the personal, such as *curiosity*, to the pragmatic, such as to *advance my career*. A study of the discussion forums in edX's first MOOC found that some people enrolled for the *personal challenge*, one even indicating that he wanted to see if he could pass a course from MIT (Breslow et al., 2013). How a person's reasons for enrolling in a MOOC influences their learning, though, is not clear. A post-course survey of learners found only marginal relationships between their reason for enrolling and their performance (DeBoer, Stump, Seaton, & Breslow, 2013). Though these quantitative studies have revealed the diversity in the motivations of people who enrol in MOOCs, they say little about how these personal reasons influence how people learn in a MOOC. This study adopted a predominantly qualitative approach to investigate how personal reasons for enrolling influenced learning behaviours in a MOOC.

Flexible patterns of engagement

Just as people have diverse reasons for enrolling in MOOCs, they also seem to have flexible patterns of engaging. First, it should be noted that although MOOCs attract large numbers of enrolees, only around 50-60% actually watch the first lecture (Koller, Ng, Do, & Chen, 2013), which contributes to the low completion rates in MOOCs (see Jordan, 2014). It seems that enrolling in a MOOC is a bit like browsing in a shop: in the same way that some people enter a shop with no intention to buy, some people enrol in MOOCs to browse the content, with no substantive intention to engage. However, of those who go on to actually engage in MOOCs, some serious learners seem to eschew the assessment requirements of a course altogether, focusing solely on the content (Glance & Barrett, 2014; Kizilcec, Piech, & Schneider, 2013). Learners who audit, rather than complete, MOOCs might have this

intention at the outset, as found in a post-course survey of learners who had persisted in but not completed a MOOC (Belanger & Thornton, 2013). A picture is emerging of MOOC learners adopting flexible approaches to learning in a MOOC, but little is known about what motivates them to approach learning in this way, and how they actually go about learning in a MOOC.

Apart from these findings about the demographics of people who enrol in MOOCs, their reasons for enrolling and their engagement patterns in MOOCs, *little is known about how people actually learn in these online environments*. This study aimed to fill this gap by investigating how people learned in a MOOC at a personal and contextual level. This investigation required a theoretical framework that could accommodate such complexity.

1.2 Theoretical Framework

To investigate the complexity of learning in a MOOC, this study used the lens of *self-regulated learning*, which is defined as "the self-generated thoughts, feelings and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000, p. 14). It is a construct developed within the social cognitive theoretical framework. *Social cognitive theory* proposes that human behavior emanates from not only internal processes, but also the behaviours in which an individual engages, and the environment in which they act (Bandura, 1986). The social cognitive lens of self-regulated learning affords an investigation into the complex and dynamic nature of human activity in social environments, such as learning in a MOOC. As the role of the *self* is highlighted in self-regulated learning, it is also a useful way to investigate how people learn in MOOCs, as the acts of enrolling and persisting is self-generated. The study of self-regulated learning is extensive in the areas of secondary and higher education, but less so in online environments due to the more recent emergence of this mode of learning.

Though people may have the capacity to regulate their learning in specific contexts, they need to be motivated to do so. Two social cognitive constructs were used to investigate specific aspects of this driver of learning. One aspect of motivation investigated was *self-efficacy*, which describes an individual's confidence about achieving or performing a task in a specific context. Self-efficacy has been found to predict academic achievement in traditional classroom contexts, but less is known about how it functions in online learning.

The second was *achievement goals*, which relates to what individuals perceive as important to achieve in learning contexts. In this area, little is known about how these personal orientations influence learning in online contexts, and nothing at all about what people perceive as important to achieve in MOOCs. It has been established that the completion rates in MOOCs are quite low (Jordan, 2014); an investigation into what drives people to enrol in MOOCs may provide an insight into why so many people enrol, but only a small proportion complete them.

1.3 Purpose of the Research and Research Questions

The purpose of this study was to provide detailed accounts of how people learned in a MOOC. Positioned within a social cognitive theoretical framework and through the lens of self-regulation, this study aimed to investigate the internal and external factors that influenced how people of varied backgrounds learned in their own particular contexts. This study was guided by the following research questions:

1. Who enrols in MOOCs and what are their characteristics?

This research question guided an investigation into the demographic, motivational and other personal characteristics of enrolees in a MOOC. An online survey was used to measure demographic characteristics such as age, gender, nationality and educational background, and to gather information on other personal characteristics such as reasons for enrolling, course completion intentions and familiarity with and experience of the MOOC topic. Two motivational constructs that have been found to influence learning were also investigated: self-efficacy and achievement goals. Subsequent statistical tests aimed to test the hypothesis that enrolees with different experiences of the MOOC topic had distinct motivational profiles.

2. How do learners self-regulate in a MOOC?

This question guided a mixed-methods investigation into the personal, environmental and behavioural factors that influenced how 10 people with varying levels of academic experience learned in a MOOC. Detailed accounts of how these participants regulated their learning were generated through the integration of data collected through interviews, learning journals, questionnaires and digital artefacts. Particular self-regulated learning

sub-processes, such as time management, goal-setting, learning strategies, help-seeking and dealing with difficulties, were investigated.

3. What outcomes do MOOC learners achieve?

This question guided an investigation into participants' perceptions about what they learned in the MOOC, and whether these gains met their personal goals on enrolling. Participants' attitudes about learning in MOOCs were also investigated.

The research context for this study was *Introduction to Biomedical Imaging*, a 10-week MOOC from an Australian university delivered on the edX platform in 2014. This course provided an introduction to the physics and engineering of modern imaging modalities and an introduction to how these modalities were applied in neurological disease, degenerative disease, reproduction and oncology. The course consisted of five episodes dealing with different imaging modalities: (1) X-Rays, (2) Computerised Tomography, (3) Ultrasound, (4) Magnetic Resonance Imaging and (5) Nuclear Diagnostic Medicine. Each episode featured a series of video lectures from academics who taught the subject on campus, screen-based readings and formative quizzes. To complete the course, learners were required to complete a multiple-choice quiz for each episode. Following this, learners also needed to complete two additional quizzes, which involved answering questions relating to a clinical practice scenario.

1.4 Significance

As students enter higher education, they are expected to take more responsibility for their own learning. In particular, university students are expected to learn online, as the integration of technologies into the delivery of undergraduate and graduate programs is widespread (Wallace, 2003). Students are now expected to engage with online environments to access content, interact with others and their teacher and submit work. This type of independent learning requires a high degree of self-direction. Students need to be motivated and capable of remaining on task in the digital age, where everyone is connected and distracting content is just a click away. The investigation of how a range of people regulate their learning in a MOOC has implications for how online environments could be designed in higher education and how students who struggle to learn independently in such a context can be supported.

The findings from this study may also improve the design of MOOCs. This new type of scalable online course has proven to be a popular instrument of lifelong learning. Lifelong learning is a concept that describes "all forms of learning undertaken by adults after having left initial education and training" (COM, 2006, p. 2). At the level of the individual, lifelong learning is considered to be central to survival and a meaningful and rewarding life. In the 21st century, continued learning throughout the lifespan is also imperative to remaining in work due to the continual need to keep up to date with changes brought about through advances in technology and globalisation. A 2001 United Nations report on lifelong learning predicted that most of the jobs that will emerge in the future will be completely new, and will require learning new skills (Medel-Añonuevo, Ohsako, & Mauch, 2001). Also, at a much deeper, personal level, the need to continually learn is central to the human experience. From a humanistic perspective, a continual engagement with knowledge is the means by which we can achieve "the complete fulfilment of man in all the richness of his personality […] as individual, member of a family and of a community, citizen and producer, inventor of techniques and creative dreamer" (Faure et al., 1972, p. vi). At the government and policy level, lifelong learning is accepted as conferring a wide range of benefits on the societies in which it flourishes, including social inclusion, active citizenship, personal development, competitiveness and employability (Department of Education and Science, 2000). Altogether, lifelong learning provides a range of benefits to the individuals who choose to engage in it and to the societies in which they live.

Along with the institutions of higher education, evening and weekend classes and all the other forms of learning with which people can engage after they leave school, the MOOC is perhaps the most significant new lifelong learning instrument to emerge in recent times. As MOOCs attract a wide range of people with diverse backgrounds and motivations (DeBoer et al., 2013), the traditional measures of assessing educational quality do not apply. In this context, it is important to investigate the learning experience, and specifically whether learners' expectations were met (Hood & Littlejohn, 2016). This study aimed to investigate the learning experiences of a range of individuals in a MOOC to determine whether their personal expectations were met. The findings from this study may provide understanding as to what constitutes quality in MOOCs and support the design of better vehicles for lifelong learning.

This study is also important in that it will contribute to the literature about self-regulated learning in online contexts. There is wide consensus in the literature that students who are strong, self-regulated learners achieve more academically (Pintrich, 1995; Zimmerman, 1990). However, the majority of self-regulated learning studies have been conducted in traditional classrooms. Less is known about self-regulated learning in online environments. Compounding this is that most researchers who have investigated self-regulated learning have adopted quantitative approaches. Little is known about how people qualitatively learn in a MOOC, or about what motivates them and what influences their behaviour. In the context of MOOCs, the study of self-regulated learning is only beginning. This study aims to contribute to this field.

1.5 Context of this Study

This study was conducted in *Introduction to Biomedical Imaging*, a ten-week MOOC created by an Australian university and delivered on the edX platform in the first half of 2014. The course provided an introduction to the science and engineering of contemporary imaging modalities and how these modalities are applied in healthcare. The course consisted of five episodes each dealing an imaging modality and had a staggered release. To complete the course, learners were given one attempt to complete seven automated multiple-choice quizzes: one for each episode and two assessment scenarios. The syllabus document advised that learners had to achieve an overall mark of 50% and have completed all the assessments within three weeks of the end of the course to pass and earn a certificate. edX platform data indicated that this MOOC attracted 14,219 enrolees which was somewhat smaller than the average MOOC enrolment of 43,000 reported at that time (see Jordan, 2014).

1.6 Research Design and Methods

To answer the research questions, this study mixed both quantitative and qualitative approaches in a sequential-explanatory design, which involves the collection of quantitative and qualitative data in independent phases and the integration of data at least once in the study (Creswell & Plano Clark, 2011). The study commenced with a quantitative phase (Phase 1), which was then followed by a qualitative phase (Phase 2) (Figure 1).

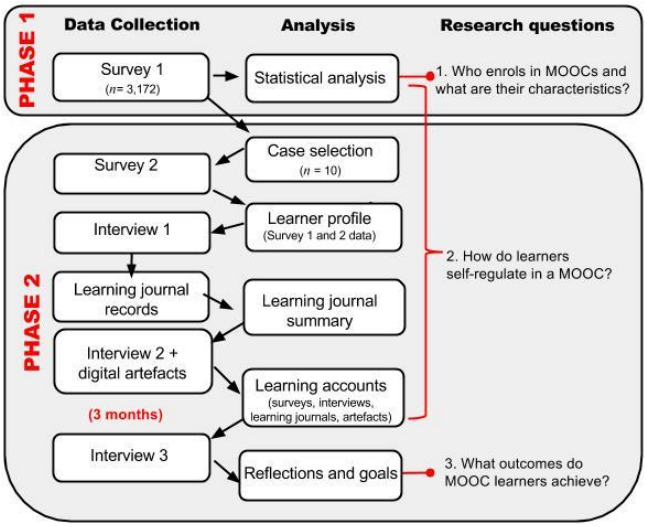

Figure 1. Data collection and analysis methods and associated research questions

As shown in Figure 1, considerably more data was collected through various methods in Phase 2 than in Phase 1. This reflects the priority given to Phase 2; in other words, it was substantively a qualitative study. Phase 2 took the form of a multiple-case study, which was chosen as it was an appropriate design for answering "how"-type research questions and for studying complex social phenomena within in a contemporary real-world context (Yin, 2014). Ethics clearance was granted on 5th December 2013 (5201300798, see Appendix A) Methods and procedures were tested in a pilot study towards the end of 2013 and revised where necessary. The main study commenced in April 2014.

Prior to implementation, instruments, protocols and procedures were tested in a small pilot study and revised where necessary. In Phase 1, MOOC enrolees were invited to complete an online survey (Survey 1) through course announcements via email. After data cleaning, the dataset consisted of 3,172 returned surveys, a response rate of 22.3% of the 14, 219 enrolees in the MOOC. The first section of Survey 1 consisted of ad hoc and other items developed with reference to the literature, designed to collect demographic and personal information about respondents' reasons for enrolling, course completion intentions and prior experience of the MOOC topic. The second section contained slightly modified items from established instruments. The *self-efficacy for learning and performance* scale from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, & McKeachie, 1991) measured respondents' confidence about their learning and level of performance in academic contexts, and the Achievement Goal Questionnaire – Revised

(AGQ-R) (Elliot & Murayama, 2008) measured respondents' beliefs about what they perceived as important to achieve in learning contexts. As these instruments had been originally developed for the classroom, some slight changes were made to suit the context of learning in a MOOC. Survey data was cleaned and imported into IBM SPSS, a statistical analysis software tool, and various descriptive and inferential statistical tests were conducted. The findings from the results of these statistical tests were used to answer Research Question 1.

At the end of Survey 1, respondents were invited to indicate their interest in taking part in the ongoing study. To be eligible for selection, interested respondents had to be (1) over 18 years of age; (2) competent English-speakers; and (3) intending to complete the course. From this pool, candidates were assigned to one of three groups based on their reported level of academic experience: (1) very experienced (master's or doctoral degree), (2) experienced (bachelor's degree or college/vocational qualification) and (3) less experienced (high school or less). Candidates were then randomly selected and invited to participate in the study. Sixteen invitees formally consented to participate; of these, 10 remained in the study to the end.

In Phase 2, research participants completed a second online survey (Survey 2) that consisted of the *test anxiety*, *metacognitive self-regulation*, *time and study environment* and *effort regulation* scales from the MSLQ (Pintrich et al., 1991), which were slightly modified to suit the research context. Participants were interviewed via Skype three times throughout the study: once at the beginning of the MOOC (Interview 1), at the end of the MOOC (Interview 2) and, finally, three months after the end of the MOOC (Interview 3). Recorded interviews were transcribed and sent to participants for member checking.

Throughout the MOOC, participants were asked to complete a learning journal on days they engaged in the MOOC. At a set time every day of the MOOC, participants were sent a text/email reminder that provided a link to the learning journal, a one-page online questionnaire. Items in the learning journal were developed with reference to the theoretical framework, the research context and a classification of self-regulated learning strategies from the literature (see Zimmerman & Martinez-Pons, 1986, 1988). The learning journal consisted of eight closed and one open item. Participants recorded the following details: (1) number of study sessions, (2) study duration, (3) time/s of day of study, (4)

study location/s, (5) learning activities, (6) strategies for learning, (7) difficulties encountered, (8) response to difficulties (open item) and (9) confidence in completing the course (1–7 Likert scale). Learning-journal data was collated and shared with participants prior to Interview 2 to serve as the basis of discussion. Participants were asked to expand on how they learned on specific days of activity as recorded in the journal. At this point, digital artefacts were collected related to their achievement in the MOOC. Following an audit of the data for each case, where gaps in data sets were discovered, email interviews were conducted to fill the gaps. Three months after the end date of the MOOC, Interview 3 was conducted. Participants were asked to talk about the outcomes of their activities in the MOOC and about their plans.

An analysis framework was developed based on the research questions, the theoretical framework and the themes that emerged through analysis of Phase 2 data. The interview transcripts, email interviews and digital artefacts were imported into HyperRESEARCH, a software program used for analysis of qualitative data, and coded according to the framework. At the same time codes, definitions and examples from the Phase 2 data were recorded in a spreadsheet and revised when necessary to improve clarity and distinction between the codes. All data collected over Phases 1 and 2 were recorded into a master data table in a spreadsheet. This enabled the integration and interpretation of data collected over the two phases within and across cases. The findings from this stage of the analysis were used to answer research questions 2 and 3.

1.7 Terms Used in This Study

Achievement goals Achievement goals relate to what people perceive as important to achieve in learning contexts (Elliot & McGregor, 2001). *Performance-approach goals* describe orientations focused on achieving positive assessments of performance, *performance-avoid goals* describe orientations aiming to avoid negative assessments of performance; *mastery-approach goals* describe orientations focused on mastering knowledge; and *mastery-avoid* goals describe orientations aiming to avoid an incomplete understanding or mastery of a topic. The *mastery-avoid* orientation is perhaps the most difficult achievement goal to

conceptualise of the four goals proposed by Elliot and McGregor (2001). It can be best understood in contexts where an individual is concerned with maintaining the knowledge they have, which may be the case for older adults who are concerned about losses of cognitive function and memory (Senko & Freund, 2015).

Lifelong learning

Lifelong learning can be defined as "*all forms of learning undertaken by adults after having left initial education and training* [original italics], however far this process has gone (e.g. including tertiary education)" (COM, 2006, p. 2).

MOOC, cMOOC, xMOOC

MOOC, short for "massive open online course", was coined by Canadian educator Dave Cormier in 2008 to describe the first MOOC, *Connectivism and Connective Knowledge (CCK08)* (see Cormier, 2008). Cormier defined a MOOC as being *open* to all, *online*, a *course* with a start and end date, and *massive*, requiring a large number of participants to create a connected learning environment (Morrison, 2013).

cMOOC, short for *connectivist* MOOC, is a term that was coined in 2012 by Stephen Downes to differentiate the original generation of MOOCs, which were underpinned by notions of connectivism, to the kind of MOOC that was proliferating on the platforms of Coursera and edX at the time . The first cMOOC, CCK08, attracted around 2,200 students (Morrison, 2013). Siemens (2005) proposed connectivism as a theory of learning that highlights the role of connecting to others as a way of building knowledge. cMOOCs, unlike the latter generation of MOOCs, were designed to maximise social connections and were characterised by a lack of top-down structure and content.

xMOOC is a term also coined by Stephen Downes to differentiate the latter generation of MOOCs from cMOOCs. The first xMOOC was *Introduction to Artificial Intelligence*, offered by Stanford University academics Sebastian Thrun and Peter Norvig in 2011; it attracted around 160,000 enrolees (Morrison, 2013). The xMOOC differed radically to the cMOOC by offering a top-down behaviourist pedagogical approach (Daniel, 2013) with structured content and assessment.

Note. Though there are two kinds of MOOCs, the term MOOC is typically used in reference to xMOOCs. Unless specified as referring to a cMOOC in this thesis, the word MOOC refers to xMOOCs.

Self-efficacy Self-efficacy describes an aspect of motivation that relates to a person's confidence in his or her ability to perform tasks successfully. As self-efficacy is domain-specific (Bandura, 1997), an individual is regarded as having self-efficacy in a specific domain; e.g. an individual's self-efficacy for learning relates to that person's confidence about learning.

Self-regulated learning Individuals who engage in self-regulated learning are active learners who set their own goals, strategise their learning and adjust their strategies as circumstances change. They are "metacognitively, motivationally, and behaviourally active participants in their own learning process" (Zimmerman, 1986, p. 308).

Social cognitive theory This is a theory of human psychology proposed by Canadian psychologist Albert Bandura; it is founded on the idea that human behaviour is the result of interrelated and mutually determining personal, behavioural and environmental factors in what he termed *triadic reciprocal causation* (Bandura, 1986).

> The word *social* in Bandura's social cognitive theory acknowledges that learning takes place in a social context, and that a person can learn by observing others. The word *cognitive* relates to the active role that people have in their own cognition, that their cognition is not just a reaction to external stimuli, but that people can control their cognition – that they can think about their thinking and change it.

1.8 Structure of this Thesis

This thesis consists of eight chapters, which include a mixture of standard thesis chapters and four research papers (Papers 1, 2, 3 and 4) that report on various aspects of the study. Each of the four papers is a manuscript prepared for submission. The thesis chapters and the four papers presented in this thesis were drafted by the first author and reviewed by other authors. The contribution from each of the authors is as follows: Norman (90%), Lockyer (5%) and Bennett (5%). The four target journals identified in Table 1 for the manuscripts were selected according to their recent history of publishing papers on MOOCs that were similar in theoretical positioning to the present study, with keywords such as: *social cognitive theory*, *self-regulated learning*, *motivation*, *self-efficacy* and *achievement goals*.

Table 1

Structure of the Thesis

Chapter	Format	Target journal (impact factor)
1. Introduction	Thesis chapter	
2. Literature Review	Thesis chapter	
3. Methodology	Thesis chapter	
4. Paper 1	Manuscript	Journal of Computer Assisted Learning (1.679)
5. Paper 2	Manuscript	Journal of Online Learning and Teaching ([a])
6. Paper 3	Manuscript	Internet and Higher Education (2.719)
7. Paper 4	Manuscript	Computers and Education (2.881)
8. Conclusion	Thesis chapter	
References	Thesis chapter	

Chapter	Format	Target journal (impact factor)
Appendices	Thesis chapter	
Other Publications	Conference papers	

Note. [a]unavailable

The target journals and some examples of recently published papers that used these keywords are: *Journal of Computer Assisted Learning* (e.g. de Barba, Kennedy, & Ainley, 2016; Pursel, Zhang, Jablokow, Choi, & Velegol, 2016); *Journal of Online Learning and Teaching* (e.g. Milligan, Littlejohn, & Margaryan, 2013; Wang & Baker, 2015); *Internet and Higher Education* (e.g. Littlejohn, Hood, Milligan, & Mustain, 2015; Milligan & Littlejohn, 2016); and *Computers and Education* (e.g. Hood, Littlejohn, & Milligan, 2015; Margaryan et al., 2015). As the *British Journal of Educational Technology* (IF: 2.098), which has been popular destination for MOOC papers, is oversubscribed with a 10% acceptance rate (according to their website), this journal was omitted from the selection process.

Overview of thesis chapters

Chapter One provides a background to this study, presents the research problem being investigated and outlines the study's theoretical framework, significance and methodology.

Chapter Two: Literature Review begins by presenting and discussing the theoretical framework within which this study was situated and the three lenses that were used to investigate how people learn in a MOOC. This chapter then turns to a review of the literature related to these three distinct fields of study, which are relevant to the problem this study addresses.

Chapter Three: Methodology begins by describing how the three theoretical lenses were applied in this study. This is followed by a presentation of the research approach, design, methods and context for this study. A six-step procedure for analysing and mixing data is presented, and issues of interpretation and validity are discussed.

Chapter Four: Paper 1 presents the first of four papers in this thesis. This paper reports on the findings of a statistical analysis of survey data collected in Phase 1, addressing the question *Who enrols in MOOCs and what are their characteristics?*

Chapters Five, Six, Seven: Papers 2, 3 and 4 present three papers that report on the qualitative phase of this study, which was realised in the form of a multiple-case study. These papers address the questions *How do learners self-regulate in a MOOC?* and *What are the outcomes for MOOC participants?* Data collected from multiple sources over the quantitative and qualitative phases was analysed, interpreted and integrated to provide detailed accounts of how people of differing backgrounds learned in a MOOC.

Chapter Eight: Conclusion responds to the three research questions and considers the implications of these findings to lifelong learning, higher education and research. Limitations of this study are described and lines of suggestions for future research are described.

A **Consolidated List of References** is provided for all the literature cited in the thesis chapters and papers. This is followed by an **Appendices** section that contains various artefacts related from this study. Two conference papers are presented in the final section, **Other Publications**.

CHAPTER TWO: THEORETICAL FRAMEWORK & LITERATURE REVIEW

This chapter begins with a presentation of the theoretical framework, *social cognitive theory*, and the three theoretical lenses, *self-regulated learning*, *self-efficacy* and *achievement goals*, that were used to investigate how people learned in a MOOC. Next, this chapter turns to a review of the literature. Empirical studies that relate to these three social cognitive lenses are discussed within the contexts of higher education, online learning and MOOCs. This chapter concludes by identifying the gap in the literature that this study aims to fill.

2.1 Theoretical Framework

Social cognitive theory provides a framework within which to investigate the internal and external factors that influence human behaviour. It was originally proposed as *social learning theory* (Bandura, 1977), which highlighted the social context of learning. Bandura (1997) proposed that people could learn on their own through the observation of others without direct reinforcement, which countered the behaviourist view popular at the time. Bandura renamed this theory *social cognitive theory* in *Social Foundations of Thought and Action: A Social Cognitive Theory* (Bandura, 1986) to differentiate it from other theories of learning then current, and to acknowledge the cognitive aspect of learning (Zimmerman & Schunk, 2003). By this renaming, Bandura wanted to highlight the active role that individuals had in their own cognition: that they were not just reacting to environmental or inner cognitive-affective forces (Zimmerman & Schunk, 2003), but that they were active information processors (Bandura, 1977) who could think about their thinking and control it.

According to Bandura (1986), human behaviour is the result of the reciprocal interaction of three linked variables: *behaviours*, which are observable actions humans engage in, such as watching television, reading a book or going to the gym; *personal factors*, which describe an individual's cognitions, habits, emotions, beliefs and biology, such as a feeling of anxiety, a belief that one is capable of performing a task or thinking about how to perform a task; and *environmental factors*, which describe stimuli outside the

individual, such as physical and online environments and other people. Bandura (1986) theorised that these three variables were in *triadic reciprocal causation* (Figure 2).

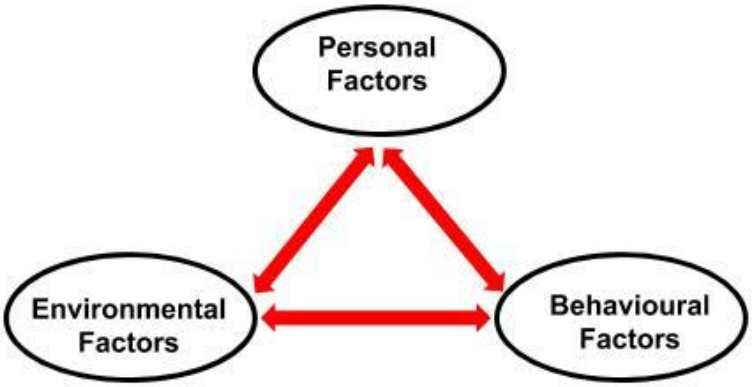

Figure 2. Triadic reciprocal causation (adapted from Bandura, 1986, p. 24)

According to this model, any change in any one of those variables causes a change in the other two, which then causes reciprocal changes back to the causative variable. For example, a woman who goes for a jog (behavioural) in a park (environmental) causes a change in the biochemistry of her brain (personal), which makes her feel good (personal). As she sees other joggers who run faster and look fitter than she does (environmental), she starts to think that she needs to exercise more (personal), and this causes her to jog faster (behavioural). These three variables continue to influence each other in this reciprocally determining fashion. Though the factors are linked and mutually determining, this does not mean they are fixed. The relative influence of each of these determinants on human behaviour varies according to the individual and the context (Bandura, 1986).

Social cognitive theory, and specifically the model of triadic reciprocal causation, is a useful framework within which to investigate learning in a MOOC. The model allows for a detailed investigation of how personal, environmental and behavioural factors influence each other and an individual's learning. The social cognitive perspective acknowledges that learning does not take place solely in the head, but is also influenced by the environment. This model also posits that learning is influenced by what a person does. For example, a student watching a MOOC lecture who pauses the video to take notes influences how that information is stored in their brain and how it is linked to existing knowledge. Thus triadic reciprocal causation models human behaviour in a way that helps understand and describe the complex phenomenon of learning in a MOOC.

Educational research situated within a social cognitive theoretical framework is useful to students, teachers and all those who have a stake in education. Central to social cognitive theory is the notion that individuals have *agency*. Bandura (2001) defined *agency* as individuals' ability to "play a part in their self-development, adaptation and self-renewal with changing times" (p. 2). The idea of agency implies an optimistic view of humanity, as it is based on the notion that people can change their lives. A social cognitive perspective assumes that humans can, through their own efforts, improve their ability to learn despite any biological, socioeconomic or sociocultural limitations. It offers hope to teachers and education stakeholders that the pedagogical approaches and systems they control can improve outcomes for all learners.

2.2 Self-Regulation

Self-regulation is a social cognitive construct that emphasises the role of the *self* in human activity. Bandura (1986) proposed that people do not just respond to the will of others, or react unthinkingly to external forces; rather, "their behaviour is regulated by internal standards and self-evaluative reactions to their own actions" (p. 20). Self-regulation can be defined as the "self-generated thoughts, feelings and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000, p. 14). Self-regulation is key to the quality of life individuals experience, and has been described as "perhaps our most important quality as humans" (Zimmerman, 2000, p. 13), as those who can can set goals, control themselves, adapt to changing circumstances and learn from their mistakes tend to have fulfilling and successful lives, whilst those who cannot lead diminished lives. Self-regulation is a domain-specific construct, meaning that a person could be highly capable at regulating themselves in one area of their life, such as how they manage their physical exercise, but less capable in others, such as how they control their emotions. One area of self-regulation that has been of interest to educational researchers is how people regulate their learning.

Self-regulated learning – the key to academic success

Self-regulated learning has been the subject of academic study for many decades. Though some theorists claim that self-regulated learning is an inherent human capability that occurs naturally in any human activity directed towards a goal (e.g. Winne, 1997), others claim that what matters is the quality and quantity of self-regulation in human activity (e.g.

Zimmerman, 2000). Schunk and Zimmerman (2008) provide a particularly helpful description of the behaviours of effective self-regulated learners:

> Good self-regulators set better learning goals, implement more effective learning strategies, monitor and assess their goal progress better, establish a more productive environment for learning, seek assistance more often when it is needed, expend effort and persist better, adjust strategies better, and set more effective new goals when present ones are completed (p. 1).

Self-regulated learning has been studied extensively, as the theory is of particular use to students and educators. According to Pintrich (1995), it is learnable, as it is not a fixed attribute in a person like genetics or personality. Self-regulated learning is also teachable, in that teachers can design and deliver instruction that can help students become better self-regulators. The study of self-regulated learning is particularly relevant to students in higher education, who have more flexibility and autonomy to direct their own learning. For these reasons, self-regulated learning has generated much research activity. However, the internal processes involved in self-regulation are difficult to observe, and for this reason it presents a challenge for researchers.

Self-regulated learning – a challenging construct to study

Self-regulated learning is a subtle and elusive theorisation of learning that has been conceptualised in different ways in the literature. Boekaerts (1997) proposed a structural model that described self-regulated learning as consisting of six cognitive and motivational strategies at the domain-specific, strategic and goal levels. However, models that capture the dynamic nature of self-regulating learning are more common. Schunk and Zimmerman (1998) proposed a three-phase model that focused on the internal processes through which individuals cycle as they self-regulate: forethought, performance and reflection. Boekaerts and Niemivirta (2000) proposed a distinct model of self-regulated learning that aimed to capture the internal processes that drive behaviour. Their *model of adaptable learning* described how individuals' learning goals interact with their well-being goals as they strive to learn. These differing models of self-regulation, whether dynamic or structural, highlight the complexity of this construct and the challenge associated with studying it. As Boekaerts and Corno (2005) noted, "there is no simple and straightforward construct of self-regulated learning" (p. 199).

Broadly speaking, there have been two approaches to studying self-regulated learning: as an *aptitude* or an *event*. Quantitative approaches, which predominated in the early decades of self-regulated learning research, positioned this capability as an aptitude, a fairly stable personal trait that held across situations and contexts. Such studies used questionnaires, structured interviews and even teacher ratings to measure it (e.g. Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1986). More recently, researchers have adopted qualitative approaches to studying self-regulated learning, which position it as an event, something that happens for an individual within a particular context (Winne & Perry, 2000). Qualitative studies have used interviews, observations and experience sampling to measure it (see Perry, 2002 for detailed accounts of these methods).

Triadic forms of self-regulated learning

Taking into account the slippery nature of self-regulated learning and the different approaches to studying it, this study selected a model that closely mirrored Bandura's orginal conceptualisation of triadic reciprocal causation (1986): the *triadic forms of self-regulation* model (Zimmerman, 1989). Zimmerman (2000) proposed that "self-regulation involves triadic processes that are proactively as well as reactively adapted for the attainment of personal goals" (p. 15) (Figure 3).

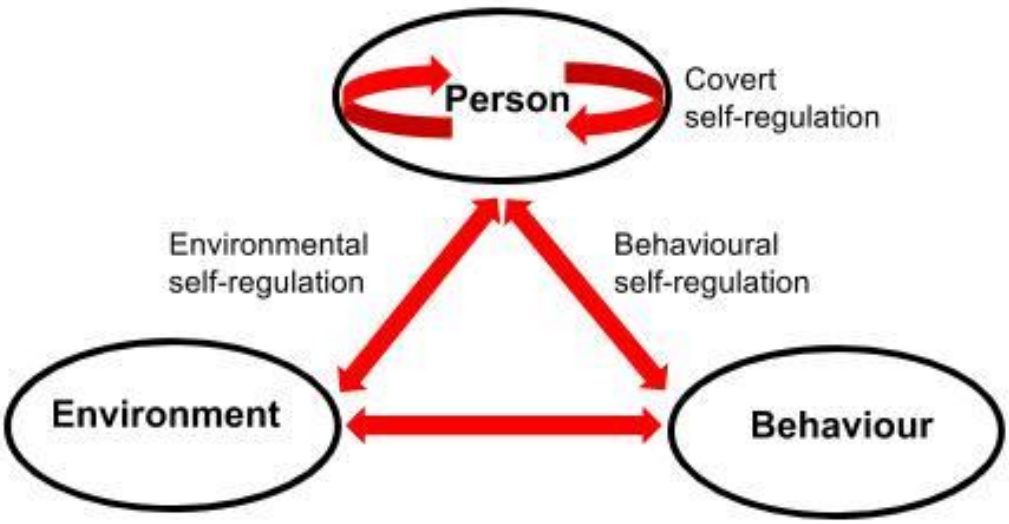

Figure 3. Triadic forms of self-regulation (adapted from Zimmerman, 1989, p. 330)

In this conceptualisation of self-regulation, people regulate their learning in response to interlinked and reciprocally influencing forces of personal, behavioural and environmental

factors. *Behavioural self-regulation* involves the observation and strategic adjustment of one's performance, such as study strategies; *environmental self-regulation* involves the observation and strategic adjustment of external conditions or stimuli, such as preparing a desk for study; and *covert self-regulation* refers to the monitoring of hidden internal states such as motivation, cognition and affect, and the strategic adjustment of them when necessary, through techniques such as imagery or relaxation exercises to improve concentration (Zimmerman, 2000).

Zimmerman's model of self-regulated learning (1989) affords a degree of flexibility and adaptability in studying and describing the complex phenomenon of learning in a MOOC. It can be used to describe how these triadic forces influence learning: how *personal* factors, such as motivation, academic experience and prior knowledge, and *environmental* factors, such as the MOOC itself and the tasks within it, and *behavioural* factors, such as how an individual takes notes (behavioural), relate to each other and the individual as they engage in the MOOC. Also, being closely aligned to Bandura's original model of triadic reciprocal causation (1986), this model accommodates other theoretical models that have developed within this framework.

2.3 Motivation: The Driver of Learning

Motivation is the engine that drives learning. The word "motivation" comes from the Latin word *movere*, which means *to move*. Motivation describes the state of mind that stimulates individuals to move in a direction towards a goal and sustains that motion; without motivation, there is no learning. The ability to self-regulate is not enough to promote performance; individuals also need to be motivated to do so (Pintrich & De Groot, 1990). Understanding what motivates individuals to enrol and expend energy and time in a MOOC is instrumental to understanding how they learn.

The study of motivation has moved from the periphery to the centre of educational research over the years (Pintrich, 2003), which reflects the established view that motivation is essential for effective learning (Ainley, 2004). This field of study is highly useful to educators, as the findings that relate to improving motivation in learners are easy to implement (Pintrich, 2003). For example, the design of a stimulating and meaningful task will help students learn by increasing their intrinsic motivation to perform the task (see

Pintrich, 2003, p. 672 for a comprehensive list of design principles that can be used to improve motivation). In the context of how people learn in an online environment, the study of what contributes to an individual's motivation and how this functions within the broader model of triadic self-regulated learning may help instructional designers and teachers use features and strategies that boost this driver.

Selection of motivational constructs

Two motivational constructs of *self-efficacy* and *achievement goals* were incorporated into the theoretical framework of this study to assist in understanding how these aspects of motivation influence learning in a MOOC. *Self-efficacy* describes an individual's belief in what they can do and *achievement goals* describes what an individual believes is important to achieve in a learning context. The field of motivational research is rich with distinct theorisations of how motivation influences learning (see Pintrich, 2003 for an extensive review of how the field of motivational research has developed). The self-efficacy and achievement goals constructs were selected over other candidates for several reasons. Firstly, both constructs have developed within the social cognitive theoretical framework and would align to that broader conceptualisation of human psychology. Secondly the empirical evidence suggests that both these aspects of motivation are key to achievement in learning contexts. Finally, and importantly, both these aspects of motivation can be easily influenced by design principles (Pintrich, 2003). The study of self-efficacy and achievement goals in the context of learning in a MOOC may have implications for how MOOCs could be improved by influencing these drivers.

Self-efficacy – confidence in one's own ability

Self-efficacy relates to what individuals believe they can do successfully. Bandura (1997) defined it as "beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments" (p. 3). It can be understood as the difference between thinking *Yes, I can do this* and *No, I can't do this*, and explains the actions that flow from that decision. Self-efficacy plays a pivotal role in learning, as it influences the choice of activities individuals engage in, how much effort they expend and their level of persistence (Bandura, 1986). Self-efficacy is also domain-specific, meaning that an individual may have high self-efficacy in one area but low self-efficacy in another (Bandura, 1997). For example, an individual may have a high level of self-efficacy in

mathematics, but low in English. The study of self-efficacy is useful to educators, as it is an aspect of human motivation that can be improved through instructional-design approaches. For example, the design of tasks that challenge but also offer opportunities for learners to succeed may develop self-efficacy beliefs (Pintrich, 2003, p. 672).

Bandura (1977) proposed four main sources of self-efficacy development: (1) *enactive mastery experiences*, which refers to information gained from performing tasks successfully in the past – in other words, success builds self-efficacy whilst failure undermines it; (2) *vicarious experience*, which refers to information gained from observing another perform a task successfully, especially when that other person is a peer; (3) *verbal persuasion*, which refers to feedback received from other people, which can be a powerful persuasive force; and (4) *physiological and affective states*, which refers to feelings of anxiety or stress related to performing a task. Strong feelings of this type are cues that warn an individual about their sense of success or failure on a task. Studying self-efficacy is key to understanding how this aspect of motivation influences individuals' choices and persistence in a MOOC. This theoretical lens afforded an investigation into distinct domains of self-efficacy, such as general academic ability, understanding the subject matter of the MOOC, learning in a MOOC and how self-efficacy beliefs influences learning.

Achievement goals – a concern for knowledge or marks

Another construct related to motivation that has developed within the social cognitive framework is *achievement goals*. An achievement goal "defines an integrated pattern of beliefs, attributions and affect that produces intentions of behaviour...represented by different ways of approaching, engaging in and responding to achievement-type activities" (Ames, 1992, p. 261). This construct afforded a framework for understanding how personally held beliefs about what is important to achieve in learning contexts would give rise to behaviour. This was of importance to understand in the current study, as the people who enrol in MOOCs do so voluntarily and may have distinct beliefs about what they perceive to be important to achieve in that context.

In the field of achievement-goal research, two distinct orientations were originally proposed: *mastery* and *performance goals* (Pintrich, 2003). *Mastery goals* drive a student to master knowledge, take risks, acquire new skills and improve performance based on self-referenced standards. Students who hold mastery goals "want to develop their competence

on a task or increase their understanding of a subject and anticipate that this end will be achieved by hard work" (Archer, 1994, p. 431). *Performance goals* give rise to behaviours concerned with demonstrations of competence, positive assessments of ability, ego-protection and outperforming others. Students who hold performance goals "are concerned primarily with demonstrating their ability (or concealing a perceived lack of ability) which is shown to best advantage by outperforming others, particularly if success is achieved with little effort" (Archer, 1994, p. 431). Originally, mastery goals were associated with adaptive behaviours, whilst performance goals with maladaptive patterns of behaviour (Dweck, 1986; Nicholls, 1984).

The field of achievement-goal research has developed in various directions and with considerable debate. In the literature, different labels have been ascribed to the dichotomous achievement-goal framework, which reflects different views on the internal processes that constitute this aspect of motivation. For example, Nicholls (1984) labelled these orientations *task-involved* and *ego-involved* goals. According to this conceptualisation, *ego-involved* learners were concerned with demonstrating their competence to others, whilst *task-involved* learners were concerned with personal feelings associated with accomplishing a task. Later on, Dweck and Leggett (1988) proposed *learning* and *performance* goals, and theorised how learners' underlying beliefs about the nature of their intelligence guided these orientations. Learners who believed their intelligence was not fixed but capable of growing throughout their lives would adopt a *learning-goal* approach to learning, whilst those who believed their intelligence was fixed would adopt a *performance-goal* approach. Despite some similarities, differences and overlaps between differing conceptualisations of achievement goals and the labels used to describe them, "mastery goals" and "performance goals" have become the standard terms used in the field (Pintrich, 2003).

The original dichotomous achievement-goal framework was extended beyond the framework of mastery and performance goals by Elliot and Church (1997), who proposed a *trichotomous framework* of achievement goals by distinguishing between *performance-approach* and *performance-avoid* goals, and then again later by Ellliot and McGregor (2001) in their accommodation of *mastery-approach* and *mastery-avoid* goals (Figure 6).

		Definition	
		Absolute / intrapersonal (mastery)	Normative (performance)
Valence	Positive (approaching success)	Mastery-approach goal	Performance-approach goal
	Negative (avoiding failure)	Mastery-avoid goal	Performance-avoid goal

Figure 6. The 2x2 achievement-goal framework (Elliot & McGregor, 2001, p. 502)

The approach-avoid binary relates to whether and in what degree individuals approach or avoid a goal depending on their personal concerns for success. For example, individuals with a performance-approach orientation would be focused on positive demonstrations of their performance, and would therefore seek opportunities to demonstrate these capabilities, whilst individuals with a performance-avoidance orientation would be concerned about negative assessments of their performance and would try to avoid situations in which such assessments were made.

This study adopted the *2x2 achievement-goal framework* (Elliot & McGregor, 2001), as this model supported the investigation of how different orientations influence learning in a MOOC. Due to the nature of participation in MOOCs, one might assume that most people who enrol would have a mastery-approach orientation, which is widely regarded as having a positive influence on learning. However, it would be of value to understand how individuals with strong performance-approach and performance-avoid orientations behave in a MOOC, where individual performances are not visible to others.

In sum, this study was grounded in a social cognitive theoretical framework to investigate how individuals learned in a MOOC. This framework was chosen as it provided a way of revealing the interdependent and reciprocally determining internal and external factors that influenced learning in the context of a MOOC. Within this framework, three social cognitive constructs were applied: self-regulated learning, self-efficacy and achievement goals. Altogether, this theoretical framework and the constructs applied within it enabled an investigation that would provide detailed accounts of how people learned in a MOOC.

2.4 Literature Review

This study is interested in how people learn in MOOCs. The very first MOOC, *Connectivism and Connective Knowledge* (CCK08), was offered in 2008 by Canadian academics George Siemens and Stephen Downes, and was driven by a desire to depart from traditional pedagogical approaches to delivering online learning (McAuley et al., 2010). This kind of MOOC, driven by *connectivism*, a theory of learning proposed for the digital age (see Siemens, 2005), later became known as a connectivist or cMOOC and was the first of a handful of online courses of this kind. The cMOOC, which favours social learning over structured content and assessment, contrasts with the pedagogical approach of the xMOOC which arrived in 2011. The Stanford University MOOC, also referred to as an xMOOC, adopted a top-down, behaviourist approach (Daniel, 2013) rather than the radical bottom-up approach of its antecedent. No matter the pedagogical approach of the MOOC, learning in these environments requires a high degree of motivation and self-regulation, as the responsibility to direct one's activity and persist in the face of difficulty falls on the learner.

Millions of people worldwide have enrolled in MOOCs in the short time that they have been offered. Though people enrol in MOOCs for a range of reasons, they are all, by virtue of *choosing* to enrol, engaging in lifelong learning, which is widely accepted as providing a range of benefits to the individual and the societies and nations in which they reside (see Department of Education and Science, 2000; Faure et al., 1972; Medel-Añonuevo, Ohsako, & Mauch, 2001). The key institution that provides lifelong learning through formal, standardised programs of study is higher education. Given the importance of lifelong learning and the role that universities play in providing this function, how people learn at this level has been the subject of considerable educational research. The findings from studies of learning within the context of higher education are of relevance to this study, as MOOCs are typically based on subjects taught within degree programs.

The first part of the following review discusses empirical studies that investigated how adults regulate their learning in contexts of higher education, online environments, and MOOCs. This is followed by a review of studies from the fields of self-efficacy and achievement-goal research, two aspects of motivation that have been found to influence learning.

2.5 Self-Regulated Learning

Self-regulation in higher education

There is wide agreement in the literature that students who are good at regulating their learning achieve more academically than weak self-regulators. Early studies in the 1980s and 90s (e.g. Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1986, 1988) established the key role that self-regulation plays in effective learning in formal school settings. Though the link between effective self-regulation and academic achievement was established in these studies in primary- and secondary-school settings, the need to self-regulate is limited in these contexts, as students' learning activities are tightly controlled. However, students who progress into higher education need to develop autonomy, self-direction and self-control if they are to succeed.

Studies have found that students in higher education can learn to become better self-regulated learners, and that this leads to improved performance. A systematic review of 10 studies involving 906 students in higher education investigated the link between self-regulatory processes (metacognitive strategies, motivation, self-efficacy, handling task difficulty and demands and resource management) and learning outcomes (Bruijn-Smolders, Timmers, Gawke, Schoonman, & Born, 2016). This review found that, in general, self-regulated learning interventions related positively to self-regulatory processes and achievement; in other words, that self-regulated learning could be influenced and that it led to higher grades.

These findings were echoed in two other studies that also involved interventions. A study of 102 first-year undergraduate students investigated the effect of a structured set of guidance activities (scaffolding) on the development of self-regulated learning (Beaumont, Moscrop, & Canning, 2016). The aim of this intervention was to investigate whether scaffolded feedback could ease students into the more autonomous learning that was required at the tertiary level. This study found significant improvements in the treatment group's understanding of assessment tasks and criteria, and increased confidence in completing assessment tasks and self-regulated learning. In another experimental study, 116 community college students were randomly assigned to a control or treatment group. The treatment group, which received training in self-regulated learning over three weeks, achieved higher marks in a mathematics test and scored higher as self-regulated learners

than those who did not receive the training (Bol, Campbell, Perez, & Yen, 2016). These findings support the view that self-regulated learning can be taught and learned, and that this capability is important to develop in higher education (Pintrich, 1995). As online learning is widespread at all levels of higher education (Wallace, 2003), researchers have also turned their attention to how tertiary students regulate their learning in online contexts.

Self-regulated learning in online environments in higher education

The link between self-regulated learning and positive outcomes holds for students in higher education who are engaged in online learning. In two studies of students enrolled in an online degree program (n = 279, 197) an online questionnaire was used to investigate six self-regulated learning sub-processes (environment structuring, goal-setting, time management, help-seeking, task strategies and self-evaluation) (Barnard-Brak, Lan, & Paton, 2010). An analysis of survey data revealed five distinct profiles for self-regulated learners, ranking from low to high in terms of self-regulation; as the ranking increased, so did students' academic outcomes, as measured by GPA. The positive influence of self-regulation on achievement has also been found elsewhere. In a study of 26 undergraduate students who were tasked with creating ePortfolios (Cheng & Chau, 2013), university students who scored high for self-regulated learning received higher scores for their ePortfolios than students with lower scores for self-regulated learning. Also, in a study of 64 undergraduates enrolled in an online course, effort regulation, a sub-process of self-regulated learning, was found to predict achievement (Cho & Shen, 2013).

Self-regulated learning has also been found to predict engagement. In a survey of 203 undergraduates in an online courses, respondents with higher levels of self-regulated learning were found to be more engaged behaviourally, emotionally and cognitively than those with lower levels (Sun & Rueda, 2012). However, a study of 204 undergraduates enrolled in online courses found no strong relationship between self-regulated learning and achievement (Barnard, Paton, & Lan, 2008). Altogether, while these findings in the main do confirm the link between self-regulated learning and positive outcomes, there may be other factors that contribute to performance in this context.

The literature also confirms the view that self-regulatory behaviours can be taught, or at least supported, in online environments. In a study of 34 college students enrolled in an eight-week online educational technology course, strategies to promote the use of self-

regulated course materials were embedded into the course content (Yang, 2006). The study found that these participants' use of cognitive and performance control strategies improved throughout the course. Though the study had no control group, these findings suggest that interventions may have been a factor in the participants' improvement. An experimental study of year-three undergraduates in a blended course found that scaffolds that promoted group awareness and peer assistance were linked to improved self-regulation and achievement (J.-W. Lin, Lai, Lai, & Chang, 2016). Altogether, the findings from these studies suggest that online interventions can help students become better self-regulators.

The majority of studies into self-regulated learning in online contexts have adopted quantitative approaches and provided valuable information about the structure of self-regulated learning and how it relates to performance, achievement and other positive outcomes. These quantitative approaches do not, however, reveal how people actually learn in online environments. Researchers interested in investigating the context and detail of how people regulate their learning have adopted qualitative approaches.

Findings from one qualitative study into self-regulated learning investigated how online learners adapted traditional self-regulated learning strategies for the online context. Whipp and Chiarelli (2004) conducted a multiple-case study of six graduate students in an online course using Zimmerman's three-phase model (Zimmerman, 2000) to investigate the strategies they used. This study found that these learners adapted strategies used in traditional settings for each of three phases: forethought, performance and reflection in the online context. For example, in traditional settings, high-school students were found to use teachers and peers as sources of support (Zimmerman & Martinez-Pons, 1986), whereas in an online setting in this study, participants were found to seek help in different ways, by accessing timely technical expertise and contacting peers to reduce loneliness, using web-based "helpers" and using student postings as models (Whipp & Chiarelli, 2004, p. 14). As well, this study emphasised the role that environmental influences, such as instructors, peers, course design and the technical and social aspects of the environment have on motivation and learning. The findings from this study highlight the influence of environment on learning. Students behave in substantively different ways to regulate their learning in online compared to traditional classroom contexts.

Self-regulated learning in MOOCs

The study of self-regulated learning in MOOCs is only beginning. The findings from one study suggest that environmental and personal factors play a part in how people approach learning. A mixed-methods study using self-regulated learning as a lens to probe the behaviours of health-science professionals in a health-science MOOC found no link between motivation and a deep approach to learning (Milligan & Littlejohn, 2014). Thirty-five self-identified professionals were interviewed about their learning in the MOOC and how it related to their work. Despite their stated intention to use the MOOC for professional development, there was little evidence of them actually integrating what they were learning into practice; rather, they did what was required to earn the certificate. Possible explanations for this finding related to the design of the course and the personal goals of the participants. The MOOC was driven by an instructivist approach involving content transmission and the testing of comprehension through quizzes. These environmental factors, combined with participants' stated goal of earning the certificate, may have diminished their motivation to learn at a deeper level. In this case, perhaps these professional learners could have progressed and earned the certificate without expending the effort on strategies for deeper learning. This finding highlights the influence of the online environment, its design and its pedagogical intent on self-regulated learning. It also underscores the view that self-regulated learning is a domain-centric activity, and that even though a person may be capable of regulating their learning, this does not mean they will do so in every situation.

Findings from two recent studies suggest that people's context or role was a factor in their self-regulated learning capability. Hood, Littlejohn and Milligan (2015) investigated the relationship between MOOC enrolees' context or role and their self-regulated learning sub-processes using adapted scales from the *Self-Regulated Learning at Work Questionnaire* (SRLWQ) (Fontana, Milligan, Littlejohn, & Margaryan, 2015). This instrument consists of scales across the phases of forethought, performance and reflection as proposed by Zimmerman (2000). Significant differences for overall self-regulated learning scores and specific self-regulated learning sub-processes were found between participants depending on their role or context. Specifically, learners who were professionals working in the area of the MOOC topic or students in a course at higher education levels were found to have higher measures of self-regulated learning than other learners. In a follow-up study

involving the same participants, Littlejohn, Hood, Milligan and Mustain (2015) interviewed 32 participants who had identified as data professionals to probe how they had learned in the MOOC. This study found that professionals who had higher self-regulated learning scores perceived the MOOC to be an opportunity to develop professionally. The high-scoring professionals were found to be more flexible and adaptive in their approach to learning than the low-scoring professionals, who adopted a more rigid approach to scheduling their study. The high-scoring professionals were more efficient and effective with their use of study time in the MOOC. The findings from these two related studies highlight how learners with different reasons for enrolling and different levels of self-regulated learning approach learning in MOOCs in different ways. Though findings from the Hood et al. (2015) study suggest that learners who were in higher education were also capable self-regulators, it is not known whether these students behaved in a similar way as the professionals.

In sum, self-regulated learning has been studied extensively, and its role in effective learning and academic achievement is well established. It is, however, a complex phenomenon to study, as it can be conceptualised in different ways and approaches to studying it vary. Early studies of self-regulated learning were characterised by quantitative approaches; more recently, qualitative approaches have become more popular, highlighting the context in which people regulate their learning. This capability is of importance in online learning contexts in which learners are required to study more independently and take more responsibility for their own learning. The few studies that have investigated self-regulated learning in MOOCs have highlighted the influence of context and the pedagogical approach of the MOOC on learning.

2.6 Self-Efficacy and Learning

Self-efficacy, which can be defined as “beliefs in one’s capabilities to organise and execute the courses of action to produce given attainments” (Bandura, 1997, p. 3), is an important predictor of performance in academic contexts. Personal beliefs about what one can and cannot do determine what one actually does in an academic context. For example, a student with a high level of self-efficacy will expend more effort, persist longer and achieve more academically than a student with low self-efficacy (Pintrich & Schunk, 2002). Studying self-efficacy is useful to educators because it can be influenced. For instance, the provision

of feedback that instils a feeling of competence, expertise and skill in a student will support the development of self-efficacy (Pintrich, 2003).

Self-efficacy predicts achievement in classrooms

The consensus in the literature is that in traditional classroom settings, at all levels, students who are more confident about their academic ability do better than those who are less confident. A meta-analysis of 39 quantitative studies of self-efficacy involving students in primary, secondary and tertiary settings found that self-efficacy beliefs were linked to both academic performance and persistence (Multon, Brown, & Lent, 1991). Studies of self-efficacy in higher-education contexts suggest that more-confident university students also experience a range of positive outcomes. For example, 42 undergraduates in a 10-week science and engineering career-planning course were assessed for their confidence in being able to complete the educational requirements of, and job tasks required in, 15 science and engineering fields. Students with higher self-efficacy scores were found to achieve more academically and to persist longer in their majors in the following year than the students with lower self-efficacy (Lent, Brown, & Larkin, 1984). In another study, first-year university students who had positive self-perceptions and who were confident about their academic ability and optimistic about life experienced more academic success and were better at adjusting to the demands of higher education than their less confident counterparts (Chemers, Hu, & Garcia, 2001).

Whilst high self-efficacy is linked to positive outcomes in higher education, the consequences of low self-efficacy are particularly negative. In Multon et al.'s (1991) review of self-efficacy studies, lower-achieving students were more influenced by their self-efficacy beliefs than higher-achieving students, meaning that less confident students were *more* likely to give up in the face of difficulties than more-confident students. Another study of 117 undergraduates found that students' confidence about their mathematics ability was a more important factor in their maths-related career choices than their actual ability (Hackett, 1985). Altogether these findings highlight the power of self-efficacy, in that these personal beliefs can override a student's *actual* ability. It is therefore an important aspect of motivation to study, especially in online contexts, where new domains of confidence are engaged, such as confidence in studying independently, study using Web-based technologies, or online information-searching.

Self-efficacy not well understood in online learning

In contrast to the study of self-efficacy in traditional classrooms, the role that self-efficacy plays in online learning is not well understood. The bulk of the self-efficacy research in the context of classroom learning took place in the late 1970s and early 1990s, before the emergence and proliferation of online learning; thus the study of self-efficacy in online learning is only in its infancy (Hodges, 2008).

The findings from self-efficacy studies in online contexts from the first two decades of the 21st century are mixed. A review of 46 studies found that, in the main, self-efficacy beliefs for online learning and general academic performance were linked to positive outcomes such as attitudes towards online learning, use of learning strategies and achievement (Tsai, Chuang, Liang, & Tsai, 2011). Other studies, though, have found no link between self-efficacy and positive outcomes in online learning contexts. A study of 73 community-college students in online general-education courses found that self-efficacy with regard to online technologies was a poor predictor of course grades (DeTure, 2004). Similarly, in a study of 815 community-college students enrolled in online liberal-arts courses, self-efficacy with regard to online technologies did not predict either course grades or satisfaction with the course (Puzziferro, 2008). A study of 16 undergraduate students enrolled in an online course found that though self-efficacy with regard to course content predicted satisfaction, neither course-content self-efficacy nor online-learning-technologies self-efficacy predicted final scores (Lee & Witta, 2001).

Reasons for inconclusive findings

The inconclusive findings from the research into self-efficacy in online contexts can be attributed to several factors: a lack of rigour in the application of the self-efficacy construct; an inconsistency in the domains of self-efficacy investigated and associated outcome variables; and the limitations of quantitative approaches. Tsai et al. (2011), in their review of 46 papers from 1999 to 2009 that investigated self-efficacy within the context of online learning, found that the majority of empirical studies were not based in the theoretical framework that had been originally proposed in *Social Foundations of Thought and Action* (Bandura, 1986). Bandura described four sources of human self-efficacy: enactive mastery experiences, vicarious experiences, verbal persuasion and physiological and affective states. Due to this lack of theoretical grounding, it is difficult to say if these four factors

function in the same way in the context of online learning as they do in classroom contexts. It may be that they influence self-efficacy in different ways in online learning settings compared to traditional settings, or that there are other influences on self-efficacy that have not been accounted for.

Second, the studies in this field investigated a range of self-efficacy domains and outcome variables. These pairings ranged from the relatively congruent, such as the pairing of self-efficacy for learning mathematics asynchronously to final-exam scores on a mathematics test in an asynchronous course (Hodges, 2008), to less congruent matches, such as the comparison of self-efficacy for general academic performance to satisfaction with online learning (Joo, Lim and Kim, 2013). According to Bandura (1986), the capability assessed in a self-efficacy instrument needs to be paired with the specific performance related to those beliefs for the relationship to be valid. This claim has been confirmed in an analytic review of self-efficacy literature, which found that in studies where self-efficacy and performance outcome were tightly matched, the relationship was stronger (Multon, Brown and Lent, 2001).

Another factor contributing to the inconclusive findings in this field is that all of the self-efficacy studies in online contexts reviewed in this section adopted quantitative approaches. Typically these studies used established instruments to measure different domains of self-efficacy, and then investigated the relationship of this measure to other variables derived from course grades or questionnaire-derived outcome variables. The field of self-efficacy research in online contexts may benefit by adopting qualitative approaches. A more contextual and nuanced investigation of how specific individuals' self-efficacy perceptions influence their learning may provide knowledge as to what domains of self-efficacy are most important in this context. These findings may then inform a more consistent approach to studying self-efficacy in online contexts.

Self-efficacy in MOOCs

MOOCs have only existed since 2012; thus the study of self-efficacy in MOOCs is only beginning. Three empirical studies relating to self-efficacy were discovered in this review, and the findings suggest that the learners' prior experience of the MOOC topic and of MOOCs themselves may be key to their self-efficacy beliefs.

One study of 2,792 learners in a MOOC on big data in education found that self-efficacy for general academic performance did not predict completion, but self-efficacy for completing the MOOC, even before commencing, did (Wang & Baker, 2015). As has been established in the literature, completion is not a valid measure of learning in a MOOC (Hood & Littlejohn, 2016), so it should not be surprising that no link was found between general academic self-efficacy and completion. The other main finding, a link between confidence about completing the MOOC and actual completion, was more interesting. Though the study gave no information about participants' prior experience of MOOCs, it may be that these confident completers did have prior successful experiences in MOOCs. As mastery experiences are a source of self-efficacy (Bandura, 1997), if they had successfully completed, or learned in, a MOOC beforehand, this may explain their confidence in completing.

Another study found a link between personal context and confidence in academic ability. A study of 788 learners enrolled in a data-science MOOC found that individuals who were working professionally in the area of the MOOC topic had a higher degree of general academic self-efficacy than others enrolled in the MOOC (Hood et al., 2015). This finding is in line with the theory that prior success in a context (in this case, data science) is a source of self-efficacy (Bandura, 1997). The literature suggests that these professionals, who had a higher general academic self-efficacy than others, would be more likely to persist in the face of difficulties and successfully learn in the MOOC than others. A follow-up study revealed two domains of self-efficacy that may be influential to learning in a MOOC. Thirty-two self-identified data professionals were interviewed about how they learned in the MOOC (Littlejohn et al., 2015). This study found that the professionals who scored highest for their general academic self-efficacy had two things in common: prior professional experience of the topic and prior experience of learning in MOOCs.

These three studies suggest that domains of self-efficacy other than simply general academic self-efficacy may be important motivational factors for people who enrol in MOOCs. They also suggest that prior experience of studying in a MOOC and previous experience of the MOOC topic influence people's motivation to learn in a MOOC. More research is needed in this area to determine what self-efficacy beliefs are salient in determining how people learn in MOOCs. This is useful to study, as strategies could be used to boost MOOC learners' self-efficacy. For example, if prior experience of MOOCs

is a factor that increases self-efficacy for learning in MOOCs, then MOOC providers could create an orientation program to provide shorter MOOCs on easier subjects that would give new learners some successful experiences to boost their self-efficacy.

In sum, whilst the empirically based knowledge about self-efficacy in traditional learning contexts is well established, what is known the about the function of self-efficacy in online contexts is less developed, with little consensus on what constitutes this construct and how it should be measured. This inconsistency of approach to investigating self-efficacy in online contexts may have contributed to the inconclusive findings in this area. Though the study of self-efficacy is just beginning, early findings suggest that there are MOOC-specific domains of self-efficacy that need to be considered in future research; this could give rise to practical suggestions that may bolster MOOC learners' confidence in learning in this context.

2.7 Achievement Goals and Learning

Another construct that has developed in the social cognitive framework is *achievement goals*. An achievement goal "defines an integrated pattern of beliefs, attributions and affect that produces intentions of behaviour...represented by different ways of approaching, engaging in and responding to achievement-type activities" (Ames, 1992, p. 261). This aspect of motivation provides a way of understanding the patterns of behaviour that arise from personally held beliefs about what is important to achieve in learning contexts. Although the field of achievement goals has developed in different directions, and is the subject of considerable debate, as discussed earlier in this chapter, in this review four achievement orientations were of interest: *performance-approach goals* describe orientations focused on achieving positive assessments of performance; *performance-avoid goals* describe orientations aiming to avoid negative assessments of performance; *mastery-approach goals* describe orientations focused on mastering knowledge; and *mastery-avoid* goals describe orientations aiming to avoid an incomplete understanding or mastery of a topic.

The literature shows considerable lack of agreement over the benefits of some of these orientations. For instance, though originally a performance orientation was regarded as maladaptive (Dweck, 1986; Dweck & Leggett, 1988; Nicholls, 1984), some researchers

later proposed that performance-approach goals were beneficial for particularly capable learners (e.g. Midgeley, Kaplan, & Middleton, 2001). However, the view that there were no benefits flowing from a performance-avoid orientation was universally accepted (e.g. Elliot & Harackiewicz, 1996; Middleton & Midgley, 1997; Skaalvik, 1997). Mastery-avoid goals have received less attention in the literature, but have generally been depicted as maladaptive. However, like the performance-approach orientation, there may be some contexts in which it is beneficial to have a mastery-avoid orientation. For example, in one study in which 63 younger and 71 older adults performed a word task, the younger adults were found to favour a mastery-approach orientation, while the older adults tended towards a mastery-avoid orientation (Senko & Freund, 2015). A general depiction of mastery-avoid orientations as maladaptive may not hold for older learners, who may be concerned about loss of memory of cognitive abilities; for these learners, a mastery-avoid orientation was found to be an adaptive strategy (Senko & Freund, 2015). Clearly, the field of achievement-goal research is complex, and has developed in different directions with considerable lack of consensus. The complexity of the construct of achievement goals may itself be a hindrance to development in the field. For example, a meta-analysis of 243 achievement-goal studies found that researchers were using the same label to describe conceptually distinct constructs (Hulleman, Schrager, Bodmann, & Harackiewicz, 2010). There is no one simple model to explain how achievement goals motivate students, as there is with self-efficacy (Pintrich, 2003). However, despite some disagreement in the literature on the value of performance-approach goals, there is a consensus on the positive value of mastery-approach goals and the negative value of performance-avoid goals to motivation and learning. Empirical studies of achievement goals in higher-education contexts support these claims.

Mixed findings on influence of achievement goals in higher education

A review of achievement-goal literature in the context of higher education revealed contrasting views as to what achievement goals were beneficial to learning. In a study of first-year university students in psychology and educational-psychology courses, students who held mastery goals, even those whose perceptions of their ability was low, were more likely to use effective strategies, have a positive attitude to learning within the course and choose hard tasks than students who held performance goals or those who held academic-alienation goals (in other words, who were only concerned with expending minimum

effort) (Archer, 1994). This finding was in line with the established view in the literature that associated mastery goals with positive outcomes (e.g. Dweck, 1986; Grant & Dweck, 2003). However, this study also found that these positive outcomes were maintained even for students who simultaneously held both mastery and performance goals. This gave rise to the *multiple-goal* perspective, which was later supported by Barron and Harackiewicz (2001), who suggested that performance-oriented students should be encouraged to add mastery goals to their approach to learning, rather than to eliminate the performance orientation from their thinking. In fact, it may be beneficial to encourage both orientations. As Archer (1994) noted, having a mastery orientation may not be of much use for students who find a task dull or boring. In this instance, encouraging a performance orientation through, for example, a reward or competition may boost motivation.

Avoid orientations are maladaptive

Nevertheless, there is substantial evidence in the literature that performance-avoid and mastery-avoid orientations are maladaptive. In a series of studies of psychology students, mastery-avoid orientations were found to be linked to less adaptive behaviours than mastery-approach orientations, and performance-avoid orientations were associated with negative health outcomes (Elliot & McGregor, 2001). The assertion that avoid goals had deleterious consequences was supported in a study of undergraduates that found that avoid orientations were negatively linked with subjective well-being (Oertig et al., 2013). However, even though there is some agreement on avoid orientations – in particular the performance-avoid orientation –some findings offer a more nuanced view of how avoid pursuits function. For example, in a comparative study of North American and Japanese-born students at a Canadian university, Hamamura (2008) found that motivation was enhanced if participants' culturally induced inclinations towards either approach or avoid orientations were activated. Specifically, this study found that the East-Asian students were more motivated by avoiding negative consequences of a learning task at hand, due to their cultural concern with avoiding losses, whereas Western students were more motivated by the potential positive consequences, due to their orientation to achieve positive assessments of their performance. These findings highlight the contextual nature of achievement goals and how shared cultural values influence what is valued in specific situations. Similarly, mastery-avoid goals may be appropriate for older learners who may be concerned about loss of memory and cognitive function (Senko & Freund, 2015). In contrast to considerable

coverage of achievement goals in traditional higher-education settings, few empirical studies have examined online contexts.

Achievement goals in online environments – a new frontier

Studies of achievement goals in online settings confirm the view that performance-avoidance orientations are deleterious to learning, whilst mastery orientations enhance learning. For example, a study of students enrolled in a laptop-based nursing program in which web-based technologies played a key role found that the performance-avoid orientation was linked to lower achievement (Goldsworthy, Goodman, & Muirhead, 2005). Other recent studies have supported the view that mastery goals are of more benefit to social learning in online contexts than are performance goals. A study of medical students using an online environment for problem-based learning found that mastery-approach students were more willing to engage in collaborative learning than others, whilst performance-approach students were less inclined to do so (Abercrombie, Parkes, & McCarty, 2015). The beneficial nature of mastery goals for social learning was confirmed in a study of 132 college students enrolled in an online instructional-technology course (Xie & Huang, 2014). Mastery-oriented students were found to engage more with others online, to more frequently undertake offline-learning activities and to perceive more benefit from collaboration with others than performance-avoid students, who engaged less with others and did only what was required.

Some studies of achievement goals have found that students with mastery goals behave in surprising ways. One study of 216 first-year educational science undergraduates in an online setting in which online support tools were available found that students with mastery goals used online support tools less than performance-goal students (Clarebout & Elen, 2009). Another study of 49 psychology students solving statistics problems in an online environment found that there was no relationship between mastery goals and the use of online text-based help (Huet, Escribe, Dupeyrat, & Sakdavong, 2011). These findings were somewhat unexpected, given that a mastery orientation is associated with increasing understanding of the subject matter, and help-seeking, in the form of readily available online tools, would be considered an appropriate strategy for such a goal. In this study, students with high mastery goals were also found to have a high sense of autonomy. This suggests that students in online environments with a mastery orientation may want to work things out for themselves. It was unclear if the online environment had something to do

with why mastery-goal students tended not to use readily available and tailored online tools to aid their learning. Would they behave the same way in a traditional classroom context? More research is required in this area.

Achievement goals in MOOCs – uncharted territory

The study of achievement goals in MOOCs, like that of self-efficacy, is only beginning. In this review only two empirical studies were discovered. Both of these studies applied only one of the achievement goal orientations: mastery goals. De Barba, Kennedy and Ainley (2016) found that mastery goals, as part of a larger construct of motivation that also included factors of value beliefs and individual interest, were related to participation and final grades in the course. Though this study extended what is known about the importance of motivation to learning in the context of MOOCs, it provided little information about how performance goals may influence learning in MOOCs. For example, how do learners with a performance-avoid orientation, which is widely regarded as being inimical to learning, perform in a MOOC? Another study found no relationship between motivation and completion in a MOOC. Wang and Baker (2015) found that neither mastery goals nor general academic self-efficacy were predictive of completion. MOOCs attract learners with a wide range of experience and backgrounds (DeBoer, Ho, Stump, & Breslow, 2014) who are not all intent on completion (Kizilcec et al., 2013). For this reason, the finding from Wang and Baker (2015) says nothing about the relationship between mastery goals and learning in a MOOC. How achievement goals play out in the environment of a MOOC at a contextual and qualitative level is unknown. A qualitative approach may provide insights into how learners of differing achievement orientations behave in MOOCs. As it is relatively easy to influence students' achievement orientations in online contexts (Pintrich, 2003), this would be a useful area to study.

The construct of achievement goals, as developed in the social cognitive framework, theorises that human learning is influenced by personal, behavioural and environmental factors that are linked in triadic reciprocal causation. However, nearly all of the studies in this review of the achievement-goal literature have investigated achievement goals using quantitative approaches that have provided little information about how such goals are influenced by internal and external factors. For a start, it would not be hard to conceptualise that a student's achievement goals change throughout a course as their perceptions and concerns change. It may be that qualitative approaches may help provide a new way of

understanding achievement goals in the various contexts of students' learning. In terms of online learning, and especially in the context of MOOCs, little has been written about how achievement goals influence learner behaviour.

2.8 Conclusion

This chapter presented the theoretical framework of the present study, which was developed to address the overarching research question *How do people learn in a MOOC?* To provide detailed accounts of how people learned in a MOOC, this study was situated in a social cognitive theoretical framework. This paradigm enabled an investigation into how triadically reciprocating personal, environmental and behavioural forces influence human behaviour.

A review of the studies that investigated self-regulated learning in higher education and online contexts confirmed the consensus view that this capability is linked to achievement and can be improved through interventions. Only a handful of studies investigated how people regulate their learning in MOOCs. Early findings from this field suggest that the individual's context and the MOOC itself are important factors in how learners self-regulate. The majority of self-efficacy and achievement-goal studies have been quantitative in approach and conducted in the context of traditional classrooms. Relatively little is understood about how these aspects of motivation qualitatively influence learning in online contexts. In the context of MOOCs, nothing is known on a qualitative level about how self-efficacy and achievement goals influence a person's learning.

The studies in these three reviews investigating learning and motivation in MOOCs from a social cognitive perspective have provided a complex and incomplete picture of learning in a MOOC. This study aimed to address this gap in the literature by applying a social cognitive perspective in generating detailed accounts of how people of differing backgrounds learned in a MOOC.

CHAPTER THREE: METHODOLOGY

This study investigated how people learned in a MOOC. Specifically, it aimed to answer the following research questions: (1) *Who enrols in MOOCs and what are their characteristics?*; (2) *How do learners self-regulate in a MOOC?*; and (3) *What outcomes do MOOC learners achieve?* The methodology presented in this chapter details how the study was conducted to answer these questions.

This chapter begins by describing how the theoretical framework for this study, in particular the triadic model of self-regulated learning (Zimmerman, 1989), informed the research strategy. This is then followed with a presentation of and rationale for the study's mixed-methods approach to sequential-explanatory design, and its research context. The chapter then describes the methods used in this study and the six-step model used to analyse the data (Creswell & Plano Clark, 2011), which accommodated quantitative and qualitative data and the mixing of findings.

3.1 Application of the Theoretical Framework

As discussed in Chapter Two, this study was situated within a social cognitive theoretical framework. This conceptualisation provided a means of investigating the internal and external influences on human behaviour in its context. The theoretical lens through which individuals' learning in the MOOC was investigated was the social cognitive construct of self-regulated learning, which describes how people self-generate thoughts, feelings and actions, and adapt these when necessary in the pursuit of personal goals. Though there are numerous distinct conceptualisations for how self-regulated learning functions, this study selected the *triadic forms of self-regulation* model (Zimmerman, 1989), which describes how a person regulates their learning in response to the interlinked and reciprocally influencing forces of personal, behavioural and environmental factors. This model was selected because it acknowledges the role of external influences on learning; in this case, the environment within and outside the MOOC. As this model closely mirrors Bandura's original model of *triadic reciprocal causation*, which underpins social cognitive theory (Bandura, 1986), it also accommodated other social cognitive constructs that were of interest in this study: self-efficacy and achievement goals. The triadic model of self-

regulated learning applied in this study and the relationship of personal, environmental and behavioural factors in triadic reciprocal causation are shown in Figure 4.

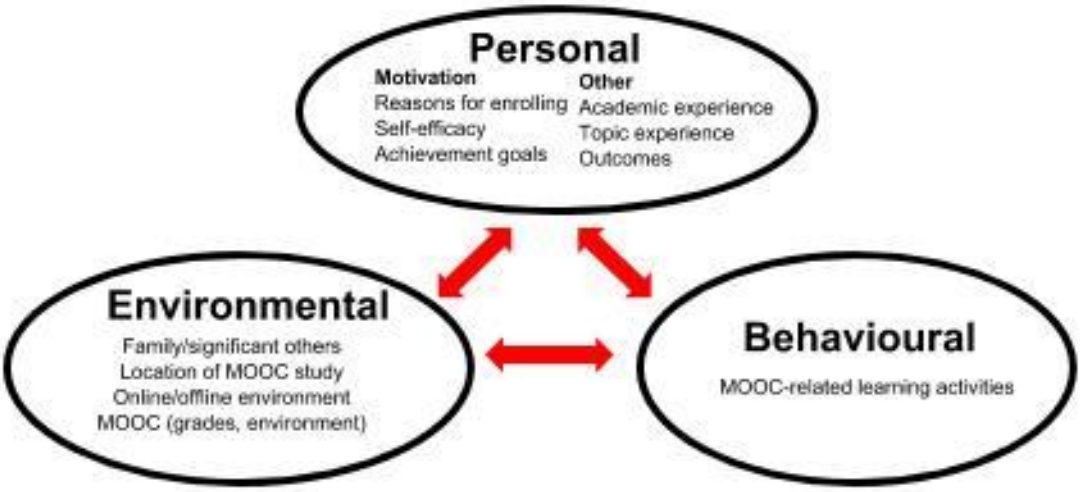

Figure 4. The triadic model of self-regulated learning operationalised in this study and associated factors investigated (adapted from Zimmerman, 1989, p. 330)

The triadic model of self-regulated learning applied in this study enabled the study of personal, environmental and behavioural factors, and how these factors influenced each other and the individual during MOOC study. *Personal* factors related to aspects of motivation as well as other personal factors (Figure 4). *Environmental* factors related to social and physical forces outside the individual, such as family and significant others in school years, the environment in which MOOC study took place and the MOOC itself, the tasks within it and feedback on performance provided to the learner through assessment results. *Behavioural* factors related to what individuals actually did in the MOOC: how they managed their time, structured their study sessions, interacted with content and took notes, what they did when they encountered difficulties and how they interacted with others within and outside the MOOC.

This theoretical framework also accommodated differing conceptualisations of self-regulated learning. As discussed in Chapter Two, some researchers have proposed models of self-regulated learning that highlight its dynamic nature, and examine what happens when a person self-regulates (e.g. Boekaerts & Niemivirta, 2000; Schunk & Zimmerman,

1998), and others have focused on its structure and constituent parts (e.g. Boekaerts, 1997). The triadic model of self-regulated learning (Zimmerman, 1989) used in this study allowed for both conceptualisations, by allowing for an investigation of how the three types of factors influenced each other and the individual (a dynamic view), and of personal, environmental and behavioural aspects of an individual's self-regulated learning (a structural view). The theoretical underpinning of the triadic model of self-regulation accommodated data from multiple sources and allowed flexibility in interpreting that data. For example, the analysis framework for this study consisted of personal, behavioural or environmental categories, and thus enabled the interpretation of evidence through a social cognitive perspective.

3.2 Methodology

Research approach

This study adopted a mixed-methods approach to investigate how people learned in a MOOC. Creswell et al. (2003) defined mixed methods as the collection and analysis of quantitative and qualitative data in sequential or parallel phases, the assigning of priority to one or the other of these phases and the integration of data from both phases. The mixed-methods approach is becoming increasingly common in social-science research, and is regarded by some as the *third major research paradigm* (Bryman, 2006; Johnson & Onwuegbuzie, 2004; Johnson, Onwuegbuzie, & Turner, 2007). Mixed-methods research is recognised as a pragmatic and eclectic approach that can frequently result in superior research compared to a mono-method approach (Johnson & Onwuegbuzie, 2004) and for its value in providing information in its context (Creswell, Plano Clark, Gutmann, & Hanson, 2003).

Mixed-methods research has not always been accepted. In the past, in what has become known as the paradigm wars, researchers argued over the superiority of their approach, be it quantitative or qualitative, and incompatibilities between them (Johnson & Onwuegbuzie, 2004). This debate centred on differences between the epistemological underpinnings of the two approaches. Quantitative approaches emanated from a position of objectivism, which states that an independent reality exists and is knowable, whilst qualitative approaches emanated from that of constructivism, which states that there is no

independent knowable reality, as reality is a social construction (Gray, 2013). Since these philosophical positions were irreconcilable, so was the idea of mixing methods. In recent times the differences between the two approaches have not been perceived as irreconcilable for researchers who adopt a pragmatic epistemological stance, which states that both positions can coexist (Johnson et al., 2007). A pragmatic position respects the differences between the two approaches but gives priority to the research problem being investigated and uses methods appropriate to addressing that problem.

The pragmatic nature of mixed-methods research was well suited to the research problem this study was addressing. Given the difficulty of observing how people actually learned in a MOOC, this study required data from as many sources as possible to form a credible picture of what this phenomenon looked like. Mixing methods allowed for the collection of data using many methods and the integration of data from different sources to generate detailed and nuanced accounts of how people learned in a MOOC. According to Yin (2006) and Bryman (2006), the main risk of mixing methods is in not integrating the data, but in effect conducting separate qualitative and quantitative studies. To minimise this risk in this study, data collected from multiple sources was displayed in a spreadsheet that provided a visual means of connecting quantitative and qualitative data. Based on this integration of data, written summaries were recorded within cells on factors of interest. For example, summaries about each participant's self-efficacy were recorded in cells within the table that mixed evidence from quantitative and qualitative sources.

Research design

The mixed methods approach that this study adopted was realised in the form of a *sequential-explanatory* design. This is the most straightforward of mixed-methods designs, as its ease of implementation makes it easy to report (Creswell & Plano Clark, 2011). It involves the collection of quantitative and qualitative data in independent phases in a sequential manner and the integration and interpretation of data at least once in the study (Creswell & Plano Clark, 2011). The study commenced with a collection and analysis of quantitative data (Phase 1), then proceeded to the collection and analysis of qualitative data (Phase 2) (Figure 5).

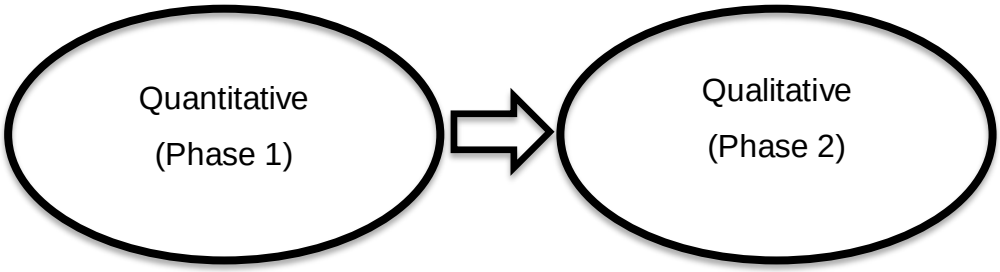

Figure 5. The sequential-explanatory design

This mixed methods study of sequential explanatory design was substantively qualitative in approach. The priority assigned to the qualitative phase of the study was appropriate for answering *how*-type questions, such as *how do learners self-regulate in a MOOC*? The dominance of the qualitative phase was also reflected by the larger amount of data collected and research time spent in Phase 2 than in Phase 1, as shown in the data-collection and methods flowchart in Figure 6.

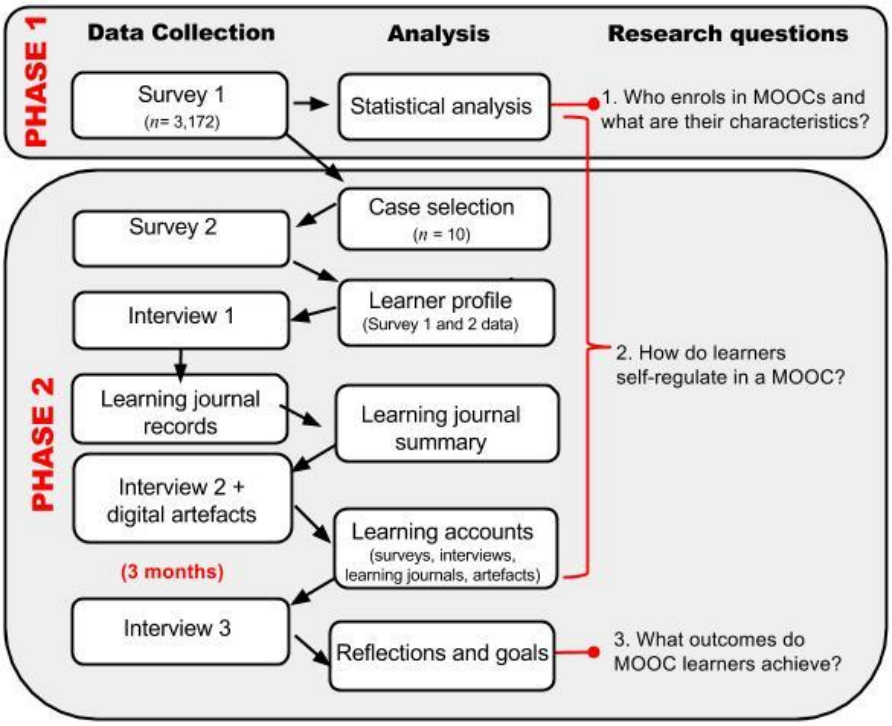

Figure 6. Data collection and analysis methods over Phase 1 and Phase 2 and associated research questions.

In Phase 1, an online questionnaire (Survey 1) was used to collect data from MOOC enrolees. Statistical tests were then conducted on this data to answer the first research

question, *who enrols in MOOCs and what are their characteristics?* The data collected in Survey 1 was also used to purposively select the cases for Phase 2. Other MOOC studies that used a survey in a similar way to purposively sample participants for a subsequent qualitative investigation involved the selection of healthcare professionals in a health-sciences MOOC (Milligan & Littlejohn, 2014), and the selection of data professionals in a data-science MOOC (Littlejohn et al., 2015). In Phase 2, research participants were asked to complete a second questionnaire (Survey 2). Although questionnaires are typically associated with quantitative approaches, at this point, data from both surveys was treated qualitatively to form preliminary case profiles for each participant. These learning profiles guided the discussion in the first interview (Interview 1). Phase 2 took the form of a multiple-case study (n=10). Throughout the MOOC participants were asked to record details of their learning in a learning journal. This data formed the basis for discussion in the second interview (Interview 2). Data collected from Interview 2 was mixed with other evidence to answer the question *how do learners self-regulate in a MOOC?* Participants were interviewed for a final time (Interview 3) three months after the end of the MOOC. Data collected from Interviews 2 and 3 was used to answer the question *what outcomes do MOOC learners achieve?* Participants were asked to reflect on the outcomes they achieved in the MOOC and to talk about plans.

Though this this study ostensibly proceeded in two separate phases using instruments designed for this purpose by the researcher, at the end of the MOOC, survey and server log data collected through the edX platform, was incorporated into the analysis. This provided information about total enrolments in the MOOC and the number of certificates awarded.

Ethics approval

Prior to implementation of the research design, approval was secured from the *Faculty of Human Sciences Human Research Ethics Sub-Committee* at Macquarie University, Sydney, Australia (Reference 5201300798 approved 5/12/2013, see Appendix A).

Pilot study

A pilot study was conducted with four volunteer participants prior to the main study. The only criterion for selection was enrolment in a MOOC or online course at the time of the pilot study. These participants were sourced through professional contacts. Two were

enrolled in a MOOC on statistics and one in a MOOC on cooking. The fourth participant was enrolled in an online professional-development course. Though this was not a MOOC, it was adequate for the purposes of this pilot study, as it was a wholly online course and the instruments and interview protocols being tested also applied to online courses in general.

Data-collection methods and procedures were tested with these four participants. Surveys 1 and 2 were also tested with the participants for clarity of items and the logistics of online delivery. The test participants were interviewed to check the established and ad-hoc questionnaire items for clarity and validity. It was noted that some survey items from the AGQ-R (Elliot & Murayama, 2008) that contained double negatives (such as *I will try to avoid performing worse than others*) were difficult to understand. Though Johnson and Christensen (2000) advised against the use of double negatives in questionnaires for this reason, these items remained unchanged, as they were derived from established instruments that had been validated and widely used in the educational research. Some minor changes were made to improve the clarity of the ad-hoc items developed specifically for this study. The semi-structured interview protocol was revised in this process, and the recording of Skype interviews was tested with a test participant who lived overseas.

3.3 Research Context

This study was conducted in *Introduction to Biomedical Imaging*, a 10-week MOOC provided by an Australian university on the edX platform in 2014. The course syllabus document described the course as providing "an introduction to the physics and engineering of modern imaging modalities and an introduction to how these modalities are applied in neurological disease, degenerative disease, reproduction and oncology" (p.3). As stated in the course document, it was designed with two audiences in mind. The basic course was designed for learners who had completed high school and studied science subjects such as biology, physics and chemistry. The advanced course was for learners who had studied first-year university-level mathematics or computer science specialising in modelling. Health professionals wishing to update their knowledge about medical imaging post-processing as part of their own professional development were also identified as a target audience for the advanced course. The course was delivered wholly online (Figure 7).

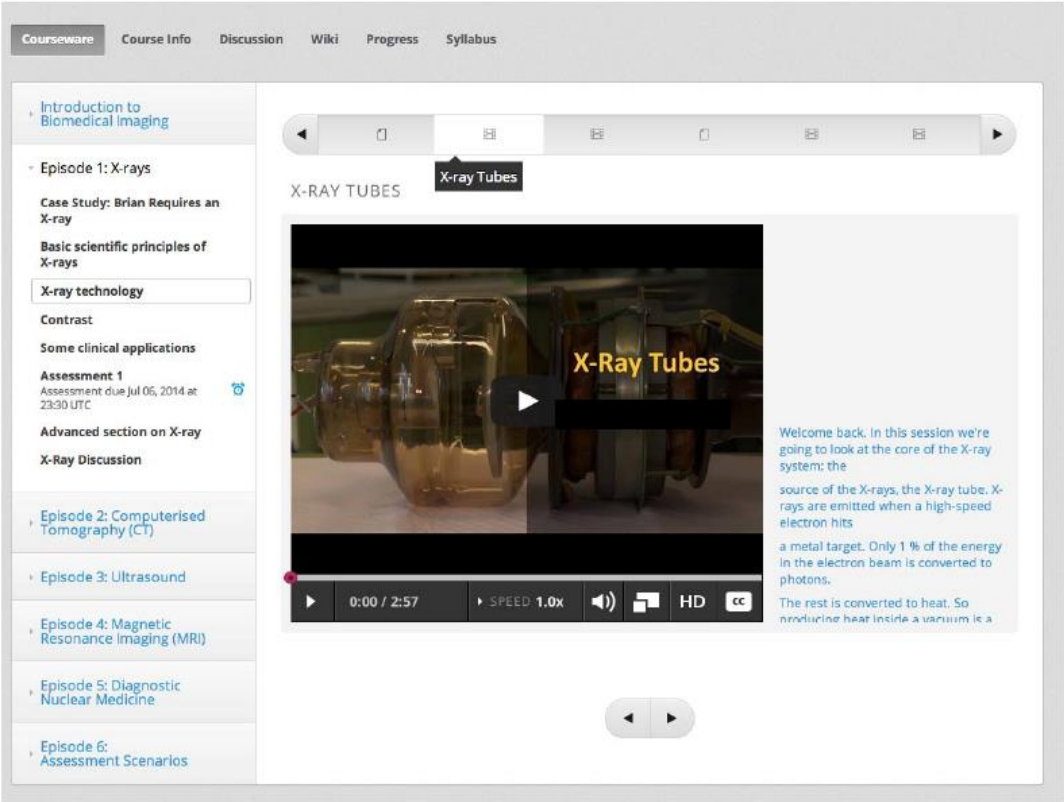

Figure 7. Screenshot of *Introduction to Biomedical Imaging* MOOC environment showing episodes on left-hand menu and sub-sections of Episode 1: X-Rays

The course consisted of online content, in the form of videos and screen-based readings, a discussion forum, a wiki and a progress screen for students to view their assessment results. Each episode featured at least one university teacher delivering content through video presentations, and was accompanied by screen-based readings, images and formative quizzes. Course content was released at set times (Table 2).

Table 2

Content Delivery and Assessment

Week	Section	Assessment[a] (weighting)
1	Introduction to Biomedical Imaging	
1	Episode 1: X-Rays	Assessment 1 (18%)
3	Episode 2: Computerised Tomography (CT)	Assessment 2 (18%)
4	Episode 3: Ultrasound (U/S)	Assessment 3 (18%)
6	Episode 4: Magnetic Resonance Imaging (MRI)	Assessment 4 (18%)

Week	Section	Assessment[a] (weighting)
8	Episode 5: Nuclear Diagnostic Medicine (NDM)	Assessment 5 (18%)
9	Assessment Scenarios (2)	Final assessment (10%)

Note. [a]All assessments were due in Week 13.

The course consisted of five episodes that had a staggered release. To complete the course, learners were given one attempt to complete seven automated multiple-choice quizzes: one for each episode and two assessment scenarios. The syllabus document advised that learners had to achieve an overall mark of 50% and have completed all the assessments within three weeks of the end of the course to pass and earn a certificate.

3.4 Phase 1 Data Collection

In Phase 1, MOOC enrolees were invited to complete an online questionnaire (Survey 1, Appendix B), which was constructed in the Qualtrics online-survey system. Survey 1 collected data on respondents' demographics and personal characteristics. Findings from an analysis of survey data answered Research Question 1, *Who enrols in MOOCs and what are their characteristics?* As MOOCs typically attract large numbers of online students, the questionnaire was deployed online so that respondents could complete it while they were engaging with the course. One of the advantages of a questionnaire is its effectiveness in collecting data from many people very quickly (Gillham, 2008), making it the obvious choice in this instance. As response rates can be low for voluntary questionnaires (Gillham, 2008), particular care was taken to ensure that the questionnaire was not too long. To encourage enrolees to complete the questionnaire, they were advised of the purpose of the study and the length of time it would take to complete the questionnaire, and that their responses would be anonymous.

Invitations to complete Survey 1 were sent to enrolees by email through course announcements. These invitations were sent six times throughout the course until week 8 of the MOOC, and advised potential respondents about the nature and purpose of the research and the researchers involved, and that the study had been granted ethics approval. Survey 1 consisted of three sections. The first two sections involved data collection for Phase 1; the third section enabled the recruiting of cases for Phase 2.

Demographic and personal characteristics

The first section of Survey 1 contained ten questions that collected data on respondent demographic and personal characteristics (Table 3). These survey items were developed with reference to papers investigating participation and demographics (Koller & Ng, 2013; Nesterko et al., 2013), learner intentions (Kizilcec et al., 2013; Koller et al., 2013) and reasons for enrolling (University of Edinburgh, 2013). Three original items were developed to collect data on respondents' perceived expertise in online learning (item 6), topic familiarity (item 8) and topic experience (item 9).

Table 3

Survey 1: Demographic and Personal Characteristics

Id.	Question (response options)
1	How old are you? (17 or under | 18-25 | 26-35 | 36-45 | 46-55 | 56-65 | 66 or over)
2	What is your gender? (Male | Female)
3	In which country do you reside? (List of 195 countries)
4	What is the highest level of education you have completed? (Less than High School | High School | College or Vocational Qualification | Bachelor's Degree | Masters Degree | Doctoral Degree)
5	Are you a native English-speaker? (If YES, skip to Item 6, If NO proceed to Item 5a)
5a	Which of the following statements best describes your level of English? (My English is not very good. |My English is good but I might find studying at an English-speaking university difficult. | I am sure my English is good enough to study at an English-speaking university. | I have an IELTS or TOEFL score that is high enough to get into an English-speaking university.)
6	Learning that takes place over the Internet is called online learning and can range from casual, like learning how to knit by watching a YouTube video, to formal, like participating in online discussions as part of a course at school or university, to structured like the Introduction to Biomedical Imaging course you have signed up for. How would you rate your expertise as an online learner? (1-7 Likert scale: 1 = novice, 4 = neutral, 7 = expert)
7	People who register for these types of courses have different reasons for doing so. Select your main reason for enrolling for this course. (I'm still at school. I'm thinking about biomedical imaging as a career. | I'm just curious about online learning. | To get learning opportunities not otherwise available to

Id.	Question (response options)
	me. | To advance my career. | To earn a certificate. | To participate in an online community. | To continue learning throughout my life. | To better serve my community. | To advance my formal education. | Other – please describe in a few words.)
8	How familiar are you with the course topic Biomedical Imaging? (Not at all familiar | Slightly familiar | Somewhat familiar | Very familiar | Extremely familiar)
9	My experience of imaging is: (As a patient or relative of a patient | As a technologist, who has made imaging my career | As a health professional, who uses imaging | As a student, for whom imaging is part of the requirements of my course | As a television-drama viewer | As a teacher on the look-out for new course material | Negligible. I just have a general interest in it.)
10	How much do you intend to do in this course? (I'm planning to do everything so I can get a certificate. | I'm planning to do everything but I don't care about getting the certificate. | I'm planning to watch all the lectures and I might do some of the assessment tasks. | I'm planning to watch all the lectures but that's all. | I'll probably watch some videos, but that's all. | I'm not sure how much I will do in the course.)

As shown in Table 3 nine of the 10 items in this section were closed. As the people who enrol in MOOCs have been found to have diverse backgrounds (DeBoer et al., 2013), item 7: reason for enrolling, provided an open-response option that allowed respondents to type in their own reason.

General academic self-efficacy and achievement goals

The second section of Survey 1 consisted of five scales of 20 closed items that measured aspects of respondents' general academic self-efficacy and achievement-goal orientations. The scale items asked respondents to rate themselves against a personal statement such as *I expect to do well in this course* on a seven-point Likert scale in which 1 = *Not at all true of me*, 4 = *Neutral* and 7 = *Totally true of me*. As all of these scales had been developed for use in traditional classrooms, some of the items were slightly modified to suit the research context.

All eight items from the *self-efficacy for learning and performance* scale from the MSLQ (Pintrich et al., 1991) were used in this section. This scale measured respondents' confidence about learning and performing tasks in academic contexts (Table 4).

Table 4

Self-Efficacy for Learning and Performance Scale Items

Id.	Personal Statement
11	I believe I will receive an excellent grade in this course [class].[a]
13	I'm confident I can understand the most complex material presented by the instructor in this course.
15	I'm certain I can master the skills being taught in this course [class].[a]
17	I'm confident I can understand the basic concepts taught in this course.
18	I expect to do well in this course [class].[a]
20	Considering the difficulty of this course, the teacher, and my skills, I think I will do well.
21	I'm confident I can do an excellent job on the assignments and tests in this course.
29	I'm certain I can understand the most difficult material presented in the readings for this course.

Note. [a]Modified to suit research context, showing original in brackets.

According to Pintrich et al. (1991) this scale reported good internal consistency with a Cronbach's alpha coefficient of .93. In this study the scale was equally reliable, with a coefficient of .92.

The Achievement Goal Questionnaire-Revised (AGQ-R) (Elliot & Murayama, 2008) provided four scales measuring the constructs of *performance-approach*, *performance-avoid*, *mastery-approach* and *mastery-avoid* goals (Table 5).

Table 5

Achievement-Goal Scale Items

Performance-Approach Goals	
16	I will try [am striving] to do well compared to other students.[a]
19	My aim is to perform well relative to other students.
25	My goal is to perform better than the other students.
Performance-Avoid Goals	
22	My goal is to avoid performing poorly compared to others.
24	My aim is to avoid doing worse than other students
28	I will try [am striving] to avoid performing worse than others.[a]
Mastery-Approach Goals	
12	I will try [am striving] to understand the content of this course as thoroughly as possible.[a]
25	My goal is to learn as much as possible.
27	My aim is to completely master the material presented in this course [class].[a]
Mastery-Avoid Goals	
14	I will try [am striving] to avoid an incomplete understanding of the course material.[a]
23	My goal is to avoid learning less than it is possible to learn.
30	My aim is to avoid learning less than I possibly could.

Note. [a]Modified [original in brackets]

Some items were modified to simplify the language for non-native English-speakers (e.g. *I will try* for *I am striving*). All the scales reported good internal consistency. For performance-approach goals, performance-avoid goals, mastery-approach goals and mastery-avoid goals, Cronbach's alpha = .92, .94, .84 and .88 in the original study (Elliot & Murayama, 2008) and .86, .91, .92 and .72 in this study respectively.

Case selection

The third section of Survey 1 was used for case selection. Respondents were advised of the requirements of participation and that involvement in the research would have no bearing on their grades or records in the MOOC. They were also informed that, if selected, they would receive a $100 Amazon gift card in appreciation for their time and contribution to the study. The researcher considered this an appropriate acknowledgement of the time

and effort required. Respondents who indicated their interest in participating were deemed eligible for selection based on their self-reported age, English-speaking competence and course-completion intentions.

3.5 Phase 1 Data Analysis

The analysis procedures for data collected in Survey 1 conformed to a six-step model as proposed by Creswell and Plano Clark (2011), which provided the benefit of accommodating quantitative and qualitative approaches. In the quantitative-analysis phase, these steps proceeded sequentially (Table 6).

Table 6

Phase 1 Analytical Steps and Activities

Analytical Step	Activities
1. Preparing data for analysis	Downloaded data from Qualtrics server and stored in Phase 1 data folder in Dropbox, imported data into SPSS and cleaned, recoded complex variables.
2. Exploring the data	Calculated mean scores for scale items, conducted descriptive analyses for all variables, looked for trends and distributions.
3. Analysing the data	Tested relationships between variables of interest using ANOVA, MANOVA, chi-square T tests.
4. Representing the data analysis	Displayed results in tables and statements of results.
5. Interpreting the results	Explained how results address research questions and how these results compared to the literature.
6. Validating the data and results	Reported external measures of validity of measures using Cronbach's alpha coefficient, identified limitations.

Data preparation

The data collected in Survey 1 underwent several procedures to prepare it for analysis. This involved downloading, cleaning and storing the data, then recoding the two variables. Returned questionnaires were downloaded from the Qualtrics server three weeks after the course ended, as the MOOC allowed enrolment up until that time. The data was stored in

a Phase 1 data folder in a password-protected, cloud-based file-hosting service and then imported into SPSS, a computer-based application for statistical analysis, where it was cleaned. Empty, repeat and incomplete questionnaires were removed from the data set. A questionnaire was designated as incomplete if the respondent had completed less than 85% of Section 2. This left 3,172 cases as the sample that underwent a statistical analysis, a response rate of 22.3% from a population of 14,219 enrolees. Although this response rate may be considered high for a questionnaire, it must be noted that as individuals had elected to complete the questionnaire on a voluntary basis, they were not likely to be representative of the total population. As it has been found that a fair proportion of people who enrol in MOOCs do not even watch the first video (Koller et al., 2013), the Survey 1 respondents were more likely to be representative of the subset of the MOOC population who were engaged rather than the whole population.

Two Survey 1 variables were recoded. Item 7 asked respondents to indicate their reason for enrolling and provided nine closed and one open option. As 196 respondents had typed in their own reason for enrolling, these responses were compiled into a table and analysed and assigned to existing or new codes. Twelve of the “Other” responses were assigned to six of the existing codes, and 184 of the “Other” responses were assigned to 13 new codes. At the end of this process 22 distinct sub-categories of reasons were identified (Appendix C). These were then grouped according to their similarity and assigned to one of four main reason categories (Table 7). The original 22 sub-categories of reasons and the “Other” responses within them point to a rich diversity of reasons for enrolling in the MOOC. Though there was a loss of data richness in collapsing the 22 sub-categories into four categories, the simplification of this variable would assist in interpreting the results of the planned statistical tests.

Table 7

Reason for Enrolling (n= 3,171)

Reason for Enrolling (*n*)	Sub-Categories (*n*)
Career (922)	To advance my career. (632)
	I'm still at school. I'm thinking about biomedical imaging as a career. (224)
	Thinking of a career change to this field. (19)[a]
	Interest in course content or design. (6)[a]
	To support my work. (35)[a]
	Requirement for CPD. (6)[a]
Formal Learning (790)	To advance my formal education. (623)
	To earn a certificate. (86)
	To support my formal learning. (63)[a]
	To support future studies. (12)[a]
	Relates to my PhD research. (6)[a]
Informal Learning (1,382)	To continue learning throughout my life. (899)
	To get learning opportunities not otherwise available to me. (370)
	I'm just curious about online learning. (71)
	To participate in an online community. (8)
	To help understand personal health issues. (6)[a]
	Interest in topic. (23)[a]
	To improve my English. (4)[a]
	For fun. (1)[a]
Service to Others (77)	To better serve my community. (74)
	To help teach others. (2)[a]
	To surprise others. (1)[a]

Note. [a] A new category of reason arrived at through analysis of open-text responses.

Item 10 in Survey 1 was also simplified. The original item asked respondents to indicate how much of the course they intended to do and provided them with six options. It has been found that some engaged learners in MOOCs adopt flexible approaches to learning in a MOOC that follow non-traditional learning trajectories (Kizilcec et al., 2013). Response options for item 10 were therefore collapsed into categories of intention to accommodate these differences (Table 8).

Table 8

Course Intention

Intention	Original Response Option
Completion	I'm planning to do everything so I can get a certificate.
High Flexible	I'm planning to do everything but I don't care about getting the certificate. I'm planning to watch all the lectures and I might do some of the assessment tasks. I'm planning to watch all the lectures but that's all.
Low Flexible	I'll probably watch some videos, but that's all.
Undecided	I'm not sure how much I will do in the course.

Respondents who intended to do everything in the course to complete it in the traditional sense were assigned to the *completion* category, those who intended to substantively engage with the course but in a flexible way were assigned to *high flexible* and those who had less substantive course intentions were assigned to the *low flexible* category. As a fair proportion of people who enrol in MOOCs have been found to not even watch the first lecture (Koller et al., 2013) another category of intention, *undecided*, was created for respondents who had not yet committed themselves to how much of the course they intended to do. The simplification of this variable in this manner would assist in the testing of relationships of course intention to other personal characteristics, such as prior experience of the MOOC topic.

Data exploration

The means for the five established scale-item scores were calculated, and new variables created for each new value. A descriptive statistical analysis was conducted to calculate frequency distributions for all survey variables. At this point distribution curves were inspected to identify any trends in the data such as the average age of respondents, the most common nationalities represented and the proportion of respondents with university degrees. The results for each variable were recorded in tables, charts and descriptive summaries in separate Word documents.

Analysis and representation of results

The quantitative analysis aimed to identify where significant relationships between key variables lay. With this in mind, inferential tests such as one-way between-groups analyses of variance (ANOVA), multivariate analyses of variance (MANOVA) and chi-square tests of independence were conducted to determine such relationships. Examples of questions used to guide this investigation were: *Is there a relationship between academic experience and reasons for signing up for the course*? *What role does academic experience play in respondents' academic self-efficacy? How does prior experience of the MOOC topic influence course completion intentions?* The results of these tests were recorded in tables, charts and descriptive texts in separate Word documents. These inferential tests, though still somewhat exploratory at this stage, sought to provide information to answer the first research question: *Who enrolls in MOOCs and what are their characteristics?*

Interpretation and validation of results

Following on from the results of the preliminary inferential tests and the identification of significant relationships between variables, research questions were constructed to guide a report of the results in the first paper in this PhD thesis (Paper 1). This paper addressed the question *What role does prior experience of the MOOC topic have on respondents' motivation?* The reliability of the established scales in this investigation was reported using Cronbach's alpha coefficient for the original scale and the scale in the present study. The results were interpreted with reference to the literature and the limitations associated with the results of this quantitative investigation were identified.

3.6 Design of Phase 2: A Multiple-Case Study

The qualitative phase of the study (Phase 2) took the form of a multiple-case study: a qualitative approach that involves the study of multiple bounded systems (cases) over time through in-depth data collection from a multiplicity of sources and the reporting of case descriptions and themes (Creswell, 2007a). The case-study design is appropriate in situations when *how*- or *why*-type research questions are being asked, the researcher has little or no control over the behaviour of participants and the phenomenon under investigation is taking place contemporaneously (Yin, 2014). It was therefore appropriate for this study, which asked, *How do learners self-regulate in a MOOC?* The case-study design was appropriate as it enabled a detailed study of learners in their contexts. In

essence, the case-study design enabled the depiction of "episodes of nuance, the sequentiality of happenings in context, the wholeness of the individual" (Stake, 1995, p. xii).

Research participants

Participants for the multiple-case study were selected in the first two weeks of the course based on their responses in Survey 1. The cases were selected using stratified purposeful sampling, which is used to illustrate the characteristics of particular sub-groups and facilitate cross-case and cross-group comparisons (Patton, 2002). Respondents interested in participating in the study were asked to indicate their willingness at the end of Survey 1. To be eligible for selection, interested respondents needed to be over 18, competent English-speakers and intending to complete the course. These selection criteria were used for three reasons. First, this study limited its focus to adults, as MOOCs are primarily aimed at adults who seek to upskill or learn new skills by voluntary participation, rather than children or adolescents still involved in compulsory education. Second, participants had to have indicated that they were competent English-speakers. This was considered necessary as the course was delivered in English, and interviews would also be conducted in English. Participants who could speak English well would be able to provide more detail to their accounts of learning in the MOOC. Third, participants had to have indicated their intention to complete the course, as it was considered that learners with this intention would be more likely to remain in the study and provide more data than those who had other engagement intentions.

A candidate pool was formed based on these criteria, and members were assigned to groups according to their academic experience. As it has been found that the majority of people who enrol in MOOCs are highly educated (Christensen et al., 2013), it was important to select participants with less academic experience to provide an account of how these individuals fared in a MOOC. Eligible candidates were then grouped according to their reported highest level of education. Three groups were formed: Less Experienced (Less than high school, High school), Experienced (college or vocational qualification, bachelor's degree) and Very Experienced (master's or doctoral degree). Equal numbers of candidates were selected randomly from each group and formally invited to participate in the ongoing study.

Thirty-eight candidates were identified from their responses to Survey 1 and formally invited to participate in Phase 2. Invitees were sent emails with an information sheet attached (Appendix D) that informed them that the research had been granted ethics approval from Macquarie University and detailed their rights regarding privacy and withdrawal. Initially, 16 individuals indicated their formal consent via an online consent form (Appendix E). Attrition and incomplete data sets caused by erratic Internet connectivity in some participant countries reduced the number of cases with complete data sets to 10 for the whole study (Table 9).

Table 9

The Ten Cases

Pseudonym	Age	Residence	English Competence	Highest Education Level
Very Academically Experienced				
Walter	38	France	IELTS/TOEFL	PhD
Antonio	30	Spain	Good enough	PhD
Monica	25	Spain	Good enough	Master degree
Huseyin	44	Turkey	IELTS/TOEFL	Master degree
Academically Experienced				
Layla	26	Australia	Native speaker	Bachelor degree
Mariam	25	Sudan	IELTS/TOEFL	Bachelor degree
Federico	24	Venezuela	Good enough	College or Vocational
Less Academically Experienced				
Arjun	24	Ukraine	IELTS/TOEFL	High school
Anna	22	Bulgaria	IELTS/TOEFL	High school
Pablo	22	USA	Native speaker	High school

The 10 cases selected for the study reported a range of academic experience. Five of the non-native English-speakers in this study (Anna, Arjun, Mariam, Huseyin, Walter) reported that they had achieved a mark in either the International English Language Testing System (IELTS) or the Test of English as a Foreign Language (TOEFL) that was at university-entrance level. The other three cases (Federico, Monica, Antonio) indicated that their English was “good enough” to study at an English-speaking university.

3.7 Phase 2 Data Collection

In Phase 2, data was collected from multiple sources to form a detailed picture of how these 10 individuals learned in a MOOC in their own particular contexts. Information was collected through questionnaires, interviews, learning journals and digital artefacts. The collection of information from different sources is a key strength of case-study research, as it allows for the triangulation of data sources, which can enhance the reliability of the study (Yin, 2014). This was a key consideration in this study given the impossibility of qualitatively observing people in an online environment in different countries and different time zones. With this in mind, information was collected from various sources in which participants' behaviours, thoughts and contexts could be corroborated. For example, information from Surveys 1 and 2 was probed qualitatively in Interview 1, and evidence from the learning journal was corroborated in Interview 2. At the same time, analytic memos and insights were recorded in a research journal. Such insights were "part of field work *and* [original italics] the beginning of qualitative analysis" (Patton, 2002, p. 436). Another principle that can enhance the reliability of case-study findings is the use of a case-study database (Yin, 2014). All the data collected in this study was stored in digital form in case folders in a secure, cloud-based storage system. As the methods used in this study generated digital files in the form of video recordings, spreadsheets, word-processed documents and screen-shot images, this was a good fit for the process.

Survey 2

The research participants were asked to complete a second online questionnaire (Survey 2) that consisted of 29 seven-point Likert items derived from MSLQ scales (Pintrich et al., 1991). The scales used were *test anxiety*, which relates to an individual's feeling of unease about taking exams; *metacognitive self-regulation*, which refers to an individual's ability to think about their thinking and change it when necessary; *effort regulation,* which refers to an individual's capacity to regulate their attention and energy in the face of difficulties and distractions; and *time and study environment*, which refers to an individual's ability to manage time and their environment for optimal learning. These scales were selected because they had been found to be good predictors of academic achievement in the original study (Pintrich et al., 1991). Some items were modified to suit the research context (Table 10).

Table 10

Survey 2 Items

Test Anxiety Scale	
20	When I take a test I think about how poorly I am doing compared with other students.
14	When I take a test I think about items on other parts of the test I can't answer.
5	When I take tests I think of the consequences of failing.
12	I have an uneasy, upset feeling when I take an exam.
1	I feel my heart beating fast when I take an exam.
Metacognitive Self-Regulation Scale	
4	During class time I often miss important points because I'm thinking of other things. (REVERSED)
16	When reading for a class [this course], I make up questions to help focus my reading.[a]
19	When I become confused about something I'm reading for this class, I go back and try to figure it out.
10	If course materials are difficult to understand, I change the way I read the material.
9	Before I study new course material thoroughly, I often skim it to see how it is organised.
18	I ask myself questions to make sure I understand the material I have been studying in the courses I have taken in the past [this class].[a]
6	I try to change the way I study in order to fit the course requirements and instructor's teaching style.
3	I often find that I have been reading for class but don't know what it was all about. (REVERSED)
13	I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.
8	When studying for this course I try to determine which concepts I don't understand well.
11	When I study for a [this] class, I set goals for myself in order to direct my activities in each study period.[a]
15	If I get confused taking notes in class, I make sure I sort it out afterwards.
Effort-Regulation Scale	
27	I often feel so lazy or bored when I study for a [this] class that I quit before I finish what I planned to do. (REVERSED)[a]

28	I work hard to do well in a [this] class even if I don't like what we are doing.[a]
17	When coursework is difficult, I give up or only study the easy parts. (REVERSED)
29	Even when course materials are dull and uninteresting, I manage to keep working until I finish.
Time and Study Environment Scale	
25	I usually study in a place where I can concentrate on my course work.
23	I make good use of my study time for courses [this course].[a]
26	I find it hard to stick to a study schedule. (REVERSED)
2	I have a regular place set aside for studying.
21	I make sure I keep up with the weekly readings and assignments for courses I have taken in the past [this course].[a]
7, 24	In the courses I have taken, I attended classes regularly [I attend class regularly].[a, b]
22	I rarely find time to review my notes or readings before an exam. (REVERSED)

Note. [a]Modified to suit research context, showing original in brackets. [b]Repeated item.

Due to an error in the administration of the *time and study environment* scale in Survey 2, one item (*I often find that I don't spend very much time on this course because of other activities)* was omitted and another item was repeated as shown in Table 10. (Appendix F contains the complete questionnaire as delivered to participants). The responses for this repeated item were excluded from data analysis. This left seven items in this scale. As Survey 2 data was to be use used qualitatively rather than quantitatively, the omission of one item was not considered serious.

Returned surveys were downloaded from the Qualtrics server as PDFs and hard copies were inspected. Scale items' means were calculated and recorded in a spreadsheet along with the scale scores from Survey 1. The information collected in Survey 2 along with that from Survey 1 was used to form a preliminary case profile that informed lines of inquiry in the first interview with participants. In this way preliminary insights about the participants could be corroborated from two sources (Yin, 2014). This profile provided a description of each participant's background, including various preliminary findings about their motivation and learning.

Experience sampling using a learning journal

An online learning journal was used to sample the experience of the participants as they learned in the MOOC. The experience sampling method (ESM) involves the participant responding to a prompt at specific times and recording what they are experiencing at that time. The purpose of ESM is to collect information about the participants' subjective experiences in their natural environments; it has been used to study a range of phenomena such as daily activities, social interactions and psychological states (Csikszentmihalyi & Larson, 1987). As the duration of the MOOC was quite long at 10 weeks, an advantage of this method was that it allowed the collection of information about daily activities in a consistent way over a prolonged period of time, which has the potential to reveal infrequently occurring and difficult-to-observe events (Consolvo & Walker, 2003). Another consideration was that this method could reduce errors of recall due to the proximity of the record to the activity. Also, as the learning-journal records were shared with participants in Interview 2, the recorded details of activities, locations, thoughts and feelings had the potential to enhance the accuracy and richness of participants' accounts through the triggering of specific memories. Information collected through the learning journals was triangulated against that from Interview 2, which was the other source of information about how the participants learned in the MOOC, thus enhancing the credibility of the findings.

Studies using ESM have typically used electronic devices to emit a signal to subjects according to a random schedule, at which point they would record their experience (Csikszentmihalyi & Larson, 1987). This is an appropriate approach to studying a subject's experience over a prolonged period of time, but not appropriate for the study of a specific activity, such as learning in a MOOC, which itself occurs at random times. Therefore this study adopted an interval-contingent approach to sampling (Barrett & Barrett, 2001) whereby participants were sent a daily email and text reminder at a regular time, usually at the end of the day, asking to them to complete an online form if they had engaged with the MOOC on that day. These reminders contained a link to an online form built in Qualtrics (Appendix H contains a blank learning-journal form as delivered to participants). The form consisted of nine items, which asked the participant to record various aspects of that day's activity. Some of these items also provided an open-response option so as not to constrain the respondent to the fixed options (Table 11).

Table 11

Learning-Journal Items

Item	Variable	Details
1	Number of study sessions	Number of separate sessions, e.g. 3.
2	Total study time	Total number of study time in hours, e.g. 0.5 (30 minutes).
3	Time/s of day	What part of day or night study took place, e.g. morning 8:00am-12pm; afternoon 12:00-5:00pm; evening 5:00-11:00pm.
4	Location of study[a]	Where study took place on a single day, e.g. at home in private room; at my workplace; on public transport.
5	Learning activities[a]	All learning activities engaged in, e.g. watched videos; read course readings; worked on assignment.
6	Strategies for learning[a]	Strategies for learning used, e.g. I set myself some goals; I searched the forums for specific information; I made a plan or outline for an assignment. Also provided response option for no strategies (I did NOT use any strategies today for learning).
7	Difficulties experienced[a]	Any internal or external phenomena that made it difficult to study, e.g. a distracting physical environment (e.g. people, mobile phone(s), TV, etc.); a lack of motivation to study; a feeling that the course is too difficult. Also provided response option for no difficulties (*I did NOT experience any difficulties with studying today*).
8	Response to difficulties	Open response – how participant dealt with difficulties they had indicated in previous item.
9	Self-efficacy for completion	Confidence in completing the course. Seven-point Likert items where 1 = Not at all confident, 4=Neutral, 7= Totally confident.

Note. [a]Provided one open-response option.

The learning journal was designed to make its completion as efficient as possible to reduce the burden on the participant. For this reason nearly all of the items provided fixed-response options, with the addition of open-response options for items as shown in Table

11. The items in the learning journal asked the participants to record the personal, behavioural and environmental factors that related to their learning on the day of activity. One of the response options for item 5 was *Assessed others' assignments*. This option was redundant, as peer assessment was not part of the research context. The responses for item 6, which asked participants to select the strategies that they had used that day, were developed with reference to a study of self-regulated learning strategies in high-school students using interviews (Zimmerman & Martinez-Pons, 1986, 1988). Only one item required participants to type in a text answer: item 8 asked them to describe how they dealt with any difficulties they had experienced on the day. The intention behind this was to provide participants the freedom to answer this any way they liked, which might also provide some detail about their capacity to reflect on their learning.

Data from returned learning journals was downloaded and collated into a spreadsheet for each case on an ongoing basis throughout the MOOC. These learning-journal summaries (Appendix I) were sent to each participant at the end of the MOOC in preparation for Interview 2.

Interviews

Interviews were the most important source of information about learning in this study. The interview is one of the key data-collection methods in case-study research (Yin, 2014), and was an appropriate method for this study as it enabled the researcher to enter the participants' world to "capture the complexities of *their* [original italics] individual experiences and experiences" (Patton, 2002, p. 348). The interviews were conducted via Skype. To minimise the risk of absenteeism, which has been found to be a concern in Skype interviews (Deakin & Wakefield, 2014), participants were sent confirmation emails and texts a day before scheduled interviews. Interview guides were used to guide conversations rather than constrain the interview to a question-and-answer format (Yin, 2014). These interviews were guided by the idea that each participant had their own "special stories to tell" (Stake, 1995, p. 65) with regard to how they learned in the MOOC.

The interviews were recorded with Call Recorder, a Skype plugin. These files were professionally transcribed and copies of the transcripts were member-checked to confirm the accuracy of the transcripts. Member checking is a frequently used approach in qualitative research that enhances the validity of the data (Creswell & Plano Clark, 2011).

Interview 1 – informing, probing and building rapport

Interview 1 took place in the first three weeks of the course and served to inform the participants of the research requirements. It was also used to probe information gleaned from the two surveys and to build rapport between the researcher and participants. First, participants were advised that even if they did not complete the MOOC, they were still of research interest. This was considered an important point to make given the high attrition rate in MOOCs (Jordan, 2014). Second, the interview was used to probe information about participants taken from Surveys 1 and 2. Certain key items, such as reason for enrolling and course completion intention, were checked at this point. Information about participants' motivation and learning that had been obtained through survey responses was also investigated in this interview. For example, if a participant had indicated a strong orientation towards performance goals, the participant may have been asked a question like *What's more important to you in learning situations, getting better marks than your colleagues or understanding the subject? Why?* Finally, it was considered that these face-to-face interviews conducted via Skype, which would put a face to a name for both the researcher and participant, would help build rapport between the two parties. Considering the effort and responsibilities required to be a participant, this bond was considered important to enhance the trustworthiness and credibility of the data collected in Phase 2.

An interview guide was used in Interview 1 to structure the discussion (Appendix G) and ensure that the 30 minutes allotted to this procedure were used efficiently. The topics and questions shown in the interview guide were addressed in a flexible way in response to how the interview ensued; this allowed follow-up questions as topics of interest arose.

Interview 2 – eliciting detailed accounts of learning

The learning-journal summary served as a basis for discussion in Interview 2, which was conducted after each participant notified that they had either completed the MOOC or ended their participation. Data collected in this interview was used to answer the question *How do learners self-regulate in a MOOC?* Interview 2 was therefore allocated more time than the other interviews to enable participants to go into the experience in detail. Prior to the interview, participants were asked to print off the learning-journal summaries that they had been sent so it could be a common point of reference in the interview. An interview guide was developed for this discussion (Appendix J).

The first part of the interview was used to clarify anything from Interview 1 that remained unclear. This part of the interview was also used to probe some contextual factors that were emerging as being influential in learning for most or all participants. For example, each participant was asked to talk about their family and their experience of school, and if there was anyone who had influenced their learning in their school days. Then the interview turned to the experience of learning in the MOOC. The participants were asked general questions about their experience in the MOOC to provide them with an opportunity to give feedback on their experience. Participants were then asked to refer to the learning-journal summary and to recount specific instances of learning recorded in the learning journal that required explanation or elaboration. For example, a learning-journal record indicated four separate study sessions taking place on one day for a total of 28 minutes. Another record indicated a 240-minute study session without a substantial break. The participants who had made these records were asked to describe exactly what happened on these days. This line of questioning provided detail about the personal, behavioural and environmental factors that influenced each participant's learning in the MOOC. At the end of the interview, participants were asked to send digital artefacts from the course such as screen shots of course progress records and certificates (if these had been achieved). Other digital artefacts were also collected, such as scans or screen shots of study notes and schedules; these were added to relevant case folders.

Interview 3 – reflecting and looking forward

Interview 3 was conducted three months after the conclusion of the MOOC. Information collected at this time was used to answer the research question *What do MOOC learners achieve?* The purpose of this interview was to gain a picture of how the participants perceived their experience in the MOOC in the context of their larger life goals. Participants were also asked to talk about their general attitudes to MOOCs. An interview guide was used to provide a flexible yet focused structure for this procedure (Appendix K).

As Interview 3 was the final requirement for each participant, special care was taken in winding up this phase of the study. A rapport and sense of trust had been established between the researcher and the participants, so it was important that the participants did not feel abandoned at the end of this interview. With this in mind, participants were thanked for their contribution and reminded about the $100 Amazon gift card that they would receive as a token of appreciation. Also, they were reminded that this was not the last

contact that they would have with the researcher, as they would receive notice of research papers as they were published.

3.8 Phase 2 Data Analysis

Though this study adopted a mixed-methods approach, it was substantively a qualitative study that took the form of a multiple-case study. Unlike quantitative data analysis, there is no set recipe for qualitative analysis; the process of analysis is informed by the intellect and style of the analyst (Patton, 1982). This line of thinking also applies to case-study research, which Stake (1995) refers to as an "art" that involves "making sense of things" (p. 72). However, even though there may be no set rules for conducting case-study research, Yin (2014) advises that qualitative researchers need to proceed with a general analytic strategy, which prioritises what the researcher is going to analyse. This study used a general analytic strategy that accommodated both the quantitative and qualitative phases of this study. The analytic procedures that this study implemented conformed to a six-step model as proposed by Creswell and Plano Clark (2011) (Table 12 shows the activities at each stage of the qualitative analysis).

Table 12

Phase 2 Analytical Steps and Activities

Analytical Step	Activities
1. Preparing data for analysis	Transcribing recorded interviews, aggregating learning-journal records, storing evidence in case-study folders in Dropbox, importing case data into HyperRESEARCH for coding.
2. Exploring the data	Extensive reading and annotating of hard copies of interviews, connecting evidence from different sources, recording notes in research journal and Scrivener, concept mapping, developing a coding framework in a spreadsheet.
3. Analysing the data	Applying codes from coding framework to interviews and other case evidence in HyperRESEARCH.

4. Representing and mixing the data-analysis findings	Creating thematic case summaries of coding analysis addressing research questions, mixing data from all sources in an Excel workbook.
5. Interpreting the results	Reflecting on meaning of findings with reference to research questions.
6. Validating the data and results	Member checking, triangulating findings.

Though the steps outlined above suggest that these analytic stages occurred sequentially, this was not the case. As Creswell (2007b) explained, the analysis of qualitative data is characterised by some steps occurring simultaneously in a *data analysis spiral* (p. 151). For example, as the findings of the data analysis were represented in tables, it may have been necessary to revise the coding framework to clarify the differences between themes that had emerged, and to apply this new coding framework to the data at the same time. Also the analysis of data in Phase 2 was characterised by many returns to the exploration stage of analysis. The insights gained from reaching the interpretation stage of analysis often required a re-exploration of the data with new eyes. For example, it was common to reread the interview in hard copy after reaching the interpretation stage of the analysis, as the insights gained from that first iteration of analysis provided insights as to what was important to look for in the data. Following is a brief account of the activities associated with each of the steps outlined in Table 12.

Data preparation

In this stage of analysis data was validated where possible, and organised into case folders. Recorded interviews were professionally transcribed, sent for member checking and revised where necessary to reflect the participants' intentions. This was particularly relevant for the non-native English-speakers, who may have at times not expressed themselves the way they intended in interviews. Also, technical problems with the recording sometimes required clarification from some participants. The downloaded learning-journal data was collated into spreadsheets. All the evidence items were given names based on the case and the source of information and stored in case folders. These files were also converted into compatible formats for importing into HyperRESEARCH, a qualitative data analysis programme.

Data exploration

The finalised interview transcripts were printed off for each case and read multiple times to get a sense of the data. The interview transcripts were read on a case-by-case basis in the order in which they were conducted to get a sense of what Stake (2006) calls the "episodes of nuance, the sequentiality of happenings in context, the wholeness of the individual" (p. xii). Analytic memos and notes were recorded in the margins of these hard copies. The main questions during this process were general in nature, such as: *What is the participant actually talking about here? Why are they saying this?* Afterwards, a few of each participant's sequence of interviews, rough case descriptions and notes were recorded in Scrivener, a word-processing tool designed for large writing projects. As a result of this process, if gaps were discovered in any of the participants' stories, email interviews were conducted to complete the data sets.

Coding the data

The next step in the analytic process was to code the data. Coding is the core analytic procedure in qualitative analysis, as most of the data that qualitative researchers deal with is text (Creswell & Plano Clark, 2011). Coding involves attaching labels, or codes, to units of text and grouping these codes into broader themes, with the aim of providing information that will help answer the research questions. HyperRESEARCH (HR), a computer-assisted qualitative data analysis software tool, was used to code the data in this study. Soft copies of the interviews were imported into HR and coded with labels stored in the HR codebook (Appendix L). At this early stage of coding the labels were descriptive in nature, meaning that they attributed a class of phenomena to a unit of text, and aimed to describe what was being said rather than interpret or explain it (Miles & Huberman, 1994). The aim of this stage of analysis was to see what emerged from the data without imposing assumptions derived from the theoretical framework or researcher bias. During this procedure, the interviews were coded across the cases; in other words, all the first interviews were coded at the same time before moving on to all the second interviews. The text was coded in this fashion so that codes could be reused to describe similar phenomena across cases. For example, all Interview 2s were coded at the same time that each participant was reporting on their learning experience in the MOOC.

The codes and their definitions were listed in an Excel spreadsheet, with examples of coded text displayed next to the codes. The codes were then analysed and grouped into themes, which formed a coding framework. The process of refining the coding framework was iterative, with codes and definitions being refined to avoid overlap in the spreadsheet; the HR codebook was then amended to match these changes. The coding framework that developed in this process aligned to closely to the theoretical framework, with three broad categories of codes: personal, behavioural and environmental; these mirrored Bandura's model of triadic reciprocal causation (Bandura, 1986), in which human activity is viewed as the product of interrelated personal, behavioural and environmental factors. This was not surprising, as the research questions and the research design had been grounded in this theoretical framework (Appendix M contains the coding framework used in this study in). Three separate categories of codes (other personal, other behavioural and other environmental) were also assigned to the data to describe phenomena that did not fit neatly within the schema provided by the coding framework.

Representing and mixing the findings

The next step involved displaying the findings of the coding analysis along with the data collected from other sources so the data could be mixed. First, the results from the coding analysis were summarised to address the research questions. Codes were grouped into categories, which were then grouped into broader themes that addressed the study's three research questions (Table 13).

Table 13

Summary of Coding Analysis

Theme	Theme Categories	Research Question
1. Personal characteristics	World/self-view, habits, surprising	1. Who enrols in MOOCs and what are their characteristics?
2. Learning in other contexts	Expectancy for success, value of learning, emotion/mood/conscientiousness, metacognitive learning, effort, learning strategies	

3. Learning in the MOOC	Expectancy for success, value of the MOOC, emotion/mood/co-nscientiousness, metacognitive learning, effort, learning strategies	2. How do learners self-regulate in a MOOC?
4. Outcomes	Other activities, satisfaction, utility, forward-looking goals, reflections	3. What outcomes do MOOC learners achieve?

As shown in Table 13, the first two themes addressed research question 1, as they summarised the participants' defining personal characteristics that had emerged from the coding analysis. The third theme addressed research question 2 by focusing on the motivation and behaviours that related to participants' learning in the MOOC; and the fourth theme addressed what each participant achieved from their experience in the MOOC. The theme categories were organised into rows and the cases into columns. The first two columns in the table displayed the names of the theme categories and their definitions, respectively. The next 10 columns displayed the summaries for each participant. These descriptive summaries incorporated quotes from the text to enhance the vitality and credibility of the summaries.

At the same time, all the data collected in the study was displayed in a master data table spreadsheet (Appendix N). Scale scores were copied into the appropriate columns for each case in the coding-analysis summary table described above. Learning-journal and digital-artefact data was analysed and displayed in a quantitative format in tables on separate spreadsheets. The display of data from different sources enabled the triangulation of findings. For example, one participant reported that he was very competitive and liked to be in a situation where he was trying to get better marks than his colleagues. This qualitative finding was checked against that participant's scores for achievement-goal orientation to assess the credibility of such a finding. Where necessary, the case summaries within the coding-analysis summary table were adjusted to reflect how data from other sources aligned with or was in contrast to the findings from the coding analysis.

Interpreting and validating the results

As this mixed-methods study was substantively qualitative, which is by nature interpretive, specific strategies were used to enhance the credibility of the findings. Qualitative research

is typically conducted by researchers working alone in the field (Miles & Huberman, 1994) interpreting what they see, hear and understand (Creswell, 2007b). Given the key role that the researcher plays in qualitative studies, validity checks need to be put in place to prove that the researcher's findings are credible. Creswell and Miller (2000) proposed a two-dimensional framework that identified nine procedures for validity checking in qualitative research, and recommended that two or three be used in qualitative studies. This study used three of these validity checks: triangulation, member checking and peer debriefings. Triangulation refers to the building of evidence across different sources to establish the themes of a study. For example, themes that emerged in participants' learning journals were followed up in interviews and then checked against the survey scores and the collected digital artefacts. In this way each finding had at least two sources of evidence. Member checking involves asking the participant to check the accuracy of an account. In this study each participant was asked to check the accuracy of interview transcripts.

As the researcher is the key research instrument in qualitative research, making personal interpretations of the data, it is important to also take into account the resesearcher's background, history and attitudes, as these could bias the findings (Creswell & Miller, 2000). As I was the key researcher in this study, I will now disclose information about myself and describe how I used peer debriefings with my supervisors to minimise the risk of my personal beliefs and attitudes influencing my interpretations.

Role of the researcher

I completed a Master of Education in Information Technology at the University of Wollongong in 2002, and subsequently worked as an educational designer, learning technologist, research assistant and documentary filmmaker until commencing this PhD study. I have a wide range of skills, and am the type of person who enjoys a challenge and is always learning something new. It is not surprising that I was excited when MOOCs arrived, and I was quick to enrol. To date, I have enrolled in around a dozen MOOCs, and have completed three. My predisposition to continually learn and my comfort with online learning may have blinded me to critiques of MOOCs and to view others' performances through the prism of my own experience in MOOCs. To minimise this risk, I engaged in regular peer debriefings with my supervisors, Professors Lori Lockyer and Sue Bennett. A peer debriefing is a validity-check procedure that involves a person familiar with the project reviewing the researcher's process and interpretations (Creswell & Miller, 2000). In my

case, my supervisors took on this role by playing devil's advocate and asking hard questions when necessary during our regular meetings. Given that they have known me as a master's degree student and a research assistant, they were effective in encouraging me to reflect on my own views and their impact on interpreting the data.

3.9 Conclusion

The purpose of this study was to provide detailed contextual accounts of how people learned in a MOOC. Guided by this purpose, this study was grounded in a social cognitive theoretical framework that enabled the study of the internal and external factors that influence learning. From this theoretical positioning this study adopted a mixed-methods approach of sequential-explanatory design to study how 10 people with varying levels of academic experience learned in a MOOC. In the quantitative phase of this study a survey was used to collect data about the respondents' demographics and personal characteristics. This survey also served as a case-selection instrument. The willing respondents were purposively selected for a multiple-case study that used evidence from many sources to reveal how they actually learned in a MOOC. Data was collected about participants' learning using interviews, experience sampling, surveys and digital artefacts, and was displayed in a format that enabled analysis of data from multiple sources within and across cases. Given the interpretive nature of qualitative research, three validity-check techniques were used to enhance the credibility of the findings: triangulation, member checking and peer debriefings.

CHAPTER FOUR: PAPER 1

Though this mixed-methods study was predominantly qualitative in approach, data collected in Phase 1 offered a valuable source of information about the people who had enrolled in the MOOC. The findings from a statistical analysis of Phase 1 data are reported in this chapter in the form of a manuscript in progress (Paper 1).

Preamble to Paper 1

Enrolees in the *Introduction to Biomedical Imaging* MOOC were invited to complete an online questionnaire (Survey 1) that consisted of items that collected information about their demographics, motivation and other personal characteristics. Some of these items were developed with reference to the literature; others were derived from established instruments. Due to the constraints of reporting in one paper, nine of the 12 variables were reported in Paper 1 (Table 14).

Table 14

Survey 1 Variables

Id.	Variable	Type	Paper 1
1	Age	Ordinal	✓
2	Gender	Categorical	✓
3	Country of residence	Categorical	✓
4	Education level	Ordinal	✓
5	English speaking competence	Categorical	
6	Perceptions of online learning expertise	Continuous (1–5)	
7	Reasons for enrolling	Categorical	✓
8	Topic familiarity	Continuous (1–5)	
9	Topic experience	Categorical	✓
10	Course completion intentions	Categorical	✓
11	Self-efficacy for learning and performance[a]	Continuous (1–7)	✓
12	Achievement goals[b]	Continuous (1–7)	✓

Note. [a]Source: MSLQ (Pintrich et al., 1991). [b]Source AGQ-R (Elliot & Murayama, 2008).

The data collected in Survey 1 was analysed in accordance with the six-step model as proposed by Creswell and Plano Clark (2011). In the exploratory phase of the analysis, descriptive analyses were run on all variables and results inspected for trends and distributions.

Preliminary analysis – does academic experience influence motivation?

In the next step, various preliminary tests were conducted to determine where significant relationships between variables lay. The first statistical tests investigated the question: *Is there a relationship between academic experience and motivation?* This was posed because the cases had been selected with the thinking that academic experience would play a role in motivation and learning. The results of these statistical tests were somewhat inconclusive and difficult to explain. For example, results indicated that the there was no significant difference in academic self-efficacy between respondents who were in or had just finished high school and those who had a postgraduate or doctoral degree.

The next question was: *Does experience of the MOOC topic play a part in motivation?* This question arose with reference to other studies that had emerged at the time. In a quantitative study of enrolees in a learning analytics MOOC, it was found that general academic success did not predict completion (Wang & Baker, 2015). In another study, survey respondents who had identified as data professionals and who had enrolled in a data-science MOOC were grouped as high and low self-regulated learners based on their self-reports (Littlejohn et al., 2015). Interviews with selected professionals found that previous exposure to the MOOC topic and previous exposure to MOOCs were common factors in participants who measured very high for academic self-efficacy. Together, these findings suggest that other factors besides general academic self-efficacy may play a role in how people learn in MOOCs. With this in mind, Paper 1 reports on the results of this investigation into the role of experience of the MOOC topic on motivation.

PAPER 1

Who Enrols in MOOCs?

The Demographics and Motivations

of People Who Enrol in MOOCs

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4.1 Abstract

The rapid growth in massive open online courses, or MOOCs, has attracted considerable attention from researchers who have sought to discover who is enrolling in them. A picture is emerging of the typical MOOC enrolee: young, male and highly educated. However, little is known about the motivational mindsets of people who enrol in MOOCs. This paper reports on the quantitative phase of a larger mixed-methods study that investigated how people learned in a MOOC. An analysis of survey data (22.3% response rate) from enrolees in a MOOC on biomedical imaging confirmed that the demographic profile of this sample was similar to what has been reported elsewhere. Experience of the MOOC topic was found to play a significant role in respondents' motivational mindsets. Respondents who had substantive experience of the MOOC topic through formal sources, such as their work or formal study, were found to be motivationally distinct from those whose experience came from informal sources, through a general interest in the topic. This study extends what is currently known about the motivational characteristics of people who enrol in these online courses, and has implications for MOOC providers, designers and researchers.

4.2 Introduction

Massive open online courses, or MOOCs, are online courses that offer access to anyone with an Internet connection and the desire to learn. The spectacular growth in MOOCs in the early days sparked debate over their possible place in the higher-education landscape. Against a backdrop of a higher-education system in a perceived crisis (see Austrade, 2013; Barber et al., 2013), the infinitely scalable MOOC was thought to offer a means of reducing the escalating cost of a degree. Though much of the initial hype about MOOCs has diminished since their arrival, participation in MOOCs has not. In 2015, MOOC enrolments doubled to 35 million from the previous year and the number of MOOCs is predicted to grow by 46% from 2015 to 2019 (Flamig, 2016). The uptake of MOOCs also drew the attention of educational researchers who were interested in finding out who these people were who were enrolling in such numbers. What were their backgrounds? What did they want to get from MOOCs? How did they engage with these courses?

The majority of people who enrol in MOOCs are from developed rather than developing countries. A study of the first year of HarvardX MOOCs revealed that a large proportion of enrolees came from developed countries, with the US (42.3%) providing the most enrolees and Canada (3.81%) and Australia (2.18%) featuring in the top four countries for enrolments (Nesterko et al., 2013). Some general trends in age and gender for the people who enrol in MOOCs have emerged. Enrolees are relatively young, with the majority in their 20s or 30s. They also tend to be male: the proportion of males in MOOCs has been reported as 56.9% in a study of 32 Coursera MOOCs (Christensen et al., 2013) and 63.4% in a study of HarvardX MOOCs (Nesterko et al., 2013). As the majority of MOOCs offered by providers have been heavily weighted towards STEM (science, technology, engineering and mathematics) subjects, which are fields of study and work in which females are underrepresented (Knapp, 2001), this may explain the male bias in MOOC participation. These general trends in age and gender have been found to be more pronounced in less developed countries than in more developed (Christensen et al., 2013). The people from poorer countries who enrol in MOOCs are younger and more likely to be male than their counterparts from richer countries.

At the same time, these enrolees tend to be highly educated. Christensen et al. (2013) reported that the vast majority (83%) of survey respondents who had studied in Coursera

MOOCs already had a post-secondary degree of between two and four years. It is noteworthy, though, that whether the enrolees came from a developed or developing country, they were significantly more educated than non-enrolees from the same country. These disparities were widest in BRICS countries (Christensen et al., 2013). This suggests that though people from less developed countries may be enrolling in MOOCs, they only represent a narrow stratum of their societies.

The reasons people enrol in MOOCs may differ too, depending on their country's level of development. Christensen et al. (2013) reported that respondents from the US were less likely to enrol in MOOCs for reasons related to work or formal study than respondents from BRICS and other developing countries, but more likely to indicate that they had enrolled out of curiosity than enrolees from less developed countries. It may be that people from developed countries are more inclined to enrol in MOOCs as a leisure pursuit, while people from developing countries have more-tangible concerns that motivate them, such as job prospects and career advancement.

More generally, people enrol in MOOCs for a range of reasons. The most popular reasons survey respondents provided for enrolling in edX's first MOOC, *Circuits and Electronics*, were to gain skills and knowledge, personal challenge and employment and job opportunities (DeBoer et al., 2013), or even to see if they could make it through an MIT course (Breslow et al., 2013). The main reason for enrolling varies from study to study: from the pragmatic, such as *to advance my career*, to the personal, such as *curiosity*. It is unclear how reasons for enrolling influence learning in a MOOC. A post-course survey of learners enrolled in *Circuits and Electronics* found only marginal relationships between reason for enrolling and performance (DeBoer et al., 2013). The diversity in the reasons for enrolling does highlight the non-homogeneous nature of MOOC cohorts and the challenge for MOOC designers and teachers to address the needs of these learners.

The people who enrol in MOOCs also appear to have differing course completion intentions. A post-course survey of learners in a science-related MOOC revealed that the majority had intended to do everything in order to earn a certificate, but that a substantial number who had persisted to the end, but not completed, had only ever intended to engage with the content (Belanger & Thornton, 2013). A pre-course survey for another MOOC revealed that only 63% of respondents intended to do everything to earn the certificate

(Koller et al., 2013). It would appear that some people who enrol in a MOOC have serious learning intentions but are not fixed on *completing* the MOOC. In a study of clickstream data from three computer-science MOOCs, Kizilcec et al. (2013) found that there were actually two types of MOOC learner who substantively engaged with the course: *completers*, who did everything so as to earn the certificate, and *auditors*, who focused on content rather than assessment. The existence of serious learners who approach learning in a MOOC in a flexible way may in part explain the low completion rates in MOOCs (see Jordan, 2014).

In sum, the first two years of MOOCs attracted a young audience who were predominantly male and from more-developed countries. The findings of one study of MOOCs offered in 2012 and 2013 (Christensen et al., 2013) suggest that the people who enrolled from less developed countries were significantly different to those from developed countries. Besides being far fewer in number, enrolees from less developed countries were younger and more likely to be male and significantly more educated than the national norm, and to have more-pragmatic reasons for enrolling than their counterparts from developed countries. This paper tested this hypothesis by investigating whether the demographic and motivational characteristics of MOOC enrolees differ depending on their nationality.

Though a picture is emerging of the type of person who enrols in MOOCs and how their demographic and motivational characteristics differ depending on their nationality, nothing is known about how well-equipped these people are to successfully learn in an environment where self-direction is key. To address this gap, this paper investigated two aspects of motivation that have been found to have a profound impact on how people learn: self-efficacy and achievement goals.

Learning self-efficacy – a predictor of academic success

Self-efficacy describes an individual's belief in his or her own competence to perform or achieve to a certain standard in a specific context. Individuals' self-efficacy beliefs influence what they choose to do, the amount of effort they apply and their level of persistence (Bandura, 1993). These beliefs, therefore, are an important aspect of motivation for learning, as people who have a high degree of self-efficacy about learning would be more likely to achieve in that environment, even given that most people do not complete MOOC-based learning in the traditional sense. The vast majority of self-efficacy

studies were conducted between the 1970s and 1990s, before the advent of online learning, so how this aspect of motivation influences learning in online environments is not well understood (Hodges, 2008). Nothing is known about the self-efficacy beliefs of people who enrol in MOOCs. Of those who enrol in MOOCs, who are most and least confident about learning? This knowledge enables the identification of the types of people who are most likely to persist and learn in a MOOC, and those least likely to.

Achievement goals – a driver of learning behaviours

Another important aspect of motivation that influences learning is what people set out to achieve in learning contexts, otherwise known as achievement goals. Broadly speaking, there are two types of achievement goals. Individuals holding *mastery* goals are concerned with gaining skills and mastering knowledge, whilst individuals holding *performance* goals are focused on gaining and maintaining positive assessments of their performance (Dweck, 1986). The mastery orientation drives adaptive learning behaviours such as challenge-seeking and resilience, whilst the performance orientation is associated with maladaptive patterns such as risk avoidance and learned helplessness (Dweck & Leggett, 1988).

Though this field of research has developed in different directions, with considerable lack of consensus over how these goals should be and studied (Pintrich, 2003), one significant development was the splitting of performance goals into *performance-approach* and *performance-avoid* goals. Evidently, in certain contexts and for specific learners, *performance-approach* goals can be positive, but for learners but with *performance-avoid* goals there is wide agreement that performance goals hinder learning. People with performance-avoid orientations try to avoid receiving negative assessments of their performance and appearing incompetent (Pintrich, 2003). Mastery goals have also been split into approach and avoid orientations, but there is less evidence for existence of mastery-avoid goals other than in the very specific context of older learners striving to avoid loss of memory and cognitive function (see Senko & Freund, 2015).

As achievement goals drive behavior, knowing how enrolees are orientated may provide a clue as to how they will behave in a MOOC. For example, people with a high performance-approach orientation may put in extra effort to get 100% on a quiz or aspire to receive recognition of their competence in online discussions or peer assessments. People with a high performance-avoid orientation may avoid submitting assessments or doing quizzes for

fear that they may appear – even if it is just to themselves – incompetent. People with a high mastery orientation may undertake self-directed supplementary research to master a difficult topic and take negative feedback on board as an opportunity for learning. This study aims to characterise the achievement-goal orientations of people who enrol in a MOOC to extrapolate how they are likely to behave and learn in that environment.

This paper addresses two purposes. First, it compares the demographic and motivational characteristics of people who enrolled in a MOOC based on the level of development of the country they came from. Second, it aims to investigate how well equipped these people were to successfully learn in a MOOC through two key aspects of motivation: self-efficacy and achievement goals. As what a person already knows about a topic is the most important factor in how they learn (Ausubel, 1968), participants in this study were grouped according to their prior experience of the MOOC topic. It was hypothesised that participants who knew more about the MOOC topic would be better equipped to learn in the MOOC than those knew less about it. The following research questions focused this investigation:

1. What characterises the people who enrolled in the MOOC?
2. Is there a relationship between enrolees' prior experience of the MOOC topic and their:
    a. course-completion intention?
    b. self-efficacy for learning and performance?
    c. achievement-goal orientations?

Research context

This research was conducted during the delivery of *Introduction to Biomedical Imaging*, a 10-week MOOC delivered on the edX platform in early 2014. The course provided an introduction to the physics and engineering of modern imaging modalities such as X-rays, computerised tomography, ultrasound, magnetic resonance imaging and diagnostic nuclear medicine, and covered how these modalities are applied in medical settings. The course was designed with two audiences in mind. The basic course was designed for high-school leavers who had studied biology, physics or chemistry. The advanced course, which was augmented by supplementary content, was designed for university students who had studied first-year applied mathematics or computer science, and for health professionals

interested in developing their knowledge in the area of biomedical imaging. The course was assessed by seven online quizzes (one for each imaging modality) and two assessment scenarios that capped the course. Learners needed to achieve a mark of 50% to earn a pass in the course.

4.3 Methodology

This paper reports on the quantitative component of a larger mixed-methods study, which investigated how people learned in a MOOC. This mixed-methods approach was realised in the form of a sequential-explanatory design that involved the collection of quantitative and qualitative data in independent phases, and the integration and interpretation of the data at least once in the study (Creswell & Plano Clark, 2011). In the quantitative phase of this study an online survey was used to collect information about the people who had enrolled in the MOOC and to purposively select cases for a multiple-case study, which was the qualitative phase of the study.

Pilot test

The survey was tested with four volunteers before implementation to check questionnaire items for clarity and validity. The volunteers were enrolled in MOOCs or online courses. Following the completion of the questionnaire, the test participants were interviewed to check if they found any items confusing, and to clarify what they understood the questions to mean. It was noted that some items with double negatives were difficult to understand, (e.g. *I will try to avoid performing worse than others*). Despite these concerns, as these items were derived from established instruments that had been validated and widely used in the educational research, they were not changed. Survey 1 was constructed using the Qualtrics online survey system; thus this test also served to trial the logistics of survey delivery, completion and return and data download.

Survey used to collect demographic and personal characteristics

The first section of the survey included demographic items (age, gender, country of residence and highest level of education) and motivation-related items (reason for enrolling, course completion intention, perceived expertise in online learning and experience of the MOOC topic). These items were developed with reference to the literature and MOOC surveys in use at the time. The second section of the survey consisted

of scale items from two established instruments that measured general academic self-efficacy and achievement goals. The Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991) provided the scale for self-efficacy for learning and performance, and the Achievement Goal Questionnaire-Revised (AGQ-R) (Elliot & Murayama, 2008) provided the scales for performance-approach, performance-avoid, mastery-approach and mastery-avoid orientations. Some items were slightly modified to suit the research context (e.g. the word *class* was replaced with *course*) and to simplify the language, given that some respondents would not be native English-speakers (e.g. the words *I am striving* were replaced with *I will try*). Each item asked respondents to rate themselves against a personal statement such as *I expect to do well in this course* on a seven-point Likert scale in which 1 = *Not at all true of me*, 4 = Neutral and 7 = *Totally true of me*. All scales used in Survey 1 were found to have good internal consistency, with Cronbach's alphas over .70 in their original studies.

Data collection and analysis

Invitations to complete the survey were sent to all MOOC enrolees via course announcements until Week 8 of the course. As this MOOC allowed enrolments until the end of the MOOC, this prolonged period of survey completion accommodated those who had enrolled later in the course. All returned surveys were downloaded from the Qualtrics server after the end date of the MOOC and imported into IBM SPSS, a computer-based application for statistical analysis, where it was prepared for analysis. First, the data was cleaned. Empty, incomplete and repeat surveys were removed, leaving 3,172 surveys in the dataset. This was a response rate of 22.3% from a total enrolment of 14,219 individuals who were still enrolled at the mid-point of the course.

Variables derived from two survey items were recoded to assist in the statistical analysis. The variable of reason for enrolling (item 7) provided respondents with nine closed- and one open-response option. A small proportion of respondents (196) had typed in their own reason for enrolling. These responses were analysed and assigned to existing or new codes. This process resulted in 22 categories of reasons that respondents had provided for enrolling in the MOOC. These categories were then assigned to one of four main categories of reasons for enrolling in the MOOC: (1) the *Career* group had indicated that they had enrolled for professional development reasons; (2) the *Formal Studies* group reported reasons related to a present or planned program of formal study; (3) the *Informal Learning*

group reported reasons related to lifelong learning or general interest in the course content; and (4) the *Service to Others* group had indicated that they had enrolled to help them benefit others in their community. Though there was a loss of data richness in collapsing these 22 sub-categories into four, the simplification of this variable would increase the explanatory power of the planned statistical tests. The course-completion intention variable (item 10) was also simplified. As it has been found that some engaged learners adopted non-traditional learning trajectories in MOOCs in which completion was not the goal (Kizilcec et al., 2013), response options were collapsed into categories of intention, to accommodate the participants' intentions behind such flexible approaches. This variable was simplified to four course-completion values: (1) *Completion* for respondents who had indicated they intended to do everything; (2) *High Flexible* for those who reported that they intended to engage with most of the content but were not fixed on completing the MOOC; (3) *Low Flexible* for those who reported less substantive course engagement intentions; and (4) *Undecided* for those who had not made up their mind. The mean scores were calculated for the six scales used in the survey (perceived expertise in online learning, self-efficacy for learning and performance, performance-approach, performance-avoid, mastery-approach and mastery-avoid), and new variables formed for each new value. This concluded the data preparation.

Next, the data was explored to form a picture of who had responded to the survey. A descriptive statistical analysis was conducted to plot the frequency distributions for all survey variables. Distribution curves were inspected to identify any trends in the data, such as the average age of respondents, the most common nationalities represented and the proportion of respondents with university degrees. The results for each variable were recorded in tables, charts and descriptive summaries.

To investigate the relationship between respondents' prior experience of the MOOC topic and their motivation, respondents were grouped according to their self-reported prior experience of the MOOC topic (Table 15).

Table 15

Prior Experience of MOOC Topic Groups (n=3,157)

Group (*n*)	Survey Response Options
Work (1,120)	As a technologist who has made imaging my career. As a health professional who uses imaging. As a teacher on the look-out for new course material.
Formal Study (932)	As a student for whom imaging is part of the requirements of my course.
General Interest (1,105)	As a patient or relative of a patient. Negligible, I just have a general interest in it. As a TV-drama viewer.

Three groups of roughly equal size based on similar prior topic experience were formed: *Work*, *Formal Study* and *General Interest*. Inferential statistical tests were conducted to determine if experience of the MOOC topic played a part in different aspects of respondents' motivation. It was hypothesised that respondents whose prior experience of the MOOC topic was derived from their work or formal studies would be more highly motivated, and therefore they would better equipped to successfully learn in the MOOC than those whose prior experience of the MOOC topic was acquired through less formal learning contexts.

4.4 Results

Of the 3,172 enrolees surveyed in this study, the majority were found to be male (59.1%) and relatively young, with 33.4% indicating that they were in the 18–25 age bracket and 31.2% in the 26–35 age bracket. A fair number of respondents were at either end of the age spectrum: 86 (7%) reported being under 17 years of age, and 77 (2.4%) over 66 years of age. Respondents came from all over the world, with more than 100 countries being represented. The top three countries for enrolments were, in order, the US, India and Australia. It was noteworthy that China, which has a huge population, only accounted for 42 respondents (1.3%). Table 16 gives a full breakdown of respondents from the top 10 countries for respondents. The second column gives the United Nations 2013 Human Development Index (HDI) classification for each of these countries and its ranking in the

world on this index (Malik, Jesperson, Kugler, & Kovacevic, 2014). The HDI takes into account a country's income and productivity and how income is related to opportunities for education and health. It is a widely accepted measure of how developed a country can be considered to be.

Table 16

Top 10 Countries for Enrolments (n = 1,934)

Country	HDI Category ([a])	Males/Females	Respondents %
1. United States	Very high (5)	1.1	37.5
2. India	Medium (135)	1.9	16.5
3. Australia	Very high (2)	.8	9.4
4. Spain	Very high (27)	1.4	6.9
5. Canada	Very high (8)	1.2	6.5
6. Brazil	High (79)	2.2	5.8
7. United Kingdom	Very high (14)	1.1	5.1
8. Mexico	High (71)	1.4	4.7
9. Colombia	High (98)	2.9	4.2
10. Poland	Very high (35)	.8	3.5
		1.3 [b]	100%

Note. [a]World ranking according to 2013 HDI index (Malik et al., 2014). [b]Overall male/female ratio.

The results show that the majority of respondents (68.9%) in the top 10 countries were from six countries with very high HDIs (USA, Australia, Spain, Canada, UK and Poland), whilst three countries with high HDIs (Brazil, Mexico, Colombia) accounted for 14.7% and one country of a medium HDI (India) accounted for 16.5% of respondents. In other words, the majority of respondents came from countries in which they had superior access to health and education opportunities compared to respondents from countries of lower HDI. Overall, males outnumbered females in the top 10 countries by a factor of 1.3. In the six very high HDI countries, the male bias was less marked. It was actually reversed in Australia, one of only two countries (the other being Poland) where there were more female than male respondents.

Tertiary-education levels were compared between HDI groups. Results show that the majority of respondents (76.0%) from the top 10 countries for enrolments had a bachelor's degree or higher (Table 17).

Table 17

Highest Education Level Achieved for HDI Groups from Top Ten Countries (n = 1,925)

Education Level	Medium HDI %	High HDI %	Very High HDI %	All Groups %
Tertiary Attainment	79.4	65.3	77.5	76.0

The respondents from the Medium HDI group (India) reported the highest rate of tertiary attainment (79.4%). This was surprising, as India's lower HDI categorisation suggests that overall there are fewer opportunities for education in that country than in the countries with higher HDI rankings (Table 18).

Table 18

Reasons for Enrolling for Top Ten Countries by HDI Groups (n = 1,933)

Reason for enrolling	Medium HDI %	High HDI %	Very High HDI %	All Groups %
Work	5.0	5.6	18.1	28.7
Formal Study	4.2	4.8	15.5	24.4
Informal Learning	6.6	4.0	34.1	44.7
Service of Others	0.7	0.4	1.1	2.1
Total				100

Results show that the majority of respondents (44.7%) from the top 10 countries indicated that they had enrolled for reasons related to lifelong learning, such as general interest in the topic. The second most frequently cited reason for enrolling overall related to work (24.4%), followed closely by students who believed the course would support their studies (24.4%). Enrolment for reasons related to the benefit of others was the least frequently cited (2.1%). It was noteworthy that lifelong learning was a far more popular reason for enrolling than reasons related to work or formal study for respondents from very high HDI

countries. This may reflect a wider acceptance of lifelong learning as being of benefit to one's lifelong development, professional or otherwise, in countries with higher HDIs.

The role of prior MOOC topic experience on motivation

The second part of this analysis aimed to test the hypothesis that respondents had distinct motivational characteristics based on their prior experience of the MOOC topic. Respondents were grouped based on their self-reported prior experience in this area. Various inferential tests investigated if this personal factor played a part in respondents' motivation; specifically, their course-completion intentions, perceived expertise in online learning, learning self-efficacy and achievement-goal orientations.

Course-completion intentions

Respondents were asked how much of the course they intended to do. A chi-square test for independence was conducted to determine if prior experience of the MOOC topic was a factor in their course-completion intentions. Results found a significant small to medium association between respondents' prior experience of the MOOC topic and their course-completion intentions: χ^2 (6, n = 3,153) = 56.02, p < .001, Cramer's V = .09 (Table 19).

Table 19

Cross-Tabulation of Prior Experience of MOOC Topic and Course-Completion Intention

MOOC Topic Experience Group	Course-Completion Intention			
	Undecided	Low Flexible	High Flexible	Completion
Work	7.6%	2.0%	45.4%	45.0%
Formal Study	8.4%	1.6%	43.1%	46.9%
General Interest	14.8%	2.4%	47.5%	35.3%
All Groups	10.3%	2.0%	45.5%	42.2%

Overall, these results show that the majority of respondents (87.7%) had intentions to substantively engage with the MOOC by either completing it or engaging with most of the content, in similar proportions (High flexible: 45.5%; Completion: 42.2%). The most

notable result was for those who intended to do everything in the course. Respondents whose experience of the MOOC topic came from their work (45.0%) or from their formal studies (46.9%) were found to be more intent on completing the course than those whose experience was from their general interest in the topic (35.3%). Around one in 10 respondents had not made up their mind about their course-completion intentions at the time they completed the survey.

Self-efficacy for learning

Respondents were asked to rate their learning self-efficacy on a 1–7 Likert scale using slightly modified items from the MSLQ (Pintrich et al., 1991). An analysis of variance (ANOVA) with post-hoc tests were conducted to test the hypothesis that respondents' self-efficacy for learning and performance varied according to their experience of the MOOC topic. The analysis showed a significant difference between the composite groups at the $p < .05$ level: $F(2, 3154) = 44.52$ $p < .001$ (Welch), 48.79, $p < .001$ (Brown-Forsythe) (Table 20).

Table 20

Comparison of Self-Efficacy Means (n = 3,157)

Group	*Mean*	*SD*	Comparison Group	*p*
Work	5.72	1.04	Formal Study	.93
			General Interest	<.001*
Formal Study	5.70	.87	General Interest	<.001*
General Interest	5.36	.95		
All Groups	5.59	.97		

Note. *Significant at the .05 level.

The three groups recorded self-efficacy means between 5 and 6 on the 1–7 scale, indicating that all respondents were fairly confident about their learning in this MOOC. Post-hoc tests found that the General Interest group had a statistically lower self-efficacy mean score than the other two groups, which means they were less confident in their general academic ability to do well in the MOOC. There was no significant difference between the Work and the Formal Study groups. The strength of the association between experience of the MOOC topic and self-efficacy was small to medium ($\eta^2 = .03$). This test partially confirms

the hypothesis that respondents' self-efficacy for learning and performance scores differed according to their experience of the MOOC topic.

Achievement-goal orientations

Respondents rated themselves on 1–7 scale items from the AGQ-R (Elliot & Murayama, 2008). A between-groups multivariate analysis of variance (MANOVA) test found a statistical difference between the three experience of the MOOC topic groups at the .05 level on the four combined dependent variables F (8, 6302) = 7.69; $p < .001$; Wilks Lambda = .98; and partial $\eta^2 = .010$. Follow-up one-way between-groups analyses of variance (ANOVA) at the Bonferroni adjusted alpha level of .012 found statistically significant differences between groups for performance-approach F (2, 3,154) = 24.7, $p < .001$ and $\eta^2 = .015$; performance-avoid goals F (2, 3,154) = 8.8, p < .001 and $\eta^2 = .006$; and mastery-approach goals F (2, 3,154) = 10.8, $p < .001$ (Welch), 11.6, $p < .001$ (Brown-Forsythe) and $\eta^2 = .007$. No significant difference was found for the mastery-avoid goals F (2, 3,154) = 4.2 and $p = .015$. Table 21 shows the results of post-hoc comparisons using the Tukey HSD test.

Table 21

Comparison of Achievement-Goal Orientation Means

Orientation	First Group	*n*	*Mean*	*SD*	Comparison Group	*p*
Performance-Approach	Work	1,105	4.88	1.49	Formal Study	.94
					General Interest	<.001*
	Formal Study	932	4.86	1.43	General Interest	<.001*
	General Interest	1120	4.48	1.52		
	All Groups	3,157	4.73	1.50		
Performance-Avoid	Work	1,105	4.58	1.71	Formal Study	.96
					General Interest	<.001*
	Formal Study	932	4.56	1.68	General Interest	<.001*
	General Interest	1120	4.31	1.76		
	All Groups	3,157	4.48	1.72		
Mastery-Approach	Work	1,105	6.11	.92	Formal Study	.82
					General Interest	<.001*
	Formal Study	932	6.14	.86	General Interest	<.001*
	General Interest	1120	5.96	1.01		
	All Groups	3,157	6.10	.94		
Mastery-Avoid	Work	1,105	5.46	1.27	Formal Study	.95
					General Interest	.04
	Formal Study	932	5.47	1.26	General Interest	.03
	General Interest	1120	5.32	1.33		
	All Groups	3,157	5.41	1.29		

Note. *Significant difference between these groups at the .012 level.

Overall, results show that all groups were more mastery-orientated than performance-orientated, with all groups showing scale means of 6.10/5.41 for mastery-approach/avoid goals and 4.73/4.48 for performance-approach/avoid goals. Results showed no statistically significant differences between the Work and Formal Study groups for any achievement goals, meaning that they were similar in how they orientated their learning in achievement contexts. The General Interest group, however, was found to have statistically weaker orientations for performance-approach/avoid and mastery-approach goals. This suggests that individuals with experience of the MOOC topic gained from their general interest in it were less concerned in general with achieving in this context than those with more formal

experience of the topic. Effect size calculated using eta squared ranged from .006 to .015 for the three orientations in which significant differences were found, indicating a very weak relationship between topic expertise and achievement-goal orientation. In other words, where there were statistically significant differences, prior experience of the MOOC topic played only a small to extremely small role in how respondents orientated their learning.

4.5 Discussion

The following discussion of the results of the statistical analysis responds to the two research questions.

What characterises the people who enrolled in the MOOC?

Most respondents in this study came from countries of very high human development, with the US, Australia, Spain and Canada featuring in the top 10 countries for enrolments. These same countries were found to be the main sources for enrolments in a study of 18 HarvardX courses, with the US coming first, Canada third and Australia fourth for enrolments and Spain providing the most European enrolments (Nesterko et al., 2013). It is notable that India, a country with a medium-level HDI, was second only to the US for respondents in this study, which is in line with a report of enrolments in HarvardX MOOCs (see Nesterko et al., 2013). A possible explanation for the exceptional uptake of MOOCs in India, rather than China, which are both rapidly developing countries, is that English is far more commonly spoken in India than China. Perhaps, not being able to speak English was an obstacle for potential Chinese enrolees.

Male bias pronounced in poorer countries

More males than females enrolled in this MOOC, and this gender bias tended to be more extreme in less developed countries than more developed. The gender bias towards males found in this study has been reported elsewhere. In a study of MOOC enrolments over the first four years of delivery of Harvardx and MITx courses, only one in three learners were female (Chuang & Ho, 2016) and this bias has been found in other studies involving large datasets (Christensen et al., 2013; Zhenghao et al., 2015). Males may enrol in greater numbers in MOOCs because in general they have more opportunities to access education than females, especially in less developed countries. It may be, too, that MOOCs on topics

that are associated with males, such as computer science and engineering, dominate MOOC portfolios on platforms such as Coursera and edX, and so attract more males than females. For example, a MOOC on electrical engineering, a male-dominated profession, attracted around nine males for every female (Breslow et al., 2013). Perhaps more MOOCs need to be offered that have a broader appeal to boost female participation.

Enrolees more educated than non-enrolees from the same country

The general picture that emerges from this study is that the respondents were from backgrounds in which they already had the benefit of a university education. Chuang and Ho (2016) reported that 73% of enrolees in edX MOOCs from 2012 to 2106 already had a bachelor's degree. In this study respondents from India, which had the lowest HDI ranking of the top 10 countries for enrolments, had the highest tertiary achievement rate, 79.4%; this is in stark contrast to the national tertiary achievement rate of 6.1% (Barro & Lee, 2016). This suggests that the people who enrolled in the MOOC from India were significantly more educated than the norm in their country, and that rather than widening access to education, as some enthusiasts have claimed (e.g. Ng & Koller, 2013), MOOCs may be primarily benefitting those who already have access to a tertiary education. The disparity between the education levels of people who enrol in MOOCs and those of the broader population in their country has been found elsewhere. A study of learners in 32 Coursera MOOCs found that 79.4% of learners over 25 years of age from five countries with emerging national economies, collectively known as BRICS (Brazil, Russia, India, China and South Africa), had a university degree; this contrasts with 5.1% for the same countries as a whole (Christensen et al., 2013). Another study of 68 edX MOOCs from 2012 to 2014 found US learners to be more educated and affluent than the national average, and that learners from backgrounds of higher socio-economic status were more likely to earn a certificate (Hansen & Reich, 2015). These findings suggest that the claims that MOOCs are democratising education should be viewed with some scepticism. At worst MOOCs may actually be widening the gaps between the haves and have-nots, at best the potential for MOOCs to widen access have not so far been realised.

Reasons for enrolling differ depending on country

The reasons respondents gave for enrolling in the MOOC differed according to the level of development of their country. If respondents were from a more developed country, they were more likely to have enrolled for lifelong-learning reasons, whilst those from less

developed countries, such as India, were motivated by their present or future work or formal study. Although in this analysis the reasons for enrolling were more diverse than reported here, the literature suggests that people enrol in MOOCs for a wide range of reasons. A survey of learners from 32 Coursera MOOCs revealed that the two most frequently cited reasons for enrolling were to advance current job and curiosity (Christensen et al., 2013). A post-course survey of learners in edX's first MOOC, *Circuits and Electronics*, an MIT course delivered in 2012, revealed that most learners had enrolled for the knowledge and skills they would gain, but a significant number had enrolled simply for the personal challenge, to see if they could pass an MIT course (Breslow et al., 2013). In a pre-course survey of enrolees in *Bioelectricity: A Quantitative Approach*, a Coursera MOOC delivered in 2012, the most frequently given reason for enrolling was fun and enjoyment (Belanger & Thornton, 2013). As MOOCs are relatively easy to enrol in – and withdraw from without penalty – it is not surprising that people enrol for serious and less serious reasons. However, the openness of MOOCs, which can accommodate individuals with differing reasons for enrolling, may have an undesirable pedagogical consequence, in that it may be difficult to form a coherent community of like-minded learners in such a context. The challenge for MOOC providers and designers is to determine the prime audience or audiences for a given MOOC.

Does prior experience of the MOOC topic influence motivation?

The following discussion addresses the second research question, whether prior experience of the MOOC topic was related to three aspects of motivation: course completion intentions, self-efficacy for learning and achievement goals. Respondents were grouped according to their experience of the MOOC: (1) *Work*, (2) *Formal Study* or (3) *General Interest*. This line of investigation sought to determine whether experience of the MOOC topic played a part in these three aspects of motivation.

Work and Formal Study respondents more intent on completion

This study found that enrolees who had experience of the MOOC topic from their work or formal study were more intent on completion than those with no formal experience of the topic. The general-interest enrolees were more intent on engaging with content than doing everything necessary to earn a certificate. Overall, though, most respondents were found to have substantive engagement intentions, reporting an intention to either complete the

MOOC or engage with most of it. In fact, these two groups were fairly equal in size, which suggests that a fair number of people enrol in MOOCs with the intention to learn, but not necessarily to complete. Other studies have found evidence for these two types of learners, categorised as *completers* and *auditors* in a study of engagement patterns in three computer-science courses (Kizilcec et al., 2014), and *engagers* and *auditors* in a study of 42 Stanford MOOCs (Glance & Barrett, 2014). Another study found that pre-course intentions predicted behaviour. Sixty-three percent of respondents to a pre-course survey in a Coursera MOOC indicated that they intended to do everything, and around one quarter of these actually went on to complete the MOOC, compared to less than 2% of other respondents (Koller et al., 2013). It may be, then, that differences in pre-course intentions found between the Work/Formal Study respondents and General Interest respondents indicate distinct actual learning trajectories. This knowledge has implications for MOOC providers and designers, who could take these two types of learner into account by providing two pathways: one that targets Work/Formal Study-type learners and leads to completion, and another for General Interest-type learners, which emphasises more-flexible goals.

Experience of MOOC topic determines confidence about learning

This study found that that there were no statistical differences between the Work and Formal Study groups in terms of their academic self-efficacy and their achievement goals. Around two-thirds of respondents were from these two groups, with a sizeable number of respondents from the General Interest group. The Work/Formal Study respondents were found to have higher levels of academic self-efficacy than their General Interest counterparts. The experience people bring with them into MOOCs is associated with these important self-perceptions about academic ability. For example, a survey of enrolees in a data-science MOOC found that respondents who identified as working professionally in the area of the MOOC topic had higher measures of academic self-efficacy than others (Hood et al., 2015). However, the inferences that can be drawn about how academic self-efficacy influences learning in MOOCs are limited, as how self-efficacy functions in online contexts is not well understood (Hodges, 2008). Therefore, it is unclear exactly what this higher level of academic self-efficacy means for Work/Formal Study learners in MOOCs. The findings from other studies highlight the domain-specific nature of self-efficacy, and that self-efficacy beliefs about one's academic ability may play a smaller role in learning

in a MOOC than originally thought. For example, Wang and Baker (2015) found that confidence in completing the MOOC, rather than general academic self-efficacy, predicted completion, and Littlejohn et al. (2015) found that previous experience of learning in a MOOC was a factor in high self-efficacy scores for data professionals in a data-science MOOC. Though the study of self-efficacy in MOOCs is only beginning, it would appear at this early stage that self-efficacy beliefs in the domains of learning related to the MOOC topic and MOOC learning experience may play an important role in what people achieve in MOOCs.

Experience of MOOC topic determines desire to achieve

As well as being more confident overall about their learning, the Work/Formal Study respondents were found to be more intent on achieving, in terms of both mastery and performance goals, than General Interest respondents. Though in general there is agreement in the literature about the positive role of mastery goals and the negative role of performance-avoid goals in off-line contexts (Pintrich & Schunk, 2002), how these orientations influence learning in online contexts is less clear (see Clarebout & Elen, 2009; Huet et al., 2011). What has been written about achievement goals in MOOCs has focused solely on mastery goals, and the findings are inconclusive. De Barba, Kennedy and Ainley (2016) found that mastery goals, as part of a larger construct of motivation, were related to participation and final grades in a MOOC, but Wang and Baker (2015) found that respondents to a pre-MOOC survey who had high mastery scores were no more likely to complete the course than others with lower mastery scores. A possible explanation for these inconclusive findings is that completion is not the only measure of successful learning in a MOOC (Kizilcec et al., 2013). A learner with a strong mastery orientation may choose to engage with some elements of a course rather than the entire course. In the present study, both the Work/Formal Study and General Interest learners were found to be more mastery- than performance-orientated, which is not surprising, given that MOOCs provide relatively little gratification to those seeking to compare their achievements with others' (see Wang & Baker, 2015 for a similar observation). More research is required to determine how mastery and performance goals influence learning in MOOCs. Given the challenge of studying learning in MOOCs through metrics such as completion, qualitative approaches may be more illuminating. As it is relatively easy to influence achievement goals (Pintrich, 2003), this may be of significance to MOOC providers and designers.

Limitations

This analysis has several limitations. First, its findings apply only to one MOOC; any generalisations about the broader population of people who enrol MOOCs are limited. Moreover, the inferences that can be drawn from this analysis are limited by the biased nature of the sample. As completion of the survey was voluntary, the people who completed it were more likely to be the engaged learners rather than from the sizeable proportion of enrolees who fail to start (see Koller et al., 2013) The findings in this paper are only relevant to those willing to give up their time to complete the survey, but nonetheless suggest something about the engaged individuals who enrolled in the MOOC. The results of this analysis were also limited by the lack of completion data for respondents. It was not possible, for example, to test whether formal learners achieved more than informal learners. Also, regarding the established instruments in this study, some issues may have contaminated the results. The MSLQ (Pintrich et al., 1991) and the AGQ-R (Elliot & Murayama, 2008) were developed for the classroom context, which was a familiar learning context for participants. The items in these scales did not take into account the specific learning context of MOOCs. For example, an individual who had no experience of learning in a MOOC may score high on general academic self-efficacy but low for MOOC learning self-efficacy. Likewise, the achievement-goal questions did not take into account the MOOC context. For example, a performance-approach goal in a MOOC will have a different meaning to a performance-approach goal in a classroom, where normative comparisons are possible.

Future research

This paper has discovered some limitations with the use of established instruments, which were developed for classroom contexts. Future MOOC researchers taking a quantitative approach to investigate aspects of motivation and learning in MOOCs could develop new instruments, which take the context of the MOOC into account. This analysis was also limited by the inaccessibility of completion data. Though the metric of completion does not tell the whole story of how learning takes place in a MOOC, it does provide us with a bit more of the picture. Unfortunately, MOOC providers and the platforms they are delivered on tend to be proprietary towards their own MOOC data, so it is more difficult for researchers outside the aegis of the university providing the MOOC then those within it (Reich, 2015). Having said that, quantitative researchers could dispense with the

completion metric altogether by considering alternative ways of measuring learning in MOOCs. For example, pre-and post-tests could be used to measure the differences in knowledge for individuals between their entrance and exit from a MOOC.

4.6 Conclusion

This paper reports on the quantitative phase of a larger mixed-methods study that investigated how people learned in a MOOC, and is based on an analysis of survey data collected from enrolees in a MOOC on biomedical imaging who returned an online survey. This investigation aimed to identify what characterised these individuals in terms of their demographics and motivation. A statistical analysis of data found that the disparity between educational levels of respondents and non-enrolees from the same country was much greater for those from developing countries than from developed countries. This finding suggests that this MOOC was reaching the advantaged rather than the disadvantaged in poorer countries, and calls into question the claim that MOOCs are a democratising force in education. MOOCs seem to be attracting individuals already participating in lifelong learning rather than those who are not engaged. Whether they can encourage those who are not already engaged into lifelong learning remains to be seen. Substantive impediments to learning in poorer and richer countries will not be magically removed with the availability of free online courses. Efforts to widen access to education need to focus on improving educational opportunities at primary and secondary levels for the disadvantaged in both poor and rich countries.

This study also found that there were motivational differences between respondents depending on their experience of the MOOC topic. Respondents who had substantive experience of the MOOC topic, derived from their work or formal study, were more confident in their general academic ability and more motivated to achieve in the MOOC than those whose experience of the topic was less substantive and derived from general interest. How these motivational differences translate into learning behaviours in a MOOC is unknown. The experience that a person brings into a MOOC matters, as it determines how much they intend to do in the MOOC, their confidence about learning in the MOOC and how much they want to achieve. In short, prior experience of the MOOC topic predicted motivation. How this motivation drives learning in the unique context of a MOOC, at a qualitative level, is to be discovered.

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CHAPTER FIVE: PAPER 2

Chapter Five presents Paper 2, the first of three papers that report findings from the multiple-case study. These three papers were guided by the research questions *How do learners self-regulate in a MOOC?* and *What outcomes do MOOC learners achieve?* Cases were selected for these three papers with a view to providing a balance of breadth and depth of coverage (Table 19).

Table 22

Coverage of Cases in Papers

Case	Paper 2	Paper 3	Paper 4
Walter		✓	✓
Antonio		✓	✓
Layla			✓
Mariam	✓		✓
Federico			✓
Arjun		✓	✓
Anna		✓	✓
Monica		✓	✓
Huseyin		✓	✓
Pablo	✓		✓

Paper 2 investigated how two participants with contrasting backgrounds and levels of achievement in the MOOC (Mariam and Pablo) regulated their learning. In Paper 3, six cases were selected based on the participants' experience of the MOOC topic. All 10 cases were covered in Paper 4, which investigated one aspect of self-regulated learning that is of particular importance to learning in a MOOC – help-seeking.

Preamble to Paper 2

Paper 2 presents two contrasting cases. Mariam, a dentist and master's degree student, achieved the highest overall mark (90%) of all the cases in the MOOC. On this basis, she was selected for this paper. In contrast, two participants could be categorised as low

achievers in terms of their overall MOOC grades: Arjun, a medical student from India, achieved a mark of 47%, and Pablo, a college student in the US, achieved 50%.

Pablo was selected for this paper as he provided more of a contrast to Mariam than did Arjun. First, Arjun reported a history of academic success, being towards the top of his class at school, whereas Pablo reported that his marks at college needed to improve. This suggests that, even though Arjun's overall mark was less than Pablo's in the MOOC, he may have been a more capable student. Second, Pablo's family background was in contrast to Mariam's. Pablo's parents were working-class migrants, whereas Mariam – and Arjun – came from middle-class families in which academic life was the norm. For these reasons Pablo was selected for Paper 2 as providing more contrast to Mariam.

The purpose of this paper was to compare how these two contrasting cases learned in the MOOC, to reveal the factors that led to their different levels of achievement. The priority of the analysis was to provide detailed accounts of Mariam's and Pablo's stories of participating in the MOOC, or, as Stake put it, to emphasise "episodes of nuance, the sequentiality of happenings in context, the wholeness of the individual" (Stake, 1995, p. xii).

PAPER 2

LEARNING AND ACHIEVEMENT IN A MOOC:

Accounts of a high and low achiever

in a MOOC

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5.1 Abstract

The rapid rise in popularity of massive open online courses, or MOOCs since their emergence in 2011, has marked them as a significant new instrument for lifelong learning. Early quantitative research revealed the demographic characteristics and engagement patterns of MOOC learners. In recent times, qualitative and mixed-method approaches to MOOC research have provided context and detail to the learning experience. This study contributes to the growing field of MOOC research by investigating how individuals regulated their learning in *Introduction to Biomedical Imaging*, an edX MOOC delivered in 2014. This article presents the findings of a mixed-methods investigation into the motivation, self-regulated learning and outcomes of two learners: *Mariam*, who achieved the highest overall grade of the participants, and *Pablo*, who achieved the second lowest grade of the 10 participants in this study. Through data collected from interviews, surveys, experience sampling and digital artefacts, this study uncovered key differences in each learner's ability to regulate their learning that led to their contrasting levels of achievement. Despite their contrast in achievement, both learners experienced difficulties in the MOOC for different reasons. To be able to regulate one's learning is key in MOOCs, but, as this study found, even the best self-regulated learners can struggle if they do not get the help they need. MOOCs are limited in the help they can provide learners; thus, providers need to take care that concepts are presented along sound principles of instruction.

5.2 Introduction

The first massive open online course (MOOC) to arrive in 2011 attracted more than 160,00 learners and began a spectacular and continued growth in MOOC learning. Even though it is now clear that MOOCs are not going to be the disruptive force in higher education that some claimed in their early years (see Barber et al., 2013; Di Salvio, 2012; Gallagher & Garrett, 2013), interest in MOOCs continues to grow. According to Class Central, 35 million people worldwide have enrolled in MOOCs, and the growth in MOOCs is escalating: in the 2015 the number of MOOC enrolments doubled to 35 million from the previous year (Shah, 2015). Based on these markers, MOOCs are the most significant innovation in lifelong learning to appear in recent times. Lifelong learning, the practice of continued learning throughout an individual's working life after school, is key to employability (Medel-Añonuevo et al., 2001b) and confers benefits on the societies in which it flourishes (Department of Education and Science, 2000). It has therefore been important to understand what motivates individuals to enrol in these courses and how they learn in these environments. The challenge for researchers is to discover who the people are who enrol in these courses, how they learn in these environments and what the outcomes of their efforts are. This was important to know in order to better understand the benefits of MOOCs, how they should be designed and how they might fit into the learning landscape.

Those who enrol in MOOCs display diverse characteristics and engagement patterns. Despite the early claims that MOOCs were opening doors of opportunity for everyone (see Koller, 2013; Koller & Ng, 2013), a study of 32 Coursera MOOCs found that the majority of enrolees were young, well educated, employed and from developed countries, and that the disparity between education levels of enrolees and the norms in their respective countries was widest in developing countries (Christensen et al., 2013). This suggests that the people enrolling in MOOCs from poorer countries, though a smaller component of global MOOC enrolments, were the most educated in their own societies. Only a small proportion of enrolees actually complete them (see Jordan, 2014). However, the evidence suggests that MOOC learners do not all engage in MOOCs with the goal of completion. A post-course survey of learners in a science MOOC revealed that some of the learners who had not completed the course had not enrolled with that intention, but just to engage with the content (Belanger & Thornton, 2013). A study of clickstream data in three computer-

science MOOCs revealed two distinct types of committed learner based on their patterns of engagement: completers, who engaged with content, assessments and interaction with fellow learners, and auditors, who only engaged with the content (Kizilcec et al., 2013). This is important information for characterising who is learning in MOOCS as a basis to further investigate how they do so.

Little is known about what it is like to learn in a MOOC or how people actually learn in them. Adams, Yin, Madriz and Mullen (2014) conducted a phenomenological study of learners in a MOOC using daily journals and interviews to reveal their experiences. Participants described a feeling of intimacy with the video lecturer and of being part of a big event, like a rock concert. These findings marked the experience as unique and particular to specific individuals, but provided no details about how different types of people learned in a MOOC. Milligan, Littlejohn and Margaryan (2013) interviewed 29 participants in a connectivist MOOC (cMOOC) to discover how they learned and what factors were prominent in their learning. They found that there were three types of learner: active learners (12/29), who were actively engaged with others; lurkers (13/29) who had made the decision to not engage with others but were nonetheless active and following the course; and passive participants, the smallest group (4/29), who were the least satisfied with how the course was structured but, surprisingly, were persisting with the course. Three factors also emerged as predictors of engagement: confidence about learning in the cMOOC, prior experience of cMOOCs and motivation. The picture of the experience of learning in a MOOC and how people actually learn is complex. These findings highlight the uniqueness of learning in a MOOC and how different types of learners go about learning in a cMOOC. The context and detail of how people learn in an xMOOC is not known. This paper seeks to address the gap.

Given that MOOCs have developed, in part, to support independent study or lifelong learning, concepts associated with self-regulated learning (SRL) are important to explore in these contexts. SRL is a social cognitive construct that describes individuals' "self-generated thoughts, feelings and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000, p. 14). Self-regulated learners set better goals, use more-effective learning strategies, can adjust to changing circumstances and seek help when it is needed. This is an appropriate lens with which to investigate learning in MOOCs, as in this context participants need to set their own schedule of study, select the

activities with which to engage, sustain their efforts and adapt to changing circumstances throughout the course. Though SRL as a theoretical lens has been used extensively to study learning in contexts of secondary and higher education, little has been been written in the context of MOOCs. Milligan and Littlejohn (2014) used SRL to investigate how professionals learned in a health-sciences-related MOOC, and found little evidence of self-relevant active learning, as the focus and design of the course did not support a learner-centred approach where self-regulation would be necessary. Instead, the professionals were other-regulated, doing what was necessary to earn the certificate.

Studying self-regulated learning is a complex and challenging phenomenon, and its study has been conceptualised in different ways. This study applied Zimmerman's triadic model of self-regulated learning (1989), a mirror of the social cognitive model of triadic reciprocal causation (Bandura, 1986), as this model highlighted how learners need to regulate mutually influencing personal, behavioural and environmental factors. This model accommodated the investigation of environmental factors, such as a learner's family and cultural context and the environment of the MOOC, to name just a few, in learners' self-regulation. This study was also guided by the self-regulated learning strategies identified by Zimmerman and Martinez-Pons (1986). These strategies and the interview protocol associated with them informed the development of instruments in the present study. This approach was appropriate for revealing the context and detail of how people actually learned in a MOOC.

Motivation – the driver of learning

Of course, being able to self-regulate does not mean a person will actually exercise this capability; they need to be motivated to do so. This study investigated two aspects of motivation that have been established to influence learning. Self-efficacy is a social cognitive construct that relates to a person's confidence in their ability to achieve or perform to a certain standard in a context (Bandura, 1997). Though self-efficacy has been extensively studied in traditional classroom contexts, how it functions in online contexts is not well understood (Hodges, 2008). This study used a scale derived from an established scale (Pintrich et al., 1991) to profile the confidence of participants in this study as learners. The second aspect of motivation investigated in this study was achievement goals, which relate to what a learner perceives as important to achieve in a learning context. Broadly speaking, learners who are *performance*-orientated are extrinsically motivated and are

concerned with the assessments they receive. Learners who are *mastery*-orientated are intrinsically motivated, and focused on mastering the knowledge. The field of achievement-goal research has developed in different ways and is characterised by a lack of consensus on how it should be conceptualised and measured. There is also evidence that learners can hold multiple goals at the same time, which further complicates any examination of learners' motivation (Pintrich, 2003). This study was informed by a 2 X 2 model of achievement goals that split the performance and mastery goals into approach and avoid strivings (Elliot & McGregor, 2001) and applied an established instrument associated with this model (Elliot & Murayama, 2008). As nothing has been written on how self-efficacy and achievement goals influence learning in a MOOC, this study aims to contribute knowledge to these fields.

Another aspect of motivation that was a key consideration in this study was why people enrol in MOOCs. According to the expectancy-value model of motivation (Eccles, 1983), a person's motivation to perform a task is related to their expectancy of success in completing it and the subjective value that they attach to the task. The value that people ascribe to learning in a MOOC would thus be a factor in their motivation and performance. For this reason, researchers have investigated the reasons why people enrol in MOOCs. It has been found that people do so for diverse reasons, which can range from *curiosity* to *personal challenge* to *job opportunities* to *professional development*, and that these reasons can vary across courses. In a study of three computer-science MOOCs, the most popular reason for enrolling was *for fun and challenge* (Kizilcec et al., 2013), and for a MOOC on technology, *to gain skills and knowledge* was the most common reason (DeBoer et al., 2013). It also seems that a learner's nationality may have something to do with why they enrol. For example, it has been found that people from developed countries tend to enrol for lifelong-learning reasons, whilst people from developing countries are more focused on benefits to their careers (Christensen et al., 2013). Little is known about how reasons for enrolling influence learning in MOOCs. A post-course survey of learners enrolled in *Circuits and Electronics* found only marginal relationships between reason for enrolling and performance (DeBoer et al., 2013). This paper investigated the value that learners associated with learning in a MOOC to understand in qualitative way how this influenced how they learned in a MOOC.

This paper reports on the characteristics, learning and outcomes of two learners in a MOOC. The learners were selected from a larger mixed-methods study conducted in a sequence of separate quantitative and qualitative phases. Ten learners of varying academic experience were selected for the qualitative phase of this research, which took the form of a multiple-case study. This paper aims to determine the detail and context of two people who had contrasting backgrounds and levels of achievement in the MOOC. These cases were selected with the purpose of discovering the personal, behavioural and environmental differences that may have influenced them to achieve at such different levels. The following research questions guided this investigation:

1. *What characterised these two learners?*
2. *How did these learners self-regulate in a MOOC?*
3. *What outcomes did these learners achieve?*

This research was conducted in Introduction to Biomedical Imaging, an edX MOOC delivered in 2014. The content was structured in five episodes: X-Rays, Computerised Tomography, Ultrasound, Magnetic Resonance Imaging and Nuclear Diagnostic Medicine. Each episode featured a different expert delivering key content through video lectures, accompanied by multiple screens of text and images and occasional interactive instructional objects. Learners were required to pass an online quiz for each episode and two additional case-study scenario quizzes to earn a certificate. These assessments comprised the summative requirements for the course. The MOOC also provided a forum for learners to interact with each other. The MOOC content was delivered over a 10-week period, and all assessments were due three weeks after the course end date.

5.3 Methodology

This study adopted a mixed-methods approach. The aim of mixed-methods research is to enhance the strengths of both quantitative and qualitative approaches whilst minimising the weaknesses (Johnson & Onwuegbuzie, 2004), which can result in superior research (Creswell et al., 2003). This approach was considered appropriate to the study of learning in MOOCs, as the number of individuals enrolled in MOOCs provided an opportunity to collect substantive quantitative data about motivation and learning, which then could be

triangulated with data collected qualitatively. This study took the form of a sequential-explanatory design, in which quantitative and qualitative data collection proceeded in separate phases and both types of data were integrated in the in the process of research (Creswell et al., 2003). The research process began with a quantitative phase (Phase 1), in which a survey was used to collect data from MOOC enrolees on a voluntary basis. Ten cases were selected for the qualitative phase (Phase 2). In this design, the priority was given to the multiple-case study. Thus, Phase 1 findings were used to assist in the explanation of findings from Phase 2. This emphasis on the multiple-case study aspect of this design provided contextual knowledge about how individuals learn in a MOOC. Integration of data took place at the beginning of Phase 2, and again after all data had been collected. Throughout the research process a research journal was used to keep an accurate account of the procedures in Phase 1 as well as to record analytic memos that emerged during data collection in Phase 2. Such insights were "part of field work *and* [original italics] the beginning of qualitative analysis" (Patton, 2002, p. 436). These different data sources, including the notes in the research journal, served to triangulate the findings and enhance the trustworthiness of the research. Prior to implementation of the design, a small pilot study was conducted to test the procedures and instruments.

Phase 1 data collection

In Phase 1, all individuals enrolled in the MOOC were invited to complete an online survey entitled *Learning in MOOCs* (Survey 1), which was administered through the Qualtrics software survey system. Survey 1 consisted of three sections: (1) demographic and motivational items; (2) items from the learning and performance scale from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991) and achievement-goal scales from the Achievement Goal Questionnaire–Revised (AGQ-R) (Elliot & Murayama, 2008); and (3) an invitation for survey respondents to register their interest in participating in the case-study component of the project.

Phase 2 case selection

Participants for Phase 2 of the study were purposively sampled from interested respondents who were 18 years of age or older, competent English-speakers and intending to complete the MOOC. Potential participants were grouped according to the level of academic experience to provide a range from high school to higher degree. Based on these criteria,

38 people were formally invited to participate in Phase 2 via an email that also included information about institutional ethics approval and of their rights regarding privacy and withdrawal. Initially, 16 individuals indicated their consent via an online form. Attrition and incomplete data sets caused by erratic Internet connectivity in some participant countries reduced the number of cases with complete data sets to 10.

The 10 participants in the larger study came from Brazil, Bulgaria, India, Seychelles, Spain (2), Sudan, Turkey, the US and Venezuela, and ranged in age from 22 to 44. Their educational experience ranged from high school to PhD. Three participants had indicated that their highest educational level was high school. The two participants who are the focus of this paper were selected based on their contrasting sociocultural economic backgrounds: "Pablo" lives in a rich country (US) and comes from a family that is first-generation migrant working class; "Mariam" lives in a poor country (Sudan) and comes from a educated middle class. These two learners also differed in their levels of achievement in the MOOC. Mariam achieved the highest overall grade (92%) of the 10 participants, and Pablo the second lowest (50%).

Phase 2 data collection

The 10 case-study participants were asked to complete as second online survey *(Survey 2)* consisting of 29 items from the MSLQ (Pintrich et al., 1991). Four MSLQ scales were selected based on their strong predictive power of achievement: metacognitive self-regulation, effort regulation, time and study environment and test anxiety. Some of these items were modified slightly to suit the research context (for example, the word "class" was replaced by "course"). Responses from the two surveys were analysed to form a preliminary case profile for each participant and to personalise prompts for pre-defined qualitative data sources.

Three semi-structured interviews, conducted via Skype, took place at the beginning and end of the MOOC and three months after its conclusion. Interviews collected information about participants' (1) life goals, current activities, educational background and family; (2) activities during the MOOC; and (3) reflection on their MOOC participation and plans for the future. All interview transcripts were sent to participants for member checking.

An online learning journal was provided for participants to complete on the days that they engaged in MOOC activity. Participants were asked to record aspects of that day's activity such as time spent, problems encountered, strategies used and confidence in completing the course. Participants were sent daily email or text reminders to complete the journal. Journals were downloaded and collated into a spreadsheet for each case. Summaries of the entries were sent to each participant to serve as prompts for questions about their experiences during the second interview. Digital artefacts such as course progress records, certificates, scans or screen shots of study notes and schedules were collected from each participant.

At the end of Phase 2, datasets were collated for each case. An audit of collected data was conducted to determine incomplete data sets. If gaps were identified, the participant was contacted by email and asked to provide this information.

Data analysis

Hard copies of the interviews were read several times and analytic memos were recorded in the margins. The data, research questions and theoretical framework guided these annotations. Concept maps were drawn from these notes to visualise emergent themes and relationships between the data. A spreadsheet was used to capture and develop these emergent themes into a framework informed by Bandura's model of triadic reciprocal causation (Bandura, 1986), and resulted in the following main and sub-categories of codes: Personal (Motivation, Belief, Other Personal); Behavioural (MOOC Learning, Non-MOOC Learning, Other Behaviours); and, Environmental (Social, Non-Social). A separate category (Other) was created to accommodate phenomena that did not at first view fit into the coding framework. Other data sources, such as learning-journal summaries and digital artefacts, were imported into HyperRESEARCH and, along with the interviews, were coded line by line based on the framework. The findings of the coding analysis and quantitative results were represented in an Excel spreadsheet, which enabled the comparison of findings within and across cases as well as the mixing and triangulation of findings from different data sources.

5.4 Findings

The findings that follow are organised around the stories of one high and one low achiever, Mariam and Pablo, in a MOOC on biomedical imaging. Each account begins with a description of the learner's background, life goals and reason for enrolling. This is followed by an account of what they actually did in the MOOC and their experience of learning in this environment. Each learner's story concludes with the learner reflecting on their experience, plans and life goals.

Mariam: Background and motivation for enrolling

Mariam is a 25-year-old female dentist studying in a postgraduate oral-pathology program and working as a teaching assistant at a university in Sudan. She is the second youngest of five children. Her father is a retired academic. Mariam's career goal is to do research whilst maintaining a clinical practice in dentistry. She enrolled in the MOOC to improve her ability to use imaging in her clinical practice.

Family and learning: "You always find someone who is doing some kind of study at our house…."

Mariam appeared for the first interview on Skype bright and enthusiastic about participating in this study. She spoke in a clear and considered way, careful to find the right word to match her thoughts. For each interview she was seated in front of shelves full of books. This was in fact her father's desk, and was a favourite place for her to study, as it was quiet there. It was also a place where her father would "sit and read for a long time" (Interview 1). Mariam was the second youngest of five children. Her two older brothers were engineers and her elder sister a physician, and her younger sister was still at university. She recognised that her family was a bit different from the norm: "You always find someone who is doing some kind of study at our house at some time of the day – especially during the evenings. Sometimes each one of us is taking a book and reading. Even our relatives, when they come to our house, they say that we are weird." (Interview 1).

Self-beliefs as a learner: "I feel good when I learn new things"

Mariam had a strong belief in her academic abilities, driven by a strong desire to learn and be her best. She had self-reported a maximal score for learning self-efficacy (Survey 1),

which suggested she had firm beliefs in her ability to achieve and perform academically. This confidence seemed well-founded, as she was rewarded with a job as a teaching assistant at university based on her performance in her undergraduate degree. She was also aware of her strengths as a learner, pointing out that she was a committed student who could concentrate well during lectures and seek help when it was needed: "I think this makes me a good student" (Interview 1). She was also aware of her weakness, citing that distractions were a problem when she was studying. Her mobile phone was the main culprit, calling it "a weapon of mass distraction" (Interview 1). An analysis of Mariam's achievement-goal orientation scores (Survey 1) suggested that she was more oriented towards mastering knowledge (mastery-approach: 7.00) rather than on assessments of her performance (performance-approach: 2.00, performance-avoid: 1.00). This hinted at Mariam's strong focus on learning for its own sake and a view of herself as a lifelong learner: "The learning itself, I find it good, I feel good when I learn new things and I get through this ignorance" (Interview 1).

Reasons for enrolling: "To deal with patients in a better way"

Mariam had indicated in Survey 1 that she used biomedical imaging in her career as a health professional. She indicated that she was only *slightly familiar with the topic* (Survey 1) and later explained that radiology had not been covered in sufficient depth in her undergraduate degree; she had enrolled to develop in this area, especially in the interpretation of images in clinical practice, "to learn new things and to know better to deal with patients in a better way" (Interview 1). Mariam had enrolled in several MOOCs prior to the biomedical-imaging MOOC, and had completed one on quantitative research. She set herself the goal of earning the certificate in the biomedical-imaging MOOC as a way of motivating herself to "keep doing and keep patience" (Interview 1).

Pablo: Background and motivation for enrolling

Pablo is a 22-year-old male in the second year of an associate degree majoring in biology and computer science at an urban-based community college in the US. He is the youngest of three children of parents who migrated from the Dominican Republic. Pablo's career goal is to get into medicine and become a doctor. Pablo enrolled in the MOOC for the personal challenge and to see if biomedical imaging could be something he could "get into" later on.

Family and learning: "Left to my own devices"

Pablo was in final stage of a two-year associate degree in biology and computer science. He was living at home with his parents in a large US city and attended the Skype interviews from his bedroom, where he liked to study, as it had a big desk, it was quiet and he could be "locked away" (Interview 1). His father worked as a limousine driver and his mother, now retired, had previously worked in a factory. Pablo was the youngest of three children. His brother, whom he described as being a "troubled student at school" (email interview), worked in a furniture company. He likened himself to his sister, who was also a college student, describing her as a "quiet student who completes her work on time" (email interview). Pablo indicated that his parents were supportive of his schooling, and that his mother would attend teacher-parent nights, but they would not, for example, check to see if he had done his homework or studied for exams. He was, as he put it, "left to my own devices" (email interview). In his spare time Pablo was learning Korean, as he was interested in going to South Korea to teach English or "something in the science field" (Interview 1).

Self-beliefs as a learner: "I would consider myself a B+ student…but I'm working on it"

An analysis of the survey data found that Pablo's measure of learning self-efficacy was relatively high (6.38). This suggests that Pablo was very confident in his academic abilities. He also offered a contrasting self-assessment: "I would consider myself a B+ student…. I need to be an A student, but I'm working on it" (Interview 1). In reply to a question about his strengths, Pablo indicated that he was good at multitasking, such as studying while watching television, and that he was "usually very good at learning concepts really fast" (Interview 1). Pablo recognised he has some weaknesses, the main being procrastination: "I usually study at the last minute…it's a bad habit of mine" (Interview 1). He also indicated that, while social media was a persistent distraction, a more serious problem for him, which had developed when he was at school, was that he was reluctant to ask for help: "That habit kind of progressed during my years as a student, whether it was in middle school, high school and even in college and it caused many headaches, many problems" (Interview 3). This reluctance may be explained by Pablo's orientation to achieving in learning contexts. He scored a maximal 7.00 for the performance-avoid orientation (Survey 1), which indicates he was strongly oriented towards avoiding negative assessments of his

performance. This may explain why he was reluctant to ask for help; he did not want to appear incompetent in front of others.

Reasons for enrolling: "…at least I'll know where I want to go in the future"

Pablo indicated that he had no formal knowledge of biomedical imaging (Survey 1) and that this was his first MOOC (Interview 1). Pablo had enrolled in the MOOC for several reasons. He was considering a career in imaging: "It's something I always had an interest in and maybe I'm going to go into that field later on" (Interview 1), and he was seeking a personal challenge and enrolled as a kind of test to see if he could get into medicine:

> If I'm able to pass this course and get a certificate then, you know, I'll know I'll be able to make it to medical school, and if I go to medical school at least I'll know where I want to go in the future (Interview 1).

Summary: Background and reasons for enrolling

Data collected from Survey 1 and Interview 1 reveal some key differences between Mariam's and Pablo's backgrounds and reasons for enrolling. First, it should be noted that the two participants were at different points in development: Mariam, a few years older than Pablo, was settled in her career as a dentist and is studying at the postgraduate level, whilst Pablo was only in the second year of college and still exploring what he wanted to do with his life. The two participants differed, too, in their family backgrounds. Academic achievement and quiet intellectual activity were normalised in Mariam's background, but the same cannot be said for Pablo, whose parents were working-class migrants. The participants' reasons for enrolling were different too. Mariam was specific about what she wanted from the MOOC – professional development – whilst Pablo's reasons were more vague, related to personal challenge and curiosity about the topic.

Mariam's and Pablo's learning journals and achievement data

Throughout the biomedical-imaging MOOC, Mariam and Pablo were asked to record the time they spent in the MOOC in a learning journal. At the end of the MOOC they were also asked to share the results of assessments within the course (Table 23).

Table 23

MOOC Study Time and Achievement

Study Time	Mariam	Pablo
Total days	11	31
Total study sessions	26	107
Average session length	69 minutes/session	24 minutes/session
Total time	30 hours	44 hours
Assessment		
1. X-Rays	100%	90%
2. Computerised Tomography (CT)	100%	100%
3. Ultrasound (US)	100%	90%
4. Magnetic Resonance Imagery (MRI)	70%	—
5. Diagnostic Nuclear Medicine (DNM)	100%	—
Assessment Scenarios		
Assessment Scenario 1	65%	—
Assessment Scenario 2	75%	—
Overall Grade	92%	50%

Overall Mariam was more efficient and effective than Pablo in how she spent her time in the MOOC. She spent around one-third the time Pablo did to achieve an overall grade of 92%, compared to Pablo's 50%. Mariam's average study sessions were also around three times longer than Pablo's. Records also show that Pablo recorded no assessment submissions from the episode of MRI onwards, despite doing very well in the first three assessments, whilst Mariam persisted to the end of the course.

Mariam and Pablo were also asked to record the strategies that they used on each day of MOOC activity. Participants were offered a multiple-check box item of 10 strategies, including an *Other* option into which they could type a response. Respondents were also offered an option to indicate that they did not use any strategies on that day (Table 24).

Table 24

Learning Strategies

Learning strategy	Mariam	Pablo
I set myself some goals.	6	8
I rewarded myself for reaching self-set targets.	3	6
I made a plan or outline for an assignment.	3	8
I interacted with course content to help me learn.	6	4
I revised my previous notes, readings and lectures.	0	2
I searched the forums for specific information.	2	3
I posted to a forum.	0	0
I asked someone I know for help.	0	1
I changed my immediate environment so I could better study.	1	3
Total instances	21	34
Other	0	0
I did not use any strategies today for learning	2	7

Pablo recorded more days of using learning strategies and days of not using any learning strategies than Mariam, which is not surprising considering that he spent considerably more time in the MOOC than her. It is notable that neither participant used the forum to interact with others, instead using it to search for information.

Participants were also asked to indicate any specific difficulties they encountered in the MOOC. This learning-journal item offered a multiple check box of eight options including an *Other* option, into which they could type their response. These responses were collated and grouped into personal and environmental categories (Table 25).

Table 25

Difficulties Encountered

Difficulty	Mariam	Pablo
A lack of motivation to study	1	1
A feeling that the course was too difficult	2	0
A feeling of being bored with the course.	0	0

A distracting online environment	3	2
A distracting physical environment	6	1
A lack of time to study	3	1
Internet connectivity	1	1
Understanding accent (Other)	1	—
I did not experience any difficulties with studying today.	3	25

Mariam, the highest achiever, recorded two days of finding the course too difficult, whereas Pablo, a low achiever whose course progress stopped mid-way, indicated none. Similarly, on most days (25 of 31 days), Pablo recorded that he experienced no difficulties while studying, whilst Mariam experienced difficulties more often (3 of 11 days). The distractions of the physical environment were a key difficulty for Mariam, who recorded it as a problem on six occasions, compared to Pablo's one.

Summary: Learning journal and achievement data

Based on the learning journal and course record data presented here, Mariam and Pablo engaged in the MOOC and perceived their progress within the course in substantively different ways. Mariam was more efficient and effective in how she used her time in the MOOC and the strategies she employed. She also seemed to be more aware of how she was going as a learner and willing to admit that she found the course too difficult; in contrast, Pablo recorded far fewer problems with the course, which is surprising considering he did not progress past MRI.

The next section describes how Mariam and Pablo learned in the MOOC based on data collected in Interview 2, at the end of the MOOC. Participants were sent learning-journal summaries and asked to elaborate and extend on what they had recorded there.

Mariam: Learning in the MOOC

Time management: "I strictly schedule the activities of today"

Mariam was effective in how she used time in the MOOC to study. She explained that she did not want to fall behind, as she had done in a previous MOOC that did not have "strict deadlines" (Interview 1). She was determined not to let this happen in this MOOC, so she set her own deadlines for assessment submission, even though deadlines for all assessments

were at the end of the course "So it's a deadline for myself so as to ensure that I complete the whole course and not accumulate things" (Interview 2). Learning-journal records show that she fell behind early in the course, as she recorded no MOOC activity for two weeks. However, she got back on track in week 6, in which she "submitted assignment of two episodes" (learning journal). Additionally, the days she recorded MOOC activity were spread out consistently in line with her self-imposed schedule and the rollout of episodes. Mariam used a tool – a paper-based calendar – to help her schedule her learning in the MOOC. In week 8 she spent 20 minutes scanning an episode to see how much time was needed so she could "schedule it correctly in my week plan" (Interview 2). She admitted she was usually able to stick to this schedule, "but it's not 100%" (Interview 2).

Besides Mariam's ability to schedule her MOOC study time, she was also able to study for extended periods of time. Mariam's learning journal records indicated that on average, she studied for more than an hour each time she engaged with the MOOC. Her longest session was 210 minutes, which took place in the last week of the course. She explained why this session was so long: "I studied a very long time because I had the episode of nuclear imaging and the final scenarios as well. I had to do them both" (Interview 2). This highlights Mariam's determination to reach self-set targets and her ability to focus on a task. Mariam indicated that one of her strengths as a student was her ability to "concentrate well during lectures" (Interview 1); she was also able to concentrate while studying on her own, which may in part explain her high level of achievement in the MOOC. As well as her ability to remain on task, she was strategic about her study on that day: "I strictly schedule the activities of today" (learning journal).

Learning strategies: "...so I can explain things to myself"

Three noteworthy learning strategies that Mariam used in the MOOC related to how she interacted with the content to learn new material and how she used rewards and her environment to motivate herself to study. The first involved how she interacted with the video lectures, which were the core instructional component in the MOOC. Due to the poor Internet connectivity in her country, Mariam needed to download the videos to her laptop so she could pause them without losing connectivity: "I stop it when I find something difficult. I repeat it again and take notes…. I go to the transcript and read it while the video is going" (Interview 2). Mariam also explained that she had a strategy for taking notes: "I tried to take notes and to draw figures so I can explain things to myself…. I use the mind

map, too" (Interview 2). Her use of words was important here: "I can explain things to myself" suggested that when she took notes she was making the effort to integrate the new content into her existing understanding of the topic. Mariam was methodical in how she organised her notes, indicating she had devoted a notebook to this MOOC. She explained that the use of notebooks was useful "so I can get back to do the subject easily when I want to study it" (Interview 2). The second learning strategy involved using rewards as a motivator for study. Learning-journal records show that she used rewards on three occasions. At the time of this research the 2014 World Cup was taking place; "I allowed myself to watch the football matches," she explained (Interview 2). She also indicated she went to the swimming pool one Sunday as a reward for her study on Saturday. Mariam also described changing where she studied as a way to motivate herself to study: "I usually have breaks and change the place where I sit, or I just gain the spirit again and try to motivate myself so I have to complete" (Interview 2).

Dealing with difficulties: "I skipped areas that I could not understand"

The first source of difficulties for Mariam was the challenge posed by specific episodes in the MOOC. Learning-journal records indicate that Mariam found the course too difficult on two occasions. On the first occasion, during CT in week 3, her response to this was to "rewatch the videos and search the forum" (learning journal) for help. She explained that she "looked for the questions that came up into my mind…to see if someone else asked the questions" (Interview 2). This strategy was successful, as she was able to find the answers to the questions she had in mind. In week 6 (MRI), though, she did not have the same success. She searched the forums for help but could not find answers to her questions, although she did take comfort from the fact that she was "not the only person who is suffering here" (Interview 2). Mariam did not give up, seeking help offline. She ran into some professors who were discussing some MRI scans at the dental hospital in which she occasionally worked and asked them for help. However, they could only offer her clinical explanations; "maybe because they themselves do not know it, well, in a deep way" (Interview 2), she concluded. Following this, she determined that it was a "mission impossible" to understand. Undeterred by the setback, she reset her goals: "I skipped areas which I couldn't understand" (learning journal, Tuesday, week 6). Despite her perception that she did not fully understand MRI, she submitted the assessment and achieved a grade of 70% for this episode. Mariam did not attribute the problem to her own limitations, but

to external factors: "There were not enough explanations for the principles," she explained (Interview 2).

A second source of difficulties for Mariam was her social environment. On Saturday of week 2 she indicated that she took a "long break to deal with distractions…" (learning journal). She explained that on that day she informed her sister and mother not to disturb her, as she wanted to study, and then locked her bedroom door. This was not successful: "…the only thing that I could do is, I tried as fast as possible to do what they want me to do and come back to the lecture" (Interview 2). Mariam also indicated that on three occasions social media was a source of distraction (learning journal). She explained that typically she would have a Facebook tab open, along with some other browser tabs, while studying in the MOOC. She had taken steps to minimise this distraction by disabling instant messaging and setting notifications to silent. However, this was not her main problem: "I manage it but it's not well. I try to ignore new notification and new things on my wall but sometimes I fail" (Interview 2).

Pablo: Learning in the MOOC

Time management: "I just lost track of the time and everything went out of focus, unfortunately"

Overall, Pablo was unable to control how he used time in the MOOC. Learning records show that Pablo's study sessions were short. On Saturday of week 11, Pablo indicated that he had studied throughout the night in four sessions for a total of 28 minutes. Pablo explained that his study had been broken up by naps in which he "dozed off" (Interview 2). Pablo also revealed that he watched TV at the same time as studying. This pattern of mixing napping, watching television and MOOC study may explain why his study sessions were numerous and short.

Pablo appeared rather embarrassed when he confessed that he had not done enough to pass the course: "I just lost track of the time and everything went out of focus, unfortunately" (Interview 2). Pablo explained that he lost control of time because he was spending time working for money and doing volunteer work. Although Pablo was keen to see if biomedical imaging could be a possible career choice, and believed his interest in medicine and technology might be a good fit for him, at some point during the MOOC he came to

the conclusion it was not for him: “It wasn’t really something that interests me” (Interview 2). This may in part explain why he spent his some of his available time doing other things that motivated him more.

Despite coming to this conclusion about biomedical imaging as a career and a declared loss of interest, Pablo recorded activity in the MOOC even into the final week. Also, Pablo rated his confidence in completing the MOOC at a maximal 7 in the final three weeks of the course (learning journal), which was at odds with the reality of his course progress. On being asked why he reported such confidence, he replied, “I know I could pass the course. It’s just with the whole time scenario that happened” (Interview 2).

Learning strategies: “I just copied and pasted into Word….”

Pablo reported that he took notes throughout the course, which were organised into one Word document per episode, but admitted, “… really I just copied and pasted into a Word [document]…. I didn’t write them myself” (Interview 2). He indicated in the learning journal that on two occasions he read these notes before attempting an assessment. He also described a flash-card application that he used to memorise new terms in the course, which he found beneficial: “Most definitely, yes, it did help. I just kept repeating it” (Interview 2). Pablo indicated that in week 11 he used rewards as a learning strategy on three occasions (learning journal). Pablo also recorded that he used rewards as a learning strategy six times throughout the course (learning journal), and revealed that he would go to the shop and buy candy, even late at night, as in the city he lived in there was always something open.

Assessment of one’s performance and the feedback it affords is a valuable opportunity to learn. Course records show that Pablo got good marks for the first three assessments, but did not submit assessments from the MRI episode onwards. He explained that he had actually worked on other assessments, but “I just saved them; I haven’t submitted them yet” (Interview 2). Given Pablo’s strong performance-avoid orientation to learning (Survey 1), he may have avoided possible negative assessments of his performance by not exposing them to even the possibility of automated feedback that was private to him. Pablo’s concern about how he was seen in others’ eyes may also have played a part in his continued recording of activity in the learning journal from the MRI episode onwards.

Dealing with difficulties: "I thought it was going to be a bit easy…."

Pablo experienced substantive difficulties with understanding the concepts presented in the course as it progressed. Although Pablo proposed that lack of time was the cause of his low achievement, the real problem was more likely to be his initial overconfidence: "Well, to be honest, I kind of underestimated the course. I thought it was going to be a bit easy but it wasn't" (Interview 2). Pablo attributed his difficulties to a lack of expertise in one area: "I never did well in chemistry. I mean I did okay but not well" (Interview 2). The only episode in the course in which chemistry played a substantive role was the last episode, diagnostic nuclear medicine; the other episodes covered modalities that required knowledge of physics. It was not clear to what aspect of the course he was referring. In any case, it would seem he lacked the underpinning knowledge that was necessary to understand what was being presented.

Learning-journal records show that Pablo used the forums on three occasions to search for information. He later explained that he searched the forums to see if "other people were having problems" as he was. It was not clear what specific problems Pablo was looking for in these online discussions, but in any case it did not help: "I felt even more lost," he admitted (Interview 2). Pablo also indicated that he sought help from someone else on Tuesday of the second week (learning journal). However, he also declared that he had not sought help from anyone else and referred back to his problem of admitting that he needed help, which was, as he put it, "one of my biggest problems" (Interview 2). So it is unclear what actually happened on that occasion to trigger this record or if he had made the record in error.

Pablo reported on several occasions that his environment was a source of difficulty when he was studying. On Monday of week 2 he indicated that he was being "bombarded" by texts and emails. He dealt with this by downloading the video lectures and turning off his connection to the Internet. On Thursday of week 3, he indicated that his upstairs neighbours were playing loud music. On this occasion he put on earphones and listened to his own music, which "helped tremendously".

Mariam: Outcomes

"I did not get too much from the course"

When interviewed three months after completing the MOOC, Mariam reported that she had since completed a separate MOOC on biology. She was enthusiastic about this course, declaring it to be "much, much, much better" (Interview 3) than the biomedical-imaging MOOC. "Each week they had an introduction video to show us what we will come across this week…the objectives of the week, what they expect us to do… it was very organised" (Interview 3). She also liked the fact that the biology MOOC asked students to submit weekly assignments involving different kinds of tasks, including the use of software that they provided.

However, she regretted that the biomedical-imaging MOOC did not deliver the learning outcomes that she had wanted: "For me as a professional practitioner, I did not get too much from the course" (Interview 3). When asked why she completed the course when it was not giving her what she wanted, she replied that she was hoping that by the end of the course it may have changed direction. Despite this disappointing experience, she remained enthusiastic about MOOCs, which she described as a "very brilliant idea" (Interview 3) because they provided an opportunity for people who lived far away to access courses from overseas universities.

In terms of the future, Mariam envisaged an academic career. She wanted to continue teaching but not to lose touch with the clinical practice of dentistry. She also expressed a strong desire to do research:

> I expect that during these three years I will finish my Masters degree…and during that time also I will find an opportunity, not in Sudan, but from outside, and I want to work with some research group as extra work to do researches, especially in the area of molecular biology. And I want to be co-author in surgeon's papers to be published. I think this is very good for my career (Interview 3).

Pablo: Outcomes

"I wonder [what] the outcome [would have been] if I was pushed just a bit in my early years"

Pablo was surprised to find out a short time after the course ended that he had done enough to earn the certificate, achieving an overall grade of 50% on the assessments he submitted. As he had made a pact with himself as to what earning the certificate would actually *mean*, he admitted to feeling a morale boost towards his ambition of becoming a doctor. He had also been accepted into a bachelor's degree at another college, and had been there for around one month at the time of the final interview. He reported that he was still settling in but revealed that his grades had dropped from "B plus" to "B".

Reflecting on his experience in the MOOC, Pablo recognised that some of his habits needed to change, such as studying late into the night and procrastinating. He put this in the context of the volunteer work he had done in a hospital, which had confirmed his dream of becoming a doctor:

> Okay, this is what I want to do. I want to be in medicine. I want to help people so I may just change my habit of…my ways of thinking – how to study, how to relate to people, my personality, and instead of being that quiet type, I actually, you know, you have to converse with other people and actually talk (Interview 2).

He also identified that he would need to change his reluctance to ask for help. In this instance he indicated that he would need external help: "Well, I'm going to need someone, like, to question me, to nudge me to make sure I get things done" (Interview 3). Pablo also reported that he had enrolled in another MOOC on epidemiology, in which he was particularly interested as the MOOC coincided with the worldwide Ebola outbreak.

Pablo reflected on his school days and the influence of his family. He described how his habit of procrastination was already in place during high school: "When I arrive home I turn on the TV, eat a meal and surf the web. Hours later is when I begin to start my homework…while this freedom was wonderful I wonder [what] the outcome [would have been] if I was pushed just a bit in my early years" (email interview).

5.5 Discussion

This paper reports on two contrasting cases within a larger multiple-case study that investigated how individuals regulated their learning in a MOOC. The two cases were selected based on their achievement in a MOOC on biomedical imaging: Mariam, a high achiever, and Pablo, a low achiever. The following discussion is organised around the three research questions.

What characterised these two learners?

Learners of differing sociocultural economic status

Mariam and Pablo lived in countries of high and low human development. The United Nations Human Development Index (HDI), which takes into account life expectancy and educational opportunities along with gross national income, ranked the US 5/187 (very high HDI) and Sudan 166/187 (low HDI) (Malik et al., 2014). Though Pablo came from a rich country and Mariam from a poor one, their immediate backgrounds told different stories: Mariam's family was of relatively high sociocultural-economic status and considered achievement at higher education levels to be the norm, whilst Pablo came from a migrant working class family that did not have access to the same cultural capital. In Mariam's, this study identifies the contextual details of the highly educated from developing countries who access MOOCs. Her demographics fit in with the findings of Christensen et al. (2013), who found that the vast majority of people who had enrolled in 32 Coursera MOOCs in 2012 and 2013 were well-educated, in employment and seeking career advancement. This study also characterises the context of a learner from a less advantaged background. Though Pablo was ill-equipped to succeed in a MOOC on the topic of biomedical imaging and it should not be a surprise that he struggled, this was not an ego-shattering experience for him. He enrolled in another MOOC on epidemiology, in which he may be better placed to succeed. He also had a taste – for free – of what it would be like to study biomedical imaging. Finding out what he is not suited for or interested in may assist him finding out what he does want as a career.

Differing motivations meant differing learning trajectories

The two learners had differing motivational mindsets, which resulted in distinct learning trajectories. Firstly, each participant had different levels of experience of the topic. Mariam

had already studied the topic in her undergraduate degree, whereas Pablo had no prior knowledge of biomedical imaging at all. It has been found elsewhere that learners with prior experience of the MOOC topic or who had prior experience of studying in a MOOC, had higher levels of self-efficacy for learning (Littlejohn et al., 2015). As self-efficacy has been found to predict academic achievement (Pintrich & Schunk, 2002, Pintrich, 2013), it should be no surprise that Mariam was able to achieve more in the MOOC than Pablo.

Mariam and Pablo's differing reasons for enrolling may was also a factor in their differing levels of achievement. Mariam had enrolled in the MOOC for different reasons. for a specific professional-development reason, to improve how she dealt with patients as a dentist. Pablo's reasons for enrolling were more abstract, involving personal challenge and curiosity about the topic. Elsewhere, a study of professionals in MOOCs on data science and health science found that professionals with high measures of self-regulated learning set specific learning goals in their respective MOOCs that related to their professional development, whereas the low-scoring professionals set more abstract goals to do with curiosity, the love of learning or the desire to broaden one's knowledge (Milligan, Littlejohn, & Hood, 2016). These findings suggest that people who enrol in MOOCs for specific reasons relating to their professional development may be more motivated and better equipped to successfully learn in a MOOC than others who enrol for more abstract, personal reasons. This has implications for how MOOCs are designed. Perhaps two learning pathways could be provided: a professional pathway for those capable learners who have enrolled for work-related reasons, and a general-interest pathway for less capable learners whose focus is on personal development.

How did these learners self-regulate in the MOOC?

Time management

The key difference in self-regulation between Mariam and Pablo was how they managed their study time in the MOOC. Mariam was an extremely effective time manager, using a calendar to schedule her activities, whereas Pablo had little control over his study time, to the point of mixing studying and napping in his numerous all-nighters. The ability to set goals and plan a schedule of study has been found to predict academic achievement in high-school students (Zimmerman & Martinez-Pons, 1986) and may be key in a MOOC, where the onus of scheduling one's time falls to the learner. Though it appeared that Mariam

followed a tightly planned schedule, there is some evidence that high-scoring self-regulated learners engaged in MOOCs in a random and ad-hoc way compared to low-scoring self-regulated learners who followed a rigid schedule (Littlejohn et al., 2015). It did appear that Mariam did follow a rigid schedule, but this may have something to do with how the course content was rolled out, which encouraged a linear, sequential approach.

Mariam was effective at motivating herself by using several strategies. She changed the location in which she studied as a way of energising herself. She also used rewards like watching football on television or going for a swim as a way of remaining energised and on course. She was also good at setting daily goals and doing what was necessary to reach them. On the other hand, Pablo remained in his bedroom, where napping proved to be a constant temptation. Although he also used rewards, his inability to set targets and to decide when to start and stop studying was a serious problem. Pablo admitted to being an inveterate procrastinator, and the behaviours he demonstrated in the MOOC were in line with that. Procrastination is a self-regulatory failure in which individuals voluntarily delay a course of action despite being worse off for that delay (Rozental & Carlbring, 2014). It is linked to lower levels of achievement (Tice & Baumeister, 1997), and has been found to predict poor performance by online learners (Michinov, Brunot, Le Bohec, Juhel, & Delaval, 2011). The finding in the present study highlights the problems an inveterate procrastinator encountered when studying in an environment where he was largely unsupervised and unaccountable. Perhaps MOOC providers could provide short courses that could help learners to understand the nature of procrastination, which is a widespread problem, and offer advice for how to overcome it.

Performance-avoid goals particularly maladaptive to learning in a MOOC

The two learners had differing orientations to learning, and this influenced how they behaved in the MOOC. Mariam was strongly oriented towards mastery-approach goals, meaning she was focused on understanding the subject material, whereas Pablo was strongly oriented towards performance-avoid goals, meaning he was concerned with avoiding negative assessments of his performance. To illustrate, Mariam was willing to submit her quiz attempt for the topic of MRI, a subject that she knew she did not fully comprehend, whereas Pablo neglected to submit his quiz attempts from the episode of MRI onwards. The performance-avoid orientation is widely regarded as driving maladaptive behaviours (Pintrich, 2003) and of undermining intrinsic motivation (Elliot &

Harackiewicz, 1996). Little is known about how achievement goals influence learning in MOOCs. The studies that have investigated achievement goals in MOOCs have focused solely on mastery goals (de Barba et al., 2016; Wang & Baker, 2015), and the findings are inconclusive. Though one might think that the people who learn in MOOCs would be mastery-oriented, as there are few extrinsic rewards in MOOCs (see Wang & Baker, 2015), this study has shown how one learner with a performance-avoid orientation learned in a MOOC. In a MOOC one cannot compare one's performance with others, but feedback, even if it is automated in the form of a quiz, can be a deterrent for people who want to avoid even *virtual* criticism. This has been an overlooked area of research in MOOCs and would be worthwhile pursuing.

Learning strategies limited to understanding content

The main learning activity in which Mariam and Pablo engaged during the MOOC involved watching the video lectures, and they went about this in very different ways. Mariam would pause the video to take notes and replay parts she did not understand, and would read the transcript while watching if needed. In contrast, Pablo watched television while he was watching the lectures. Unfortunately, Pablo was under the misconception that doing two things at once is possible without a loss of performance. It has been established that multitasking has a negative impact on memory encoding (Judd & Kennedy, 2011), so this habit may in part explain his inferior performance in the MOOC. Both learners took notes, but again, they went about this in different ways. Mariam's note-taking involved trying to *explain* things to herself, whereas Pablo just copied and pasted text from the screen into a Word document, which was not an active learning activity at all. In a review of 700 scientific articles Mariam's strategy of self-explanation –trying to explain to oneself in different ways what was presented – has been found to be effective across a range of subjects and ages (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). Pablo, like many students, may have believed that reading or rereading the text that he had copied was an effective strategy, but the evidence is that it is not. It compares poorly to more active strategies like self-explanation, asking questions of the text and self-testing (Dunlosky et al., 2013).

The challenge of seeking help

Both Mariam and Pablo sought help with the concepts presented in the MOOC in different ways and with mixed outcomes. It was noteworthy that within the MOOC environment,

neither learner used the forums to post a question, but rather used them to search for information. Mariam searched for discussions based on the questions that arose in her mind; this was successful on one occasion but not on another. Pablo's strategy was less focused: he browsed the forums out of curiosity rather than with a specific purpose. Mariam also sought help outside the MOOC from colleagues in her professional network, which was not successful in resolving her confusion, and Pablo did not seek any sort of social assistance, revealing that in general he was reluctant to ask for help from others. Seeking help, from either social or non-social sources, is a self-regulated learning strategy that has been found to predict achievement in high-school students (Zimmerman & Martinez-Pons, 1986). The forums within MOOCs, though provided with the intent of facilitating interaction and fostering learning, may not be that conducive to that purpose. A study of forum activity in a MOOC of 87,000 learners found that only a tiny proportion (4%) of enrolees actually posted to the forum, that those who did tended be young, educated and from the West, and that participants formed transient *crowds* rather than persistent *communities* where they developed relationships and interacted with each other over time (Gillani & Eynon, 2014). Another study of forum use in two successive instances of a MOOC discovered that forum use was driven by course milestones, such as assessment events, and that potentially useful information got trapped in pockets rather than spread globally through the forum network (Gillani, Yasseri, Eynon, & Hjorth, 2014). Simply put, MOOC forums were too big to facilitate the formation of learning communities or the consistent and efficient exchange of knowledge. The content-centric focus of the MOOC in the present study did not encourage interaction, so it is not surprising that Mariam and Pablo used the forums infrequently. Finding a way to adapt the forum to be used effectively by large numbers of heterogeneous users should be a focus for forum software engineers and MOOC providers.

What outcomes did these learners achieve?

Mixed outcomes, but MOOCs seen as a valuable for lifelong learning

Mariam and Pablo experienced mixed outcomes from their experience in the MOOC. The course did not deliver what Mariam wanted – clinical knowledge about interpreting biomedical images – so she was ultimately disappointed by her experience. It was apparent that she was becoming a critical MOOC user, as she had completed another MOOC by the time of the third interview, which she considered to be of superior design to the imaging

MOOC. She was enthusiastic about the idea of accessing quality content from distant universities, and it appeared that MOOCs would become part of her lifelong learning journey as she pursued her goal of doing research and continuing her dental practice. Pablo's experience in the MOOC was at first characterised by the sense of failure from non-completion, but then a sense of surprise and delight that he had achieved a pass and been awarded a certificate. In some ways, Pablo demonstrated insight that he needed to change some fundamental aspects of how he studied that had surfaced during his participation in in the MOOC. He accepted that this would not be easy, but believed that he could make these changes. Despite the difficulties he had experienced in the MOOC, he had enrolled in another, which was related to the health profession; thus it would seem that he also perceived value in enrolling in MOOCs. This investigation of two individuals with differing motivations and capabilities has found that both valued the learning that can be derived from MOOCs. MOOCs seemed likely to become part of each individual's lifelong learning journey as each strove to advance their career or progress towards a career.

Perhaps the main reason that Mariam and Pablo achieved contrasting outcomes in terms of their academic performance was the difference in prior knowledge of the MOOC topic that each brought into the course. Mariam had already studied radiology in her dentistry degree and had applied this knowledge in clinical practice, whereas Pablo had no formal knowledge of imaging at all. Ausubel (1968) argued that prior knowledge has been found to be the main determinant of learning outcomes, so it is perhaps no surprise that the two cases achieved at such different levels. Elsewhere, a study of data professionals in a data-science MOOC found that prior knowledge of the MOOC topic and prior MOOC experience were linked to higher learning self-efficacy scores (Littlejohn et al., 2015). As it has been established that learning self-efficacy predicts academic achievement in traditional classroom settings (Pintrich & De Groot, 1990; Zimmerman & Schunk, 2003), these findings suggest that prior knowledge of the MOOC topic and prior MOOC experience may be factors that predict successful learning in MOOCs. More research is required here.

Limitations

First, the generalisability of the findings from this paper is limited by the small number of participants and the fact that it concerned only one MOOC. Second, this study was based on an analysis of participant data collected through self-reports, which were subject to social-desirability bias and errors of human recall. Wherever possible, data collected by one method has been triangulated with another source to enhance the trustworthiness of the findings. Third, participation in this research was an environmental factor that may have influenced participant behaviour in the MOOC. For example, the daily learning-journal messages sent from the researcher were a regular reminder of their commitment to the study and may have influenced their motivation to engage in the MOOC.

Implications for further research

This study took a mixed-methods approach to investigating learning in a MOOC. Through the triangulation of data sources a rich and detailed picture has emerged of how two individuals experienced learning in a MOOC. Combining both quantitative and qualitative approaches is an appropriate strategy for investigating the complex phenomenon of learning in a MOOC. Future MOOC researchers could consider adopting this strategy to further an understanding of learning in these environments. This MOOC was assessed by multiple-choice quizzes, which meant an individual could complete it without interacting with anyone. Nothing is known of how assessment methodologies in MOOCs influence motivation and learning; this is an area of MOOC development that could be improved based on empirical evidence. This paper showed how an individual with poor self-regulatory skills struggled in a MOOC. The study of self-regulation in MOOCs is key to understanding how to deliver a better educational product that can accommodate and assist learners with differing levels of self-regulation.

5.6 Conclusion

This paper recounted the stories of two learners enrolled in a biomedical-imaging MOOC who were selected for their contrasting levels of achievement. Mariam, the high achiever, was found to be more strongly motivated, with specific career-related reasons for enrolling. She also had prior experience of learning in MOOCs and substantively more prior knowledge of the MOOC topic than Pablo. She was well equipped motivationally to succeed in the MOOC and demonstrated competence in regulating her MOOC-based

learning. Pablo, in contrast, struggled with the basic concepts in the MOOC; his confusion was compounded by habituated self-regulatory failures. Despite Mariam's substantive advantages and demonstrated success in the MOOC, she struggled in one section of the course. This paper found that even an excellent self-regulator with the requisite knowledge, skills and experience to succeed in a MOOC can struggle when trying to understand a complex topic. This highlights a limitation of learning in MOOCs, where there are no teachers to provide guidance, tailored support and corrections to students' misconceptions. In this case, the learner lost some confidence in the quality of the course but was nevertheless able to complete it. MOOC developers and designers need to ensure that the content presented is well designed, follows sound pedagogical principles and is of a consistent level of difficulty throughout. As well, course providers may wish to analyse forum posts and assessment results to identify where learners may be going wrong and take steps to fix these areas.

The stories of Mariam and Pablo provide two distinct portraits of lifelong learners and support the view that MOOCs are a significant new force for lifelong learning. Though each struggled in their own way in the MOOC to overcome problems which led to differing learning outcomes, it was significant that neither one was discouraged by this experience. They were both positive about what MOOCs could offer and had already taken steps to use MOOCs again in their lifelong learning journeys. This points to the value of continued research into MOOCs and efforts to improve them so that they provide more effective learning opportunities for those who choose to participate in them.

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CHAPTER SIX: PAPER 3

Preamble to Paper 3

This paper extends the findings from Paper 1, which found a link between experience of the MOOC topic and motivation. Specifically, a statistical analysis of survey data found that respondents who had substantive experience of the MOOC topic, through their work or formal study, had superior motivational mindsets to respondents who had less formal experience of the topic. The Work and Formal Study respondents were found to be more intent on completing the course, more confident about their academic ability and more energised to achieve than the General Interest respondents. Paper 3 then continues this line of inquiry by asking, *how do learners with differing experience of the MOOC topic learn?* Based on the findings of Paper 1, it was expected that Work and Formal Study learners would be more successful at learning in the MOOC than General Interest learners because of their superior motivation.

Six cases were selected for this paper based on their experience of the MOOC topic, using the same grouping logic as in Paper 1. Five participants reported that their MOOC-topic experience came from their work (Federico, Mariam, Layla, Antonio, Walter). As Mariam, the highest achiever, had been covered in Paper 2, the next two highest achievers, Walter and Antonio, were selected for Paper 3 as the *Work* participants. Only two participants' experience came from formal study, so these participants, Anna and Arjun, were selected as the *Formal Study* participants. Three participants (Pablo, Huseyin and Monica) had reported that their MOOC-topic experience came from general interest. As Pablo's learning had been reported in depth in Paper 2, Huseyin and Monica were selected as the *General Interest* participants in Paper 3.

PAPER 3

TOPIC EXPERIENCE AND LEARNING IN A MOOC

Investigating the influence of topic experience on motivation and learning in a MOOC

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6.1 Abstract

The people who enrol in MOOCs have diverse backgrounds. Some have substantive experience of the MOOC topic from their work or their formal studies, whilst others have less formal experience, having gained some knowledge about the MOOC topic from their general interest. Whilst it has been established that people have differing backgrounds, motivations and patterns of engagement in MOOCs, little is known about how learners of differing backgrounds actually learn in these environments. This paper draws on the findings of a larger mixed-methods study that investigated how learners with differing backgrounds learned in *Introduction to Biomedical Imaging*, an edX MOOC delivered in 2014. In this paper, six cases were grouped based on their experience of the MOOC topic. The three groups were: (1) Work (Walter and Antonio), (2) Formal Study (Arjun and Anna) and (3) General Interest (Monica and Huseyin). Data was collected from multiple sources and analysed through the lens of *self-regulated learning* (SRL) to generate detailed accounts of how these three different types of participant learned in the MOOC. The *Work* learners, the highest achievers in this paper, were found to expend the least effort on regulating their learning in the MOOC, as it was not required. Their extensive experience of biomedical imaging meant that they found the course easy. The *General Interest* learners were the most strategic in how they approached the MOOC, resetting their goals and adjusting their effort to achieve their goals. The profiling of MOOC learners by their topic experience may be useful to MOOC providers and designers. Pedagogical approaches and tasks could be designed to meet the needs of specific audiences, which would boost their motivation and encourage self-directed learning.

6.2 Introduction

In the digital age, perhaps the most significant innovation in lifelong learning is the massive open online course, or MOOC. These completely online courses are open to anyone with the desire to learn and access to technology and the Internet. Since they emerged in 2011, participation in MOOCs has risen rapidly. Over a four-year period from 2012 to 2016 there have been on average, 1,554 new enrolees per day in MOOCs from Harvardx and MITx (Chuang & Ho, 2016) and participation in MOOCs is predicted to continue (Flamig, 2016). As lifelong learning is the bedrock of a thriving economy and society and a necessity for remaining employable in a quickly changing job landscape (Department of Education and Science, 2000; Medel-Añonuevo et al., 2001a), the emergence of a new type of learning technology that promotes such participation is of importance. Though MOOCs have attracted millions of people into lifelong learning, relatively little is known about how they qualitatively learn in these environments (Veletsianos & Shepherdson, 2016).

The open nature of massive open online courses, or MOOCs, means that anyone can participate, from those who enrol on a whim to others who have serious intentions to engage with the course for professional or formal study reasons. It is not surprising, then, that people in MOOCs have different ways of engaging with the courses. Educational researchers have studied this and come up with different categorisations of MOOC learner based on their engagement. In a mixed-methods study involving interviews with 29 learners in a connectivist MOOC (cMOOC), three types of learner were identified based on their engagement: *active learners*, who were actively contributing to the network; *lurkers*, who were reading but not contributing; and *passive learners*, who, oddly, were persisting with the course but dissatisfied with the experience (Milligan et al., 2013). In their study analysing survey and clickstream data from three computer science MOOCs, Kizilcec, Piech and Schneider (2013) identified two types of engaged learner: *completers*, who engaged with everything in the course, and *auditors*, who were focused on the content but not the assessments. A study of log records from 42 Coursera MOOCs confirmed that there were at least two types of learners in MOOCs: *engagers*, who watched videos and did quizzes, and *auditors*, who just watched the videos (Glance & Barrett, 2014). These findings suggest that people engage in MOOCs in different ways. However, they reveal little about how people actually learn in MOOCs.

MOOCs require learners to be self-directed. In the informal learning environment of a MOOC, in which completion is an option and not a requirement, learners are free to select what aspects of a MOOC they wish to engage in and where and when they do so. As one-to-one support is absent, the need to self-direct one's learning is heightened. *Self-regulated learning* is a theoretical construct that describes how learners direct their own learning and adapt it when necessary to meet their personal goals. Although this lens was originally used to study learning in formal classroom contexts, it has been used extensively to study learning in online contexts. One of the findings of a review of studies of self-regulated learning in online learning was that online environments are best used by people who can regulate their learning (Bernacki, Aguilar, & Byrnes, 2011). The primacy of self-regulated learning in online environments was echoed in a separate review that called for research that increased understanding of how motivation, metacognitive skills, learning strategies and dispositions influence learning in MOOCs. Self-regulated learning was used as a lens to understand how people learned in Change 11, a connectivist MOOC; the researchers found that the participants had diverse backgrounds, and that not all of them could regulate their learning, or chose not to regulate their learning (Milligan et al., 2013). A study of a cMOOC on educational technologies that used survey and logfile data and an SRL approach to understand learning found that participants who set goals of earning an open badge or certificate of attendance were more likely to persist than others (Haug, Wodzicki, Cress, & Moskaliuk, 2014).

Some researchers sought to understand whether a learner's background influenced their learning in a MOOC. A mixed-methods study involving interviews with 35 learners who had identified as working professionally in the area of the MOOC topic found little evidence of learners directing their own learning and integrating new knowledge into their existing practice (Milligan & Littlejohn, 2014). The design of the MOOC, which was of a repetitive nature, with a focus on content transmission rather than knowledge creation, may have discouraged learners from taking more control of their learning. MOOCs are a potential source of professional development and could meet an increasing need for learning new skills in a swiftly moving global job marketplace. But professionals are not the only ones who enrol in MOOCs; people enrol in MOOCs for a variety of reasons: to supplement their formal studies, to challenge themselves, to satisfy their curiosity or for other personal reasons. Little is known, though, about how a learner's background and

motivation influence how they learn in a MOOC. This study aims to fill this gap by investigating how learners of differing topic experience and learn in a MOOC.

Theoretical framework

This study is situated in a social cognitive theoretical framework that conceptualises human action as the result of interdependent and mutually influencing forces of personal, behavioural and environmental variables, in what Bandura called *triadic reciprocal causation* (1986). Several models describe self-regulated learning and propose various ways of measuring it, which makes it a challenge to study (Boekaerts & Corno, 2005). This study applied Zimmerman's *triadic model of self-regulation* (1989, p. 330), as it aligned to the social cognitive framework from which it was derived. Zimmerman's model was also useful in this study as it provided a way of understanding how personal, behavioural and environmental factors influence the learner and each other. It is a simple model, but subtle enough to explain human learning in all its complexity and nuance.

Even capable self-regulated learners do not necessarily take control of their learning in a self-regulated sense; they have to be motivated to do so (Pintrich & De Groot, 1990). Two aspects of motivation that have developed within the social cognitive theoretical framework were of interest in this study. The first is *self-efficacy*, which describes a person's confidence in achieving or performing to a certain level in a specific context. Self-efficacy for academic learning has been established to predict achievement in traditional classroom contexts, but how it functions in online contexts is not well understood (Hodges, 2008). Confidence and prior experience of learning in a MOOC were found to mediate engagement in a cMOOC (Milligan et al., 2013), suggesting that self-efficacy for learning in MOOCs may be a factor in performance in MOOCs. Little is known, though, about how self-efficacy influences learning in the more structured environment of xMOOCs delivered on Coursera or edX.

Another aspect of motivation that has been found to influence learning relates to what type of achievement an individual chooses to value in learning contexts. These achievement goals can be broadly categorised as performance and mastery goals. Learners with *performance* goals are focused on assessments of their performance, and learners with mastery goals are concerned with the mastery of the knowledge. Though this area of educational research has developed in different ways and with considerable lack of

consensus, there is a wide agreement that learners who hold a mastery-goal orientation are more resilient, persistent and adaptive than learners who hold a performance-goal orientation who tend to avoid challenge and do only what is necessary to get good grades, with less concern for the intrinsic value of learning. This study adopted the 2 X 2 achievement-goal framework as proposed by Elliot and Murayama (2008), which broke these two broad orientations into *approach* and *avoid* strivings. Within this framework three of the four orientations were of interest. Little is known about how these personal value systems influence learning in MOOCs. One might expect that learners who are mastery-approach orientated would engage actively in MOOCs, seeking opportunities to learn. It is not at all clear how learners with strong performance orientations would behave in MOOCs, as comparison with one's peers in MOOCs, unlike classrooms, is not possible. Nonetheless, assessments of performance are available in MOOCs, if the learner decides to engage with that aspect of the course. It would be of value, then, to study how learners with strong *performance-approach* or *performance-avoid* orientations behave in this context.

Purpose of this paper

The purpose of this paper is to investigate how learners with different backgrounds learned in a MOOC. An analysis of survey data of enrolees in the MOOC that forms the context of the present study found that experience of the MOOC topic was linked to motivation (see Paper 1 in this thesis). This paper aims to extend the quantitative investigation reported in Paper 1 by qualitatively studying how individuals with differing experience of the MOOC topic learned in a MOOC. Following the same grouping logic as Paper 1, three types of learners were studied: those who reported that their experience of the MOOC topic came from their work (Work); those whose experience came from their formal studies (Formal Study); and those whose topic experience came from a general interest (General Interest). It was hypothesised that Work and Formal Study learners would have higher levels of achievement and be more capable self-regulated learners than the General Interest learners. The following questions guided this investigation:

1. *What were the characteristics of these learners?*
2. *How did these learners self-regulate in a MOOC?*

3. *How did experience of the MOOC topic influence these learners' motivation and learning?*

The research was conducted in *Introduction to Biomedical Imaging*, an edX MOOC from an Australian university delivered in 2014. The content was structured in five episodes: (1) X-Rays, (2) Computerised Tomography, (3) Ultrasound, (4) Magnetic Resonance Imaging and (5) Nuclear Diagnostic Medicine; these were delivered over a 10-week period. To earn a certificate in the course, learners had to achieve at least 50% from seven automated quizzes. The deadline for all assessments was three weeks after the course end date. An online discussion forum was also provided for learners to interact with each other.

6.3 Methodology

This research adopted a mixed-methods approach. Mixing methods in social-science research is an appropriate strategy for investigating complex social phenomena (Creswell et al., 2003). The study took the form of a sequential-explanatory design that involved the collection of quantitative and qualitative data in independent phases in a sequential manner and the integration and interpretation of data at least once in the study (Creswell & Plano Clark, 2011). The research process started with a quantitative phase (Phase 1) in which cases were selected for a subsequent qualitative phase (Phase 2), which took the form of a multiple-case study. The case study is an appropriate research strategy when asking "how" or "why" questions, when the researcher has no control over behavioural events and when the focus of study is taking place in the here and now (Yin, 2014). It was therefore an appropriate strategy for investigating how people learned in a MOOC. The findings from both phases were mixed throughout the qualitative phase of the study. This triangulation of data sources enhanced the trustworthiness of the findings.

Phase 1 data collection

Phase 1 involved a survey (Survey 1) consisting of original and established items. The first section asked respondents to indicate their age, gender, nationality, English-speaking competence, academic experience, reason for enrolling, course completion intentions and experience of and familiarity with the topic. Established items included the s*elf-efficacy for learning and performance* scale from the MSLQ (Pintrich et al., 1991) and the *performance approach*, *performance avoid*, *mastery approach* and *mastery avoid* scales from the Achievement Goal Questionnaire-Revised (AGQ-R) (Elliot & Murayama, 2008).

Some of these established items were slightly modified to suit the research context, then tested prior to implementation. MOOC enrolees were invited to complete the survey through course announcements.

Case selection

Survey 1 also served as a case-selection instrument. Respondents were asked to indicate their willingness to participate in the ongoing research. Thirty-eight respondents who wer over 18, competent English-speakers and intending to complete the course were grouped based on their academic achievement. Three groups were formed: *Very Experienced* (PhD and master's degree), *Experienced* (bachelor's degree and college/vocational) and *Less Experienced* (high school or less). Candidates from each group were randomly selected and invited to participate. Sixteen formally consented to participate. Due to attrition and technological problems associated with the recording of interviews, the final dataset consisted of ten cases.

Phase 2 data collection

Phase 2 took the form of a multiple-case study. Methods of data collection were surveys, interviews, learning journals and digital artefacts. After case selection, the 10 research participants were asked to complete another survey. This online survey (Survey 2) consisted of the metacognitive self-regulation, effort regulation, time and study environment, and test anxiety scales from the MSLQ (Pintrich et al., 1991). Some of these items were slightly modified to suit the research context and tested before implementation. The test anxiety scale was subsequently removed from analysis, as items related to exams were not relevant to the research context. An analysis of Survey 1 and 2 data formed the basis of a preliminary case profile for each participant, which informed the subsequent investigations.

The participants were interviewed via Skype three times throughout the study, using a semi-structured protocol to provide consistency across the cases. These interviews took place at the beginning of the MOOC (Interview 1), at the end of the MOOC (Interview 2) and three months after the course end date (Interview 3). Interview transcriptions were sent to participants for member checking at each instance.

Participants were required to complete a learning journal on the days that they engaged in MOOC activity. This learning journal was an online survey built in Qualtrics that consisted of nine items asking participants to record various aspects of that day's activity (such as time spent, learning activities, strategies employed, difficulties experienced, responses to difficulties and confidence in completing). Learning-journal summaries were sent to each participant before Interview 2. These entries served as triggers for the recall and recounting of specific learning activities. Digital learning artefacts, such as course progress records and achievements, such as completion certificates, were also collected. Interview 3 took place three months after the conclusion of the MOOC. Each participant was asked to reflect on their participation in the MOOC and to talk about their plans for the future. The participants also shared a screen shot of their course progress screen at the end of their participation. This screen displayed a bar graph that provided a numerical result for the overall grade.

Data analysis and integration

Interview transcriptions along with other data items were printed out for each case. An audit of collected data was conducted to determine incomplete data sets, and steps were taken to fill these gaps by going back to the cases with further questions via email interviews. Hard copies of interviews and other data items were read several times, and analytic memos were recorded in the margins of the copy and the research journal. The data, research questions and theoretical framework guided these annotations and memos. A conceptual map was drawn from the notes to visualise emergent themes and possible relationships within the data. A spreadsheet was used to capture and develop these emergent themes into a coding framework that indicated and defined the theme and noted examples. The framework, informed by Bandura's model of triadic reciprocal causation (Bandura, 1986), resulted in the following main categories and sub-categories of codes: (1) Personal: Motivation, Belief, Other Personal; (2) Behavioural: MOOC Learning, Non-MOOC Learning, Other Behaviours; (3) Environmental: Social, Non-Social; (4) Other: phenomena that did not at first view fit into the coding framework.

At this point, all the data items were imported into HyperRESEARCH, a computer-assisted qualitative data-analysis software system, and a codebook set up based on the coding framework. The interviews were then coded according to the framework. In response to

this process, the coding framework was adjusted to clarify the codes and provide clear distinctions between them.

6.4 Findings

From the original 10 cases in the larger study, six were selected to be the focus of this paper based on their experience of the MOOC topic. Three groups were formed: Work (W), Formal Study (FS) and General Interest (GI) (Table 26).

Table 26

Case Demographics

Experience Source	Case (Age)	Country	Education	Current Activity
Work (W)	Walter (38)	Brazil	PhD	Neuroscientist using imaging
	Antonio (30)	Spain	PhD	Researcher and imaging technologist
Formal Study (FS)	Arjun (24)	India	High school	Medicine student (year 5)
	Anna (22)	Bulgaria	High school	Medicine student (year 4)
General Interest (GI)	Monica (25)	Spain	Masters	PhD candidate in technology
	Huseyin (44)	Turkey	MBA	Working in family business

Walter and Antonio (W) used imaging modalities extensively in their work as researchers, Arun and Anna (FS) had studied radiology as part of their undergraduate studies, and Monica and Huseyin (GI) had no formal experience of biomedical imaging.

Participants' scores for aspects of motivation and learning strategies were calculated based on survey responses. Scales from the MSLQ (Pintrich et al., 1991) were self-efficacy for learning and performance (SELP), metacognitive self-regulation (MSR), time and study environment (TSE) and effort regulation (ER). The AGQ-R scales were performance-approach (Papp), performance-avoid (Pavo), mastery-approach (Mapp) and mastery-avoid (Mavo) (Elliot & Murayama, 2008) (Table 27).

Table 27

Motivation and Learning-Strategies Scores

		Work		Formal Study		General Interest	
	Scale[a]	Walter	Antonio	Arjun	Anna	Monica	Huseyin
Motivation	SELP	5.63	5.38	5.88	6.38	5.88	6.63
	Papp	3.00	4.00	4.00	7.00	6.67	4.00
	Pavo	2.67	4.33	4.67	6.67	5.33	1.67
	Mapp	5.67	6.67	6.33	6.67	6.33	6.67
	Mavo	3.67	7.00	6.33	4.67	6.33	4.33
Learning Strategies	MSR	4.83	5.25	5.17	4.75	5.83	4.75
	TSE	5.13	4.50	5.75	5.63	6.63	4.50
	ER	4.50	6.50	5.50	5.50	6.00	6.00

Note. [a]The mean for each scale (which ranged between 1 and 7) was calculated.

The results showed no strong patterns in motivation between the three groups. Walter and Antonio (W) registered the lowest learning self-efficacy scores of all six participants, while Huseyin (GI) was the most confident about his general academic ability. There was no strong pattern in participants' achievement-goal orientations. Walter and Antonio (W), Arjun (FS) and Huseyin (GI) had stronger mastery-approach than performance scores, meaning they more concerned with mastering knowledge than with external measurements of their performance. The only two participants to be more concerned with external assessments than mastering knowledge were Anna (FS) and Monica (GI).

Nor were there strong patterns between the three groups' self-regulated learning scores, though in general, all participants rated themselves as fairly strong to very strong on the measures reported here. However, the differing results from Walter and Antonio are difficult to explain. Antonio had the highest score for effort regulation (6.50) while Walter had the lowest (4.50). This suggests that Antonio saw himself as being very strong at being able to persist on a task, while Walter, who has also had a PhD, rated himself as being only moderately strong at regulating his effort.

Participants recorded their time-related MOOC activity in a learning journal and shared a screenshot of their course progress screen from the MOOC (Table 28).

Table 28

Time-Related Activity and Achievement

	Work		Formal Study		General Interest	
Study Time	Walter	Antonio	Arjun	Anna	Monica	Huseyin
Active days	10	12	15	10	7	5
Hours Spent	17	18	34	14	9	9
Sessions	17	20	33	18	10	9
Mins/Session	58	52.3	62	45.8	51	57
Study < 11pm	9	15	14	18	8	3
Study > 11pm	5	3	11	0	0	4
Achievement[a]						
1: X-Rays	80	70	70	80	90	90
2. CT	100	90	100	90	100	100
3. Us	100	90	90	70	100	100
4. MRI	70	70	—	20	60	—
5. DNM	100	90	—	100	70	100
Scenario 1	100	100	—	70	30	30
Scenario 2	75	90	—	100	50	50
Overall Grade	90%	83%	47%	73%	80%	74%

Note. [a]Results for episodes and scenarios were estimated from a bar chart.

Results show that Walter and Antonio (W) were the highest achievers, and that they spent similar amounts of time in the MOOC. Monica and Huseyin (GI) spent the least amount of time studying in the MOOC but, surprisingly, completed the course with fairly high grades, even higher than Arjun and Anna (FS), who had studied the topic at university. It is also notable that Arjun was the lowest achiever but recorded much more study time in the MOOC than the other participants. Assessment results suggest that the MRI episode may have been particularly difficult. Arjun stopped at this point, Huseyin skipped it, and the others recorded their lowest marks for this episode.

Profile 1: Work experience in MOOC topic

Walter: Neuroscientist wanting to better humanity

Walter was a 38-year-old Brazilian male living with his wife and working in a large city in a university in France. Walter's parents had high school educations. His father worked in accounts and his mother in payroll for the same company. His younger brother and younger sister had started degrees but did not complete because of the cost. Walter, a gifted student, was mentored by a retired physicist who was teaching at his school. Walter planned to continue his research into the brain and behaviour and hoped it would better humanity. Walter was a MOOC enthusiast and had enrolled in and completed many MOOCs.

Motivation

Surprisingly, Walter only registered a modest score for his learning self-efficacy (5.63), considering he had achieved a great deal academically and was working as a neuroscientist at a university in a large city in France. Walter had been the dux of his school but reflected that academic competition was of no interest to him, which is reflected in his relatively strong mastery-approach score (5.67) and weaker performance-approach (3.00) and performance-avoid (2.67) scores. What motivated Walter was knowledge, not marks. Walter was an avid lifelong learner who had already completed many MOOCs on a wide range of subjects. In whatever he studied, he tried to relate new knowledge back to "neuro-images", which was his "favourite issue" (Interview 1). His effort-regulation score was surprisingly low (4.50), which seemed at odds with his achievement. Perhaps this highlights the subjectivity of these self-ratings. Walter enrolled in the MOOC because "clearly this is my field" (Interview 1), which suggested that he believed what he could learn from the MOOC might be of benefit to his work.

Time management

Walter revealed that the imaging MOOC was one of many he was enrolled in. He used Evernote, a cloud-based note-taking tool, to schedule his activities across MOOCs: "Yes, I usually put here all the subjects that I'm taking, for example, and the deadlines" (Interview 1). Learning-journal records show that, as the assessment due dates approached, Walter finished the course in a burst of activity. On the last day of recorded activity on Sunday of week 11, he indicated that he had spent four hours in the MOOC without taking a break. As he explained, "I was motivated and I thought, 'I have to finish this course.' I set a goal

and I did it" (Interview 2). He stated, "I just set up a goal and then I did it. It is common for me" (Interview 2). Walter reported that he had started to use the To Do list functionality in Evernote to schedule his MOOC study, which he found helpful. Walter stated that in addition to his research as a neuroscientist, he was studying other MOOCs concurrently and had completed four including the imaging MOOC. He indicated that he did not need to sleep much: "five hours, sometimes less…four hours" (Interview 2). This may explain how he could combine his work and MOOC study in multiple MOOCs simultaneously.

Learning and task strategies

Walter indicated that he used Evernote during the course. Walter also put Post-It notes to keep track of all the things he had to do: "At least the thing goes away from my mind and keeps on my eyes at least, so this does not disturb me anymore" (Interview 2). He indicated that he watched the video lectures on his phone: "It's usually when I'm moving from one [place] to another [place], for example, from my home to the hospital" (Interview 2). He would make a note in Evernote of sections of a lecture to which he wanted to return when he was next at his desk.

Help-seeking

Walter did not seek help of any kind during the course. He explained, "This course didn't take me a lot of time, maybe because it was easy for me, maybe it's because I'm familiar with this" (Interview 2). Although he had indicated in the earliest interview that he liked to engage with others in the forums in other MOOCs, he did not do so in this course: "I was really planning to be active during the MRI…but I could not do that" (Interview 2). Learning-journal records show one instance (Sunday, week 3) of searching the forums for discussions on X-rays, which he found the most interesting of all the episodes. Unlike the other participants in this study, Walter had no problems with the content of the MRI episode: "This is going to be biased because I handle MRI. The episode of MRI was nice. I really liked that episode, especially the cartoons that they do" (Interview 2).

Personal satisfaction

Walter was pleased about what he had learnt in the X-rays episode. As he put it, "[the episode] was completely a surprise for me. I like that so much maybe because I didn't know a lot of things" (Interview 2). He was critical of the MRI episode, not of the content, but of the assessment questions, which he thought were unnecessarily tricky. Walter had

continued his prolific MOOC activity after the conclusion of the biomedical-imaging MOOC, completing three MOOCs: R Programming, Statistical Analysis of fMRI Data and Statistical Inference. However, he pulled out of a MOOC on Mandarin "because the level that they were teaching, it was very, very high" (Interview 3). He was also enrolled in other MOOCs that covered a wide range of subjects, but was only "following them" (Interview 3) and not intending to do the assessments.

Antonio: Researcher and academic developing his career

Antonio was a 30-year-old male living with his wife and dog in a provincial city in Spain. His father was a nurse, his mother a primary school teacher and his brother a lawyer. He indicated that his mother was a big influence when he was young because he went to the same school in which she worked, and so had to be an example to others. He had been lecturing at the university for about three years when his research focus widened to encompass biomedical imaging, which led to working in a surgery centre. He planned to continue his imaging-related research and teaching and was considering his career prospects at home and overseas. Antonio had completed two MOOCs prior to enrolling in this MOOC.

Motivation

Antonio had achieved a great deal academically, earning a bachelor's, master and doctoral degree by the age of 30. His PhD thesis was on astronomical imaging; thus it may be assumed that he had a deep understanding of the MOOC topic of imaging. His self-efficacy score for learning and performance (5.38) was only moderately high considering his history of academic success; he had always been one of the top students at school. He indicated that his success was due to the fact that he always had a "plan for study" instead of leaving it to the last minute (Interview 2). He indicated, too, that in he was not the type of person who gave up if learning became difficult. As he explained, "I'm a person that always try to finish everything that I start" (Interview 2). His strong effort-regulation score (6.50) supported this claim. Antonio enrolled in the MOOC to add the course as an achievement on his CV. He explained that, in Spain, it was important to record MOOC achievements as it might help his career prospects.

Time management

Learning-journal records show that Antonio was an efficient and effective learner. The most common strategies that Antonio used in the MOOC were goal-setting and self-rewards for reaching a goal. He explained, "So, according to the length of the episode, I try to divide it. And when I finish one division, one virtual division, then I perform some tasks to relax." The rewards Antonio used were activities like watching television or looking at Facebook, "something for distraction", as he put it (Interview 2). Antonio's weekdays were very full with his academic work and imaging work in the surgery centre, and he indicated that when he came home at around 7pm he continued to be busy. Rather than schedule his activities in the MOOC, Antonio tried to be consistent with his effort: "I always tried to be very constant in the course. If I was very tired, I had to do something in the course although it is a very small part of the course" (Interview 2).

Learning and task strategies

Though Antonio had indicated in the first interview that he was an avid note-taker, in this MOOC he took no notes at all. He explained that the course was "very well organised and structured. It was taught very well in the course so I didn't have to take any summaries and anything like that" (Interview 2). Antonio took advantage of the transcripts of the video lectures provided in the courseware to help with watching the lectures. He described his strategy for this: "…it was very useful for me to have the transcripts in the right hand of the video because I was reading and I was able to understand everything. But, if there is something that I didn't understand then I just stop the video and go backward and read again just to see if I did understand. If I didn't, then I searched for it on the internet…before continuing the video" (Interview 2). His learning-journal entries also revealed how he managed his attention while he studied: "Trying not thinking about things different from the course until I finished one section" (Monday, week 2); "Trying to concentrate with headphones and taking a rest after each content point" (Saturday, week 6); "Trying to understand as much as possible" (Sunday, week 7); and "Working hard and trying to understand as much as possible" (Monday, week 8). These records, along with his strong effort-regulation score, suggest that he was able to expend effort in a focused way in the course even though it may have been difficult at times.

Help-seeking

Antonio did not report any interaction with other people, within or outside of the MOOC, from whom he sought help or with whom he had discussions. Antonio did not use the MOOC discussion forum, regarding them as "awful". He indicated that he did not feel comfortable with so many discussions, and was concerned that there may be a "lot of people wanting to give me some solution to my doubt". He stated that if he needed help he preferred to use Wikipedia or Google (Interview 1). Like some others in this study, Antonio found MRI to be the most difficult episode of the course. Specifically, he needed to refresh his memory of how electromagnetic fields worked, as he "didn't remember very well how they work" from his high-school studies, so he went online for help: "I wrote on the internet the electromagnetic fields and I found some links in Wikipedia…and I got the basics" (Interview 2). There were no other recorded instances of Antonio seeking help in the MOOC, although he was prompted out of interest to investigate the types of drugs used in NDM, other than those outlined in the course: "But it was more interest than something I wasn't able to understand. I searched for it because I was interested" (Interview 2).

Personal satisfaction

Antonio indicated that what he learnt from the MOOC had helped him to communicate better with health professionals working with X-rays and MRIs in the surgery centre where he worked: "I was able to understand everything and even I made some questions of the kind of contrast they used and all that, so it's been very, very useful for me and it's been very, very good" (Interview 2). Antonio reported that he had enrolled in another MOOC on extrasolar planets that was being offered by an Australian university and was looking forward to the different cultural perspective that foreign universities can offer in MOOCs.

Summary

Antonio and Walter, both of whom had professional experience of the MOOC topic, shared many personal characteristics. Both were highly educated to the level of PhD and both had the experience of a significant person in their school years who influenced their early learning. They were similarly motivated to enrol in the MOOC, believing it would benefit their work in some way. Antonio was more extrinsically motivated than Walter, as he wanted to add the MOOC certificate to his CV, whereas Walter seemed more interested in anything new he could learn. They were both economical with the time they spent in the

MOOC and achieved the two highest grades of the six cases reported here. The course was fairly easy for both of them. This might explain why the learning activities in which they engaged were limited to some sporadic web searching, reading of forum posts and note-taking, although it should be noted that these activities were not common to both. Neither used the forum to communicate with others. Though they were at slightly different points in their careers because of their age difference, they were both enthusiastic about their work and wanted to continue in the same direction. They also reported that they had got something out of the MOOC.

Profile 2: Formal study of MOOC topic

Arjun: Medical student wanting to specialise overseas

Arjun was a 24-year-old Indian male in the fifth year of medicine at an English-speaking university in Ukraine. Arjun was the only child of parents who lived in India. His mother used to be headmistress of a school and his father was still working as an accountant. Arjun went to a private English-speaking convent in India for his primary and secondary education, where he consistently got good marks and was in the top rung of achievers. Arjun attributed much of his academic achievement to the strong influence of his mother. Arjun's career goal was to specialise in trauma or as an orthopaedic surgeon. Arjun had had no experience of MOOCs before enrolling in the MOOC examined in the current study.

Motivation

Arjun believed he was a good student and reported that he was one of the top students in his year, which was reflected by his fairly strong score for self-efficacy for learning and performance (5.88). Arjun was amongst the best students at school and topped the year once his "most fierce and main competitor left the school" (Interview 1). Although this comment suggested that he used competition as motivation, his achievement-goal scores suggested he was more mastery- than performance-orientated. Despite this contradiction, it did seem that he was aware of the competitive nature of his chosen career, as he was already planning to do his specialisation in either Canada, the US or the UK: "in order to realise that dream, I need to up my game, or rather, I need to be at par with the educational standard in those countries, otherwise they would not have me" (Interview 1). Arjun credited his mother with his ability to plan his study. He shared an example of a study

schedule that he written freehand in a paper diary that he used at university, which detailed what he was to do from 7am until bed time at 1am. He explained that this habit was due to his mother, who would provide him with a study schedule when he was at school. He indicated that completing the MOOC and earning the certificate would "add another feather" to his achievements (Interview 1). Arjun was hoping that the MOOC would augment what he had already learnt at university and fill any gaps that had not been covered by his non-native English speaking teachers, whose "standard and level of communication is not optimum", he explained (Interview 1).

Time management

Arjun's learning-journal records show that he spent 34 hours in the course over 15 days. Despite this relatively large expenditure of time, he did not complete the course. In fact, his progress stopped at the MRI episode, despite getting high marks in the first three assessments. Arjun's attention in the first few weeks of the MOOC was on his impending university exams. He found it hard to motivate himself at this time. In the learning journal he wrote, "Struggling to concentrate even when I want to study and [am] enjoying the topic. But once I start its easy to continue, but convincing myself to start is HARD!!" (Tuesday, week 2). The following week, his focus was consumed by upcoming exams: "Have a lot on my plate right now, med school exams coming up which is keeping me busy and taking the share of time I intend to spend on the online course" (learning journal).

At the post-MOOC interview Arjun explained that his vacation home to India had started earlier than planned, as he had had been evacuated from his study town because of the war in Ukraine. Thus, from week 10 until the end of the course, Arjun was back in India in the family home. Being back home presented several difficulties for studying the MOOC. First, and probably most importantly, he went into "vacation mode" (Interview 2), which made it hard for him to get motivated to study. He also organised an internship in a local hospital "and not just sit around during the entire summer" (Interview 2). Another problem was trying to study in the family home. The dial-up Internet connection to a computer in the living room was erratic and prone to dropping out and a lack of privacy meant he was continually being interrupted by his parents. Whilst Arjun recorded an extraordinary number of hours compared to the others in this study, he may have felt a need to record activity as he was feeling guilty about the MOOC every time he received the daily email

reminders about the learning journal: "Had it not been for your emails, I might not have possibly covered all these chapters that I have" (Interview 2).

Learning and task strategies

Though Arjun struggled with remaining motivated in the MOOC when he went on vacation, he found the course easy and was pleased with his progress: "As I progressed with the course, I found it getting progressively easier, perhaps because I got the grasp of the subject and I was interested" (Interview 2). An early learning-journal record from Friday, week 2 shows that he was rigorous in how he approached learning: "started reading the texts out loud and forced myself to hear my own voice" and "not giving up on a specific segment until and unless I understand it completely and not carrying on with a vague idea of understanding". During this time he also took copious notes: "I love taking notes and it helps me to remember and understand what I'm reading. Whatever I do, I take notes" (Interview 2). In the learning journal he recorded, "Took down notes, sketched diagrams, replayed videos whenever I felt myself being distracted" (Friday, week 2). He reported that he kept his notes organised: "when I came here I had to make a new notebook where I took down my notes and I organised it according to dates" (Interview 2). Arjun was unable to use his usual strategy of pausing and rewinding video lectures when he was back in India, due to the erratic Internet connection: "I would hit the space bar, just stop, and try to remember what the lecturer said before and, like, you know, take it down and then start the video again" (Interview 2). Despite the evidence that Arjun had been a competent learner at high school and in his medical studies, within the MOOC he struggled to control his attention: "Did I ever cope with online distractions? That's the main question. I did not really because I would indulge into Facebook any time and every time I would be online" (Interview 2). This may explain why Arjun achieved less whilst spending more time than others in this study; even though his study strategies were effective, his study time was inefficient as he was unable to remain on task.

Help-seeking

Records show that Arjun posted to the course forums twice, but these were not self-generated activities: "I thought it was more like a mandatory thing to do so that was the only reason why I did it" (Interview 2). Arjun only sought some sort of help in the MOOC once, in the episode in which his MOOC progress stopped: "I actually took the longest to study MRI, and also I had to Google some stuff because I had no idea what they were

talking about" (Interview 2). Arjun admitted that MRI was the most difficult of the four episodes he attempted. However, he attributed some of the difficulty to the way the subject was presented: "The videos were short, even though they were self-explanatory but they were really, really short for me to understand, and I did not think it was sufficient" (Interview 2).

Personal satisfaction

Despite not completing the MOOC, and perhaps feeling a sense of guilt about his failure to fulfil what he perceived to be the researcher's expectations, Arjun was happy with what he had gained from the MOOC. He explained he could "actually participate and impart ideas" (Interview 3) when discussing CT or MRI reports because he now understood how these imaging modalities worked. Though Arjun was experiencing considerable stress in a new study town in Ukraine, where he had been transferred to finish his studies, he was determined to complete his degree and pursue his goal of specialising in trauma or orthopaedics overseas.

Anna: Medical student wanting to specialise overseas

Anna was a 22-year-old female in the fourth year of medical school in a major city in Bulgaria. Anna's mother had a degree in microbiology and her father was an engineer working in optics. She had a younger brother who was finishing a degree. She regarded her mother, who had home-schooled her and her brother for six months, as being hugely influential in her study habits. Anna's career goal was to specialise in obstetrics or gynaecology in Germany. Anna was an experienced MOOC learner, choosing MOOCs that were related to medicine or art. She had completed several and just engaged with the lectures in others.

Motivation

Anna was very confident in her learning ability, which was reflected in her strong learning self-efficacy (6.38). She indicated that she was quicker at learning things than her peers: "I remember things quickly and that really helps me" (Interview 1). She also indicated that she was very ambitious, that if she had a goal she would "pursue it very strongly" and that she was very successful in her studies (Interview 1). It would seem she was strongly motivated by her performance: "Well, I like to score well or to perform well depending on the thing I'm doing. I don't know, I like competition" (Interview 2); her maximal

performance-approach score (7.0) supports this and suggests that she was accustomed to getting high marks. Anna had an upcoming radiology exam and had enrolled in the MOOC to help her prepare for it.

Time management

Anna indicated that she did not have a lot of time to devote to the MOOC, and the fact the course was assessed by quizzes alone meant she could use her time efficiently: "Not that I took a lot of time on it. I just did as much as I could" (Interview 2). Learning-journal records show that Anna spent 13.8 hours in the MOOC over 10 days, for an overall grade of 73%. Anna completed the MOOC in 18 study sessions, which were, on average, 45.8 minutes long. In the first interview, she indicated that she preferred to study late at night: "I find it easier to study after 10:00 pm. I don't know why but it's just a very good time for me because it's really quiet" (Interview 1). Records show, though, that she did not study at all after 11pm. She explained that "during the time I was doing the course, we finished with our classes and I was in exam sessions so basically the last four weeks I think I had more free time in the day so I didn't really stay up that late". As well, after her exams she was on break: "I was in my home town so it is quieter there in general" (Interview 2). Anna did not record any activity between weeks 8 and 11, but in week 12 of the course she recorded 330 minutes. In that week she recorded that she was experiencing some difficulties. On three days she indicated a lack of time as a problem, and on one day she indicated she was bored with the course. Despite this, on Sunday of that week, she managed to complete the course with a marathon session of 200 minutes with only two breaks: "That was the day when I decided I would finish everything that I had left to do in the course. I had quite a lot left" (Interview 2).

Learning and task strategies

Learning-journal records show that Anna set within-session goals on four of the nine days she spent in the MOOC, and her entries explained the strategic intent behind using goals: "Tried to remain focused and reach my goal" (Monday, week 4). She indicated that she watched the lecture videos and read the transcript at the same time. She explained, "I read that it's very beneficial if you can use your sight, your hearing, everything, you can just make it more multi-media; you can learn better than just by reading or just by watching" (Interview 2). Anna also indicated she took notes in the course. She pointed out that she did not take takes "all the time", but only when she "felt like it". She made freehand notes

on loose paper and indicated that she would only keep them if she felt she would need them later on.

Help-seeking

Anna did not record any instance of seeking help from another person. She did, however, go into the forums, although not to post: "I don't really enjoy writing in the forums…I usually just check them out of curiosity, what things people ask, because the questions that are answered are the ones that are most popular, especially in MOOCs that have a lot of participants" (Interview 2). Assessment records show that Anna's lowest score was for the MRI episode. Anna resorted to going to the library to find textbooks in her native language, which she found easier to understand. Anna attributed her poor performance for the episode to both external and internal factors: "It's a very complex imaging modality. The explanations behind it are related to physics and I have difficulty grasping physics, so, for me, that's why it was difficult." She also attributed some of the problem to how the topic was presented: "I think that they could have explained it in a more, easier to understand way" (Interview 2).

Personal satisfaction

Anna had enrolled in the biomedical-imaging MOOC to help her prepare for a radiology exam. Though she would have preferred the course to be more clinically oriented, she felt that it "definitely" delivered what she had hoped for and that she was "very happy with the [exam] result" (Interview 3). Anna reported that she had passed all her university exams and had started in her fifth year of medicine. She added that she had also completed another health-related MOOC, which she had found interesting.

Summary

Anna and Arjun shared some similarities. They had influential mothers who had been strong influences on how they learned when they were at school and they both credited their mothers for that. They shared a history of being successful at school and being at the top of their class, and were both competitive and seemed accustomed to using a performance orientation as a motivation to perform. Though it is difficult to compare their performances in the MOOC, as their contexts differed, a key difference was that Arjun was unable to control his attention in the face of distractions, especially the temptation of Facebook. This in part explains how he recorded so much time but did not progress past

the MRI episode. Anna, on the other hand, achieved more in far less time. Despite some substantive differences in performance and achievement, they both expressed satisfaction at what they had gained from the MOOC, which translated directly to either their studies or their practice of medicine.

Profile 3: General interest in MOOC topic

Monica: PhD candidate curious about imaging

Monica was a 25-year-old female in the second year of a PhD in a university in a large city in Spain. Monica had migrated with her parents and her older brother from Romania when she was 15. Monica's mother was a nurse and her father a locksmith. She enrolled in the MOOC out of curiosity about the topic and because she thought that it might be relevant to her research topic. Monica's career goal was to gain an academic position at a university and become a good teacher. Monica was a MOOC enthusiast and liked to complete the MOOCs she started. She normally enrolled in two MOOCs at a time: one related to her work and one of more general interest.

Motivation

Monica had a history of academic success, reporting that she was the top of her class in high school. Though she declared that outperforming her peers was not her goal, her strong performance-approach score (6.67) suggests that she was competitive. She credited her mother, who would say "Your work, you have to study, that's your work" (Interview 1), for her success. Monica completed a five-year engineering degree, then a one-and-a-half year postgraduate degree in multimedia and communications; at the time of this study, she was in the second year of her PhD, which was looking at wireless sensor networks. She indicated that the certificate was important in Spain to demonstrate her achievements: "It's all about papers, about bureaucracy" (Interview 1). Monica had enrolled in the MOOC out of curiosity, as she had considered studying bioengineering for postgraduate study. She also thought that what she could learn in the MOOC might help her in the future.

Time management

Learning-journal records show that Monica was very effective and efficient with how she managed her time in the MOOC. She spent only nine hours in the course, spread over seven days, for a grade of 80%. Her supervisor, who was normally busy, had time to devote

to her PhD during the period that she studied in the MOOC, so this took priority, and she fitted MOOC study in around it. She was busy writing papers for publication and meeting with him. She indicated that her pattern of study was to spend time in the MOOC while she was waiting to meet with him; she found these meetings stressful, so studying in the MOOC was a way of dealing with them: "I focus on something else" (Interview 2). She used an online calendar to plan her weekly activities. This was an effective strategy, she said, as notifications popped up to remind her to do something on her mobile phone and computer and were hard to ignore. She reported that she liked to set achievable goals in her study sessions, and normally this was to complete an episode. But she realised the MRI episode would take longer than one session, so she reset her goals: "If I set a goal and I don't accomplish it, I don't like it" (Interview 2).

Learning and task strategies

Monica watched the videos while reading the transcript, but did not take notes throughout the course, "as most of the video lectures had notes below to explain the interesting points of the video. So I only watched the video, and after I would read all the notes" (Interview 2). When Monica realised that the course was more medically than engineering-orientated, she adjusted how she engaged with the course: "I think it depends on the goal. I can read it at any time and I think that I understood most of the parts of the course, so I didn't have to take additional notes about what they were saying" (Interview 2). This approach also influenced how she engaged with the last two assessment quizzes, which were related to clinical practice "It's very medical-orientated. So I read them [scenario questions] and tried to guess the answers, but I finished very quickly with the final assignments" (Interview 2). This explains her low scores for the two scenario quizzes.

Help-seeking

Monica found the first three episodes easy, but the MRI and NDM much less so: "I had to focus more and search about information outside the course" (Interview 2). She did not post to the forums at all, explaining that she did not normally like to write in forums unless she was "really stuck" (Interview 2). In this MOOC she did not have the need, but did browse them out of curiosity "to read them and see what other people find challenging and difficult " (Interview 2). However, on one occasion she did have the opportunity to discuss a video lecture on MRI that she was watching at her desk with her supervisor, who had

studied physic: "It's a bit confusing with the electrons that are moving there and here, and he explained it to me a little bit" (Interview 2).

Personal satisfaction

Monica indicated that the MOOC was not exactly what she wanted: "I thought it would be more oriented to bioengineering and it wasn't" (Interview 2). When she realised this, she lowered her expectations and adjusted her learning goals: "When I saw that it was not exactly what I was looking for, I didn't put in so much effort to learn everything". She did, however, persist with the course: "I still had that curiosity to learn" (Interview 2), and earned the certificate she had planned to achieve at the outset. She did not think that what she learned in the course would be useful in the future: "I learned things, although they are not for my job, but I think I learned things that maybe sometimes in my life will help me if I have to go to doctors and things like that" (Interview 3). Monica reported that she and around a dozen of her colleagues had enrolled in a MOOC on mining massive data sets, which she believed would help her with her work.

Huseyin: Business executive thinking of career switch

Huseyin was a 44 year-old male living in Turkey with his wife and daughter. Huseyin's father was a civil engineer with his own construction business and his mother was a doctor. He had two older sisters: one was a doctor and the other was an industrial engineer with an MBA. Huseyin's first degree had been in electrical engineering, but he decided to do an MBA program in the US so he could work in the family construction business. He was planning a career switch from business back to computer science. Huseyin was an avid MOOC learner and had even been selected as a teaching assistant in one of the early MOOCs, as he had been a prodigious contributor to forum discussions.

Motivation

Huseyin had enrolled in and completed many MOOCs prior to this one and considered himself one of the "starters" with MOOCs, as he had been using them continually since 2012, when they first became widely available. Huseyin recorded a very strong mastery approach (6.67) and a very weak performance-avoid orientation (1.67), which suggests that he was driven to understand what he was studying and not at all concerned with performing poorly by others' standards. He was a curious person with a wide range of interests; the

MOOCs he had enrolled in covered subjects other than computers and technology. Huseyin said, "It's easy to learn" (Interview 1), and his strong learning self-efficacy score (6.63) reflects this strong self-belief. He scored a very strong effort-regulation score (6.00), which indicates that he had the capacity to remain focused in the face of distractions. Despite this strong motivational profile for learning, Huseyin admitted that he lost interest in his undergraduate studies and his marks suffered, which suggests that interest in the subject was a key aspect for him to remain motivated to learn. Huseyin enrolled in the MOOC because he wanted to learn something that would help him "switch fields" (Interview 1) back to computer engineering.

Time management

Huseyin was enrolled in more than 10 MOOCs while he was in the biomedical-imaging MOOC. |He therefore planned to engage with the imaging MOOC in the context of how to spend his time across courses: "As the number of courses increase[s], I tend to make a schedule of the deadlines and plan my studying and work according to that so that I may attack all of them" (Interview 2). Learning-journal and course progress records suggest that Huseyin was efficient in his participation, considering he achieved an overall grade of 74% and gained the certificate with only eight-and-a-half hours' study. He decided to delay his participation in the course until just before the assessment deadlines. He finished the course just before the deadline, in a seven-hour burst over two days: "I left everything to the last couple of days, so I did not have much time" (Interview 2). His assessment results show he omitted the MRI topic altogether. This was a strategic decision based on the time he had available and his awareness that the course content would probably remain open after the end date. He left the door open to return to the MRI topic in the future when he had time to study it "slowly" and at his "own pace" (Interview 2). He reported that he had completed around 10 of the MOOCs that he had been studying in this period.

Learning and task strategies

For Huseyin, apart from the MRI episode, the course presented no difficulties: "The course started easy and went on easy" (Interview 2). Huseyin indicated that his general note-taking strategy was to use Google Docs, an online word-processing system: "So that wherever I am, if I recall something, if I want to check something I can go to the document on the Google Drive and check what the note was" (Interview 1). However, in this MOOC he reported that he did not take notes at all, because he was not planning to use the

information from the course later on. He said, "it was something you either understand and remember or not so I didn't see any reason for taking notes" (Interview 2). He indicated that with some courses, when he was familiar with the content and was aiming to refresh his knowledge, he would watch the lecture videos while watching sport with the sound turned down. However, for this MOOC he chose not to do that: "With this course I didn't do that because although the concepts, most of the concepts, were easy to understand, they were not things that I knew well" (Interview 2).

Help-seeking

Huseyin did not seek help during the course. As discussed above, for the most part Huseyin found the course easy. He did not use the forums in this MOOC despite earlier attesting to their value: "The special forums are wonders with MOOCs. If you have the time they really help a lot" (Interview 1). In other MOOCs, Huseyin would help others in the forums. Huseyin was so active in the forums for one MOOC in which he participated that he was invited to be a teaching assistant on the next iteration of the course: "I think that [working as a teaching assistant] also provided some motivation and self-confidence afterwards" (Interview 1). However, he did not use the forums in every MOOC, only when there was a need: "With this course, everything was straightforward except that one section, and with that one section, the videos were also straightforward; the problem was soaking in the information. And again, I did not need the forums for that" (Interview 2).

Personal satisfaction

For Huseyin, the MOOC was more medically oriented than he had expected, so it was less relevant to his central interest in computers and technology. This influenced his expectations and strategies in the course. He was somewhat ambivalent about the MOOC's benefits: "Not bad. Not great. It was fine. I was looking to get some basic information and it provided that basic information, so I guess I got what I wanted" (Interview 2). Huseyin had been using MOOCs to help him make a career switch. At the final interview he was excited to announce that he had been accepted into several programs, picked one and started a part-time postgraduate program in computer engineering.

Summary

Monica and Huseyin shared many similarities in terms of their motivation. They were both confident learners with a high level of education and academic success. They were both

curious about the topic and had enrolled with the hope that the course might provide some learning that would support their main goals. Both adjusted their expectations in the course when they realised that it was not going to deliver exactly what they wanted and reduced their effort in the MOOC. For example, neither took notes in the course, and forum use was cursory for Monica and non-existent for Huseyin. They both decided to reduce the amount of time they spent in the course, which manifested in an absence of note-taking. Huseyin was a capable and highly strategic self-regulated learner, who decided to skip a difficult topic altogether so he could continue to the end. It seemed like he was keen to complete the course and add another certificate to his personal records. Both learners were at different points in their life: Monica was towards the end of a long educational pathway that leads to academic work, whilst Huseyin was at the point of switching careers and returning to study. It is also noteworthy that these two General Interest learners had different backgrounds. Huseyin was born into a family of relatively high socioeconomic status in which academic achievement was the norm; in contrast, it seemed that Monica's success was hard-earned, and driven largely by her mother who wanted her daughter to have a better life.

6.5 Discussion

This investigation revealed the situated and contextual details of these participants' motivation and learning in a MOOC. Overall, experience of the MOOC topic played an important role in explaining these individuals' motivation and behaviours, but for three of the cases presented here, environmental and personal factors played a more important part in their learning in the MOOC.

What were the characteristics of these learners?

The six participants in this study were remarkably similar, despite any differences in the development of the countries they came from. According to the Human Development Index (HDI), a United Nations statistic that takes into account health, education and wealth factors in a country (see Malik et al., 2014), the participants came from countries at various levels of development: Antonio and Monica (Spain: very high HDI); Anna, Huseyin and Walter (Bulgaria, Turkey, Brazil: high HDI); and Arjun (India: medium HDI). Despite these differences in human development on the national levels, these learners were highly educated. The only two who had not at the time of this study achieved a tertiary degree

were more than halfway through medical school, which, in itself, is an achievement, considering the competitive nature of medical-school entry. Elsewhere it has been suggested that MOOCs are reaching those who need them least (Christensen et al., 2013; Emanuel, 2013). The findings from the present study support this claim, as each of the participants depicted here had already accessed higher education and were either in full-time employment or heading towards professional careers.

Prior experience of MOOCs a factor in MOOC learning

It may be no coincidence that the lowest achiever in this study was the one person who had no previous MOOC experience. Arjun had some experience of studying video lectures but had not enrolled in a MOOC before. The other participants in this study had a range of MOOC learning experience, and had all completed at least one MOOC. A prior experience of learning in a MOOC may be a factor in how successfully a person navigates their way through such an environment. A pre-course survey of learners in a learning-analytics MOOC found that respondents who were confident about completing the course at the outset tended, in fact, to complete it (Wang & Baker, 2015). It may be that previous experience in a MOOC may contribute to a person's confidence about achieving in it. In a mixed-methods study of learners in a connectivist MOOC, participants who had prior experience of MOOCs were more likely to be active learners in the course than those who had no prior experience (Milligan et al., 2013). A mixed-methods study of professionals in a data-science MOOC found that high self-efficacy scores were linked to learners who had previous experience of the MOOC topic and previous experience of MOOCs (Littlejohn et al., 2015). Learning in a MOOC may well be a daunting experience for newcomers to the format. They may not know what to expect, how to structure their time or how to deal with the chaotic and overwhelming number of discussions taking place in the MOOC forums. MOOC providers should consider providing extra support to first-time MOOC learners, in the form of resources or even seasoned MOOC enthusiasts, like Huseyin, who could mentor a first-time learner.

How did these learners regulate their learning in the MOOC?

The six participants in this study were capable self-regulated learners. They had a history of academic success, and reported examples of how they had regulated their learning in the past. However, being able to regulate one's learning does not necessarily mean a person

will actually do that in a given context; they have to be motivated to do so (Pintrich & De Groot, 1990). The participants in this study were motivated to enrol in the MOOC. They had personal reasons for enrolling, which related to their work or studies, or simple curiosity, but they were also, at the outset, intent on earning the certificate. They were, therefore, both intrinsically and extrinsically motivated. Both these motivational orientations played a part in how, when and if learners regulated their learning in this study.

The setting and resetting of personal goals important to learning in a MOOC

Being able to adjust what one wants from the MOOC was a feature for four of these competent self-regulated learners. Monica and Huseyin (GI) reset their personal goals when they realised the course was more medically oriented than they had hoped. Their subsequent economising of effort reflected this. Arjun and Anna (FS) reset their goals but in different ways. Anna was disappointed that the course was not more medically oriented, and economised her efforts because of that. Though Arjun failed to earn a certificate, he changed his perception of this outcome by focusing on the impact of his learning on his clinical practice. In this sense, both Arjun and Anna were successful. Walter and Antonio (W), who had the most experience of the MOOC topic, and probably more prior knowledge than others, found no need to reset their personal goals. They found the course relatively easy, and so there was little expense of effort, or self-regulation, required to progress and earn the certificate. Research shows that only a small proportion of enrolees complete MOOCs (Jordan, 2014) but that does not mean that only the completers are successful, as this study found in the case of Arjun. Elsewhere it has been found that not all the people who enrol in MOOCs intend to complete them (Koller, Ng, Do, & Chen, 2013), and that some learners who do not complete MOOCs are nonetheless substantively engaged with the content (Glance & Barrett, 2014; Kizilcec et al., 2013). The findings from the present study provide some detail and context about a learner who did not complete a MOOC but nonetheless achieved something of personal value from it. MOOC designers need to take this type of learner into account by encouraging the setting of self-relevant goals and establishing adjustable learning pathways.

Context influences motivation and learning

Despite Arjun being successful in in terms of his personal goals, his final mark was the lowest of the cases presented here. This was surprising considering he spent far more time

in the MOOC than the others. The high number of hours he recorded for MOOC study may be explained by his failure to control his attention between the MOOC and Facebook. Two interrelated factors contributed to Arjun's self-regulatory failure. First, he was no longer motivated to study in the MOOC. When he returned to India, he went into "vacation mode", which affected his performance. Second, research has found that self-regulation is a finite resource (Baumeister & Heatherton, 1996; Baumeister, Vohs, & Tice, 2007). Some of Arjun's self-regulatory resources were expended on dealing with the technical problems and social distractions of being back in the family home. Perhaps he did not have enough remaining to devote to the MOOC. This would have also served to diminish his motivation. A study of enrolees in a data-science MOOC found that participants' context influenced their ability to self-regulate: those working professionally as data scientists or studying towards a degree were more capable of regulating their learning than others (Hood et al., 2015). The findings from the present study highlight the dynamic nature of a learner's context; it can change throughout the duration a MOOC and influence a learner's motivation and self-regulatory capability. This has implications for MOOC learners. MOOCs require effort and time, which are both finite resources. People should consider carefully how much of both they have available to devote to a MOOC, and set their goals accordingly, but also be prepared to change these if necessary. Also, MOOC providers should provide accurate estimates about how much time is needed to progress in the MOOC at different levels of topic experience.

Finding time for MOOC study and using it strategically

As the case of Arjun demonstrates, it is not the amount of time devoted to a MOOC that matters; it is how that time is spent. Finding time, though, was the first step. Three of the completers (Walter, Monica, Huseyin) scheduled their study using online tools, such as calendars and Evernote. Whilst Antonio did not report any MOOC-related planning, his approach was about being "constant" with his MOOC study. This was his "plan for study", which he declared he always had. The only completer who did not seem to plan her MOOC study was Anna, who took a more ad-hoc approach, engaging with the MOOC when she felt like it. Arjun, despite using handwritten schedules in his study town for his medical studies, seemed to forgo this habit back home in India. Another time-finding strategy involved converting downtime into study time. Three of the five completers spoke of studying in the MOOC while they were travelling on public transport (Walter), waiting for an exam (Anna) and waiting for an important meeting (Monica).

The literature suggests that time management is an important factor for learning in a MOOC. In a study of 34 MOOC learners, interviews revealed that time management was the dominant factor in why people completed or dropped out of a MOOC (Eriksson, Adawi, & Stöhr, 2017). How well MOOC learners can find time in their busy lives when other factors compete, such as uncontrollable life events, such as exams or being evacuated from one's place of study, is a factor in what a learner achieves in a MOOC. The findings from this study, though, suggest that this level of time management alone is not enough: the time needs to be used with strategic intent. This aligns with the research by Littlejohn, Milligan and Littlejohn (see Littlejohn, 2015) in their investigation of how strong self-regulated learners use their time in a MOOC. To be effective in a MOOC, learners need to do more than just find time to devote to it, they need to use that time strategically.

Several time-related learning strategies were surfaced in this study. A common theme was the setting of goals within study sessions. These goals were used to focus attention – "Tried to remain focussed and reach my goal" (Anna) – and were usually achievable. "I set a goal and I did it" (Walter) typified how the completers used goals. It was also clear that these goals were meaningful targets that they tried to keep to: Monica's comment "If I set a goal and I don't accomplish it, I don't like it" highlighted how these learners were conscientious about what they set out to do. At the same time, if circumstances changed, if they got tired or lacked time, they were willing to reset their goals by continuing the next day. Rewards were used in association with reaching these goals to boost motivation and performance. The completers spoke of using Facebook, food, television and coffee with friends as rewards for reaching a goal. These competent, self-regulated learners did not rigidly plan their time in the MOOC; they were opportunistic, adaptive and strategic about how they spent their study time. A study of data professionals in a data-science MOOC (Littlejohn et al., 2015) found that high-scoring self-regulated learners took a similar approach to how they spent their time in a MOOC, adjusting their approach to meet the needs of the situation, whilst low-scoring self-regulated learning professionals took a more scheduled approach.

How did experience of the MOOC topic influence these learners' motivation and learning?

The six participants reported in this paper were capable self-regulated learners with a history of academic success. However, Walter and Antonio's professional contexts meant they had more prior knowledge of the MOOC topic than others, and most probably more

previous experience of success with the MOOC topic. As prior knowledge is a key determinant of learning (Ausubel, 1968), and enactive mastery experiences are a determinant of self-efficacy (Bandura, 1986), this explains their superior achievement in the MOOC. Unlike Monica and Huseyin, these professionals did not need to expend much effort, as they found the course easy; they did not need to do much to progress. These findings are in line with the Littlejohn et al. (2015) study that found that data professionals who measured highly for self-regulated learning in a data-science MOOC conceptualised the MOOC as a professional-development opportunity, which influenced their motivation and performance. It was notable that in the present study the participants used only a limited range of learning strategies. This may have something to do with the content-centric design and repetitive format of the course, which may have encouraged a limited response. A similar phenomenon was found in a study of health professionals in a health-science MOOC (Milligan & Littlejohn, 2014). Though the participants had enrolled for professional-development reasons, there was little evidence of integration of knowledge into practice or of self-generated learning. This was because the health-sciences MOOC, like that in the present study, aimed to transmit knowledge to the learner rather than encourage the learner to build their own knowledge. This highlights how the pedagogical intent and design of a MOOC affects learning. This has implications for how MOOCs should be designed.

Limitations

The findings from this paper are derived from a small number of learners with differing experiences of the MOOC topic, although they were all highly capable self-regulated learners with a history of academic success. Therefore, nothing can be said about how less capable self-regulators may have behaved in the same context. The context of this study was a MOOC on biomedical imaging, a rather specialised subject that attracted a highly-educated cohort, many of whom were working with images in some context or studying the subject at university. This limits the generalisability of the findings to other types of learners and other types of MOOCs. Another limitation in this study was that all the participants had indicated that they were planning to do everything to earn the certificate, meaning that they were, to some extent, extrinsically as well as intrinsically motivated. This may explain their rather rigid adherence to persisting with the course, with five of the

six earning the certificate; this was in sharp contrast to the general low completion rates in MOOCs.

Implications for future research

The 10 cases that were selected for the larger study were selected based on their intention to complete the MOOC and earn the certificate. Of the six cases reported in this paper, all but one completed the MOOC. Not all people who enrol in MOOCs do so with such rigid completion intentions (Koller et al., 2013), and a proportion of serious learners in MOOCs do not earn a certificate (Glance & Barrett, 2014; Kizilcec et al., 2013). It would be of value, then, to conduct a qualitative comparison study of how people with differing course completion intentions learn in a MOOC. This may help MOOC providers design more-flexible MOOCs. The participants in the present study were all highly capable self-regulated learners. Other studies have shed light on how high- and low-scoring self-regulators with professional contexts or roles learn in MOOCs (see Littlejohn et al., 2015; Milligan & Littlejohn, 2014). It would be useful to compare the learning of poorly and strongly self-regulated professionals, students and general-interest learners in a MOOC. This may improve understanding of how to better support poor self-regulators in MOOCs. Another aspect of this study that limited its findings is that all the participants were highly educated. It would be useful to investigate how individuals with no higher-education experience, such as school leavers or those with less than high school, learn in MOOCs. There is evidence that MOOCs can attract younger learners who are investigating study and career options (Stokes, Towers, Jinks, & Symington, 2015), but little is known about how they learn in MOOCs. Finally, this study found that prior experience of MOOCs may have been a factor in achievement. A comparison study of learners with extensive (or greater) experience of MOOCs may provide knowledge about how best to support learners new to MOOCs.

6.6 Conclusion

This paper reported on an aspect of a larger mixed-methods study that investigated how people of differing backgrounds learned in a MOOC. In this study six cases were selected based on their differing experience of the MOOC topic. The participants in this study were found to be highly educated, and all but one of the participants, who, interestingly, was also the lowest achiever, had prior experience of learning in MOOCs. All six participants were

highly capable self-regulated learners, and although the MOOC did not encourage a flexible or learner-centred approach to learning, two of these participants, who had only a general experience of the topic, took control of their learning by adjusting personal expectations and how they expended their effort. Topic experience played a strong role for those whose experience of the MOOC topic came from their work. These learners benefitted from their superior prior knowledge of the topic and their focus on the professional-development opportunity the MOOC provided, which together translated to a superior performance compared to the learners whose experience of the MOOC topic came from their formal studies or general interest.

The findings from this paper suggest that differentiating the people who enrol in MOOCs by their experience of the MOOC topic may be useful. This paper found that those with professional experience of the MOOC topic were particularly successful in the MOOC and in achieving their personal goals. MOOC providers could target learners who enrol in MOOCs for professional-development purposes by better understanding these learners' motivation and learning behaviours. For example, tasks could be designed to encourage professionals to integrate what they were learning into their practice. This may also be of benefit to students preparing to enter a profession, by providing them with a taste of what professional practice is like (see Stokes et al., 2015 for an innovative use of a MOOC to promote the study of dentistry). However, as this study has found, some learners are neither professionals nor students, but nonetheless engage in a MOOC for a range of personal reasons. Perhaps tasks that encourage these learners to relate what they are learning to their main topic of interest would be of more value than tasks that assume all learners are working in, or are planning to work in, the area of the MOOC topic.

MOOCs are undoubtedly a significant new instrument for lifelong learning. However, it should be acknowledged that all the participants in this study were already engaged in lifelong learning, as they had all undertaken some form of education past their compulsory schooling which is in line with other studies which have found that the vast majority of people who enrol in MOOCs already have the benefit of an education (Chuang & Ho, 2016; Zhenghao et al., 2015). This raises the questions about what function MOOCs perform in societies. Some contend that MOOCs are reaching only the disadvantaged (Christensen et al., 2013): and widening the gap between the haves and have nots (see Hansen & Reich, 2015). Though MOOCs may be defined as "open" we should not assume that everyone

has access to them. The significant barriers to engaging in education will not magically crumble with the advent of MOOCs. So far, they have been doing a good job at attracting lifelong learners, the promise that they can truly widen access to learning remains to be realised.

Paper 3 References

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CHAPTER SEVEN: PAPER 4

Preamble to Paper 4

In Paper 4, the last of the four papers presented in this thesis, the intention was to provide detailed accounts of the 10 cases who participated in this study. So far, qualitative accounts have been provided for seven of the cases. Paper 2 gave in-depth accounts of two contrasting cases, and Paper 3, which sought to investigate how prior exposure of the MOOC topic influenced learning, covered six of the cases in some detail. In Paper 4, so as to not spread the coverage too thin, the scope of the paper was narrowed to one aspect of self-regulated learning that was of singular importance to learning in a MOOC: help-seeking. Help-seeking is a self-regulated learning strategy that has been found to predict academic achievement in classroom settings (Zimmerman & Martinez-Pons, 1986, 1988), yet little is known about how people seek help in MOOCs. This aspect of self-regulated learning is of particular importance in MOOCs, as instructors are not provided to help students on a one-to-one basis if they encounter difficulties. Paper 4 reports on the analysis of data collected from multiple sources to provide detailed accounts of how these 10 participants sought help when they needed it.

PAPER 4

HELP-SEEKING IN A MOOC:

An investigation into what learners do when they encounter difficulties in a MOOC

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7.1 Abstract

Despite the significant take-up of massive open online courses, or MOOCs, little is known about how people seek help in these online environments. This is particularly important in MOOCs as instructors are not provided to offer support or tailored feedback to people who need help. This paper reports on an aspect of a larger mixed-methods study that investigated how people learned in *Introduction to Biomedical Imaging*, an edX MOOC delivered in 2014. Situated in a social cognitive framework, this study used the lens of self-regulated learning to investigate the help-seeking behaviours of 10 learners of differing backgrounds and motivations through interviews, experience sampling, digital artefacts and surveys. The participants were found to engage in help-seeking strategies infrequently and in a limited way. In particular, participants were found to prefer searching for help and information outside rather than inside the MOOC. This study highlights the influence of the instructional design on learner behaviour. In an environment where social learning is neither required nor encouraged, it is unlikely that highly capable self-contained learners will need or want to engage with others. MOOCs should be more than "content systems without a tutor", and MOOC providers need to understand the value of social learning and how it can be encouraged in MOOCs, so that like-minded learners can help each other.

7.2 Introduction

Current thinking about educational practice considers learning as an ongoing, dynamic process of knowledge construction rather than knowledge acquisition. A key thinker who influenced this contemporary approach to learning was Soviet psychologist Lev Vygotsky (1978), who highlighted the importance of the social environment on child development. Another prominent thinker in this area was American psychologist Albert Bandura (1977), who theorised that learning is not solely a cognitive process but is influenced by the social environment. The importance of learning with others is most evident in contemporary classrooms. Modern classrooms are noisy places, with students in discussion as they work together in small groups. The teacher takes the role of being on the side, setting up and guiding these small groups as they learn together. The Internet, and more specifically Web 2.0, has created new possibilities for people to participate in what Brown and Adler termed "social learning" (2008, p. 18), which is based on the idea that knowledge is socially constructed. People can now engage with others using Web 2.0 technologies to co-create content, or knowledge, around problems or points of common interest. This socially constructed content has become a valuable resource for learning. Wikipedia is an example of a socially constructed resource that enables learning on a huge scale. Another aspect of social learning is communities of practice, such as the thriving and self-sustaining open-source software communities, providing pathways for novices to become experts in a field through access to free resources, training and community support. Against this backdrop of the social-learning web, the MOOC has emerged. However, relatively little is known about how people engage with each other in MOOCs.

Though research into social learning in MOOCs is just beginning, the evidence suggests that most people who enrol in MOOCs do not engage with others. A study of 150,000 learners in the first edX MOOC using a post-course survey found that the majority (75.71%) studied entirely on their own. Though this statistic shows that the majority did not engage with others, the fact is that a fair number reported to have engaged with others, with either another learner in the same MOOC (17.68%) or an expert in the content area (2.57%) (DeBoer et al., 2013). Given that these social learners would have amounted for more than 26,000 learners, this indicates that some people in MOOCs do engage in social learning, and they can number in the thousands even if they are in the minority. Elsewhere, a qualitative study of 29 participants in a connectivist MOOC, which has social learning

embedded in its pedagogy, found the largest category of learner was *lurkers* (13/29), who passively engaged in the course by reading others' contributions but not actively contributing; the next group was the *active participants* (12/29); and the smallest group was the *passive participants* (4/29), who seemed to be distinguished from the *lurkers* only by fact that they had had negative experiences in the course (Milligan et al., 2013). These findings suggest that though some people engage in social learning in MOOCs, it is not a priority for all.

Use of MOOC forums limited and inconsistent

Online forums are provided in MOOCs as a means for staff to make course announcements and to support social learning. The evidence suggests, though, that the people who do participate in forums do so in limited ways. A study of forum use in the first edX MOOC found that only a tiny proportion (3%) of enrolees participated in the forum, and the majority of these contributors made only a small number of posts (Breslow et al., 2013). A study of 73 MOOCs offered in the summer of 2013 (Brinton et al., 2013) found that forum participants tended to post at the beginning but then trail off as the course progressed, with a fair proportion of those posts not relating to the course at all.

It seems that MOOC forums may have structural problems due to their size that make them far from ideal for social learning. Brinton et al. (2013) found that in around a third of the MOOCs studied, it was impossible to read all the posts generated. Studies of two successive instances of a popular business MOOC found that forums were not conducive to the exchange of knowledge and learning within the forum community (Gillani et al., 2014), and not supportive of the development of ongoing peer-to-peer relationships (Gillani & Eynon, 2014). This evidence suggests that MOOC forums may not be effective platforms for promoting social learning.

Learners need to regulate their own learning in MOOCs

In MOOCs, where instructors are not provided to guide learners, it is up to the learner to direct and manage their activities to learn effectively. Some researchers have used the lens of self-regulated learning (SRL) to understand how people do this in MOOCs. SRL describes learning that is goal-driven, self-generated and adaptive to changing circumstances. People who regulate their learning are simply better learners than those

who do not: they set better goals and reset them when necessary and use better learning strategies, and they are better at seeking help when needed compared to learners who do not regulate their learning (Schunk & Zimmerman, 2008). In MOOCs, the ability to regulate one's learning is critical. In two recent studies of learners who had identified as professionals in MOOCs related to their work, high self-regulators were found to be intent expending their effort on learning, to benefit their current and future roles as a professional, while low-scoring self-regulators were more performance-orientated, doing what was required to progress without much regard to the value of what they were learning (Milligan et al., 2016).

Help-seeking is important in MOOCs

One aspect of self-regulated learning that is important for successful learning in MOOCs is help-seeking. As instructors are not available to provide tailored support for learners in MOOCs, being able to get the help one needs, in the form of finding someone who can answer a question or finding the information one needs by searching online of offline, may be the difference between success and failure in reaching personal learning goals. A study of high-school students in traditional classrooms found that those who sought help achieved more academically (Zimmerman & Martinez-Pons, 1986, 1988). Studies of college students found that help-seeking was related to instrumental achievement behaviours and not a reflection of a lack of competence (Karabenick & Knapp, 1991). In other words, the more competent and active a learner is, the more likely they are to seek help when required.

In classroom contexts, help-seeking and information-seeking were studied separately, but in online contexts the boundary between social and non-social sources of information has become blurred (Puustinen & Rouet, 2009). For example, Wikipedia is a resource that has been created through contributors interacting with each other. When one searches Wikipedia, it is like entering an ongoing conversation on a topic. Though a page on Wikipedia may appear to be a non-social source of information, it is actually the manifestation of socially constructed knowledge. Research into student behaviour in the context of socially constructed knowledge has suggested that students have different attitudes to seeking help in different contexts. For example, a study comparing college students' help seeking in distance, distributed and traditional classes found that the participants actually preferred ask questions of their instructors online, finding it more effective than face-to-face (Kitsantas & Chow, 2007). Little is known, though, of how

learners in MOOCs seek help when they need it. Do they search the forums, do they post questions, do they find another learner locally to meet up with in person?

This paper reports on an investigation into how 10 learners of varying backgrounds and motivations sought help in a MOOC. Through interviews, experience sampling, surveys and digital artefacts, the study investigated how these learners sought help within and outside the MOOC. These findings were drawn from a larger mixed-methods study that investigated how people of varying academic experience learned in a MOOC. The investigation was guided by the question *How do learners use help-seeking strategies in a MOOC?*

This research took place in *Introduction to Biomedical Imaging*, a 10-week MOOC provided by an Australian university in 2014. The MOOC was delivered in five episodes: X-Rays, Computerised Tomography (CT), Ultrasound (US), Magnetic Resonance Imaging (MRI) and Nuclear Diagnostic Medicine (NDM). Each episode was capped with a 10-question automated quiz. Assessment requirements for the course consisted of these five episode quizzes and two additional scenario quizzes at the end of the course. Forums were provided within the course for learners to interact with each other to ask questions and discuss course content. University staff used the forums to make announcements and moderate discussions.

7.3 Methodology

This study adopted a mixed-methods approach, which was realised in a sequential-explanatory design. The mixed-methods approach is a pragmatic and eclectic approach to research that can frequently result in superior research compared to mono-method approaches (Johnson & Onwuegbuzie, 2004), and is particularly useful for the investigation of complex social phenomena (Creswell et al., 2003). Data was collected in two separate phases: quantitative (Phase 1) and qualitative (Phase 2). Priority was given to Phase 2 in this design, which took the form of a multiple-case study. The case-study design is an appropriate strategy when *how* questions are being asked, when the researcher has no control over behavioural events and when the phenomenon being investigated is a complex social phenomenon taking place in a contemporary real-world context (Yin, 2014). A research journal was kept throughout data collection and analysis to record memos and

insights into emerging patterns and themes. Such insights are "part of field work *and* [original italics] the beginning of qualitative analysis" (Patton, 2002, p. 436).

Case selection

In Phase 1 a survey was used to collect data and select cases for the multiple-case study. A section of the survey invited respondents to indicate whether they would be interested in participating in the research. To be eligible for the study, candidates had to be: over 18 years of age, a competent English-speaker, and intending to attain the certificate offered in the course. Potential participants were grouped according to their level of academic experience into three groups: (1) Very Experienced (postgraduate and doctoral); (2) Experienced (undergraduate and college/vocational), and (3) Less Experienced (high school or less). Equal numbers of candidates were randomly selected from each group and invited to participate. Thirty-eight email invitations were sent to eligible candidates. A research information sheet was attached to the invitation informing recipients of the ethics status of the research and their rights to privacy and of withdrawal from the study without explanation at any time. A total of 16 individuals formally consented to participate in the study. Due to participant attrition and problems with Internet connectivity during several interviews, the number of cases with complete data sets was reduced to 10.

Data collection

Data was collected from participants using multiple methods: survey, interview, learning journal, digital artefacts and email interview. Following is a chronological account of how data was collected, analysed and integrated.

Motivation and learning scores

The study commenced with the participants completing two surveys (Surveys 1 and 2), which measured various aspects of their motivation and learning. These online surveys, constructed in the Qualtrics online survey software system, consisted of five scales from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991): *self-efficacy for learning and performance*, *metacognitive self-regulation*, *effort regulation*, *time and study environment* and *test anxiety*. The Achievement Goal Questionnaire-Revised (AGQ-R) (Elliot & Murayama, 2008) provided four scales: *performance-approach*, *performance-avoid*, *mastery-approach* and *mastery-avoid* goals. These surveys

were tested prior to implementation in a small pilot study and revised based on participant feedback. Some of the items in these scales were slightly modified to suit the research context. For example, the word “class” was replaced with “course”.

The means of scores for the nine scales were calculated for each participant. As the sample was so small, only within-case analyses were conducted. For example, if an individual scored higher on mastery-approach goals than performance-approach and performance-avoid goals, it could be inferred that that participant was more mastery- than performance-orientated in achievement contexts. This analysis of survey data formed the basis of a preliminary case profile for each participant, which guided the first interview.

Interview 1

The first interview (Interview 1) was conducted within the first three weeks of the MOOC, and was used to explain the purpose of the study, outline participants’ responsibilities and build rapport between the researcher and participants. Based on the preliminary case profiles, participants were also probed about their reasons for enrolling and what sort of learner they thought they were. This interview was also used to inform the participants of the learning journal, which was key to recording aspects of their motivation and learning in the context of their lives throughout the MOOC.

Learning journal, Interviews 2 and 3

Throughout the MOOC, participants were sent daily reminders to complete an online learning journal if they had engaged in the MOOC on that day. The learning journal consisted of eight closed items that asked participants to record details of where, when and for how long they studied, what activities they engaged in, what learning strategies they used, any difficulties they experienced and how confident they were about completing the MOOC. One open item was also provided for participants to write in how they responded to any difficulties they experienced on that day. Returned forms were downloaded and collated into a spreadsheet throughout the MOOC and sent to participants as a basis for discussion in the post-MOOC interview (Interview 2). Interview 2 took place when the participants indicated that they had ended their participation in the course. Participants were asked to recall and recount what they did on certain days in the course as recorded in the learning journal. They were also asked to provide screenshots of their course progress screens from the edX system and other digital artefacts related to their study in the MOOC.

Interview 3 took place three months after Interview 2. In this interview participants were asked to reflect on their experience and to talk about their plans for the future. All interviews were recorded, transcribed and sent to participants for member checking. Finally, as gaps were discovered in the case-specific data sets, email interviews were conducted with relevant participants. For example, Huseyin was asked via email to write about his family and his school days, which were topics that had not been covered in interviews.

Data analysis

This study adopted an analytic strategy that accommodated quantitative and qualitative data and the mixing of these methods, as proposed by Creswell and Plano Clark (2011). This process involved six steps: (1) preparing data for analysis, (2) exploring the data, (3) analysing the data, (4) representing and mixing the findings, (5) interpreting the results and (6) validating the data and results. Though this research adopted a mixed-methods approach, it was substantively qualitative in approach, which is reflected in the amount of data collected and time spent on collection and analysis. The analysis of qualitative data was also guided by the data-analysis spiral proposed by Creswell (2007b, p. 151), which likens the different steps of qualitative data analysis to spirals of activity, which can take place simultaneously; this approach highlights the recursive nature of qualitative data analysis, which moves through stages of analysis from data-in to account-out.

Data was organised on a case-by-case base into online folders in Dropbox. Interview transcripts were printed off and read extensively to get a general sense of the data, and analytic memos were recorded in the margins and insights and thoughts recorded in the research journal. An analysis framework was developed based on the research questions, theoretical framework and themes that were emerging from the analysis. The interview transcripts, email interviews and digital artefacts were then imported into HyperRESEARCH, a software program used for analysis of qualitative data, and coded according to this preliminary framework. At the same time, these codes, definitions and examples from the data were recorded in a spreadsheet and revised when necessary to improve clarity and distinction between the codes.

All data collected over Phases 1 and 2 were recorded in a master data table in an Excel spreadsheet. The scores for the nine constructs measured in Surveys 1 and 2 and quantified

data from the learning journal were recorded in this table along with the coded data derived from the analysis framework. This enabled the comparison of findings within and across cases. At this point of analysis, qualitative and quantitative data were integrated. Within the qualitative cells, some preliminary analysis of the data was also recorded for each case, with reference to quantitative data where appropriate. For example, a cell that contained a qualitative description of a participant's self-efficacy beliefs about learning would consist of quotes from interviews about their confidence about learning mixed with references to their self-efficacy scores.

7.4 Findings

The following section presents the findings of this study. First, the case participants are characterised with specific reference to their capabilities as self-regulated learners. The findings that relate to the research question are then presented, describing how the participants sought help inside and outside the MOOC.

Participant backgrounds

The 10 participants in this study came from various countries and with various educational backgrounds. The participants are displayed in Table 29 from the least academically experienced in the bottom row (Pablo) to the most academically experienced in the second to top row (Walter). An effort-regulation score (Survey 2) was calculated for each participant. The effort-regulation scale from the MSLQ (Pintrich et al., 1991) is a measure of how committed a learners are to achieving their personal goals even in the face of difficulties or distractions (Table 29).

Table 29

The Ten Cases

Case	Age	Home	Education	Current Occupation	ER[a]
Walter	38	Brazil	PhD	Neuroscientist	6.50
Antonio	30	Spain	PhD	Imaging professional/academic	6.50
Monica	25	Spain	Master's	PhD candidate (year 2)	5.83
Huseyin	44	Turkey	Master's	Businessman	4.75
Mariam	25	Sudan	Bachelor's	Studying for master's in oral pathology	4.00
Federico	24	Venezuela	Bachelor's	Studying for US medical licensing	6.25
Layla	26	Seychelles	Bachelor's	Unemployed	4.75
Arjun	24	India	High school	Medical student (year 5)	5.50
Anna	22	Bulgaria	High school	Medical student (year 4)	5.50
Pablo	22	USA	High school	College student (year 2)	4.25

Note. [a]Effort regulation score, from 1 (min.) to 7 (max.).

All 10 participants had achieved a degree or were on track to achieve at this level. Broadly speaking, they were highly educated. Although three of the participants (Pablo, Anna, Arjun) had self-reported that their highest education level was high school (Survey 1), their level of academic experience differed. Anna and Arjun were more than halfway through their six-year medicine degrees, whilst Pablo, the least academically experienced of all participants, was nearing the end of a two-year associate degree when this research was conducted. The two participants with most academic experience (Walter, Antonio) registered the highest scores for effort regulation (6.50 for both), whilst the least academically experienced participant (Pablo) registered the second lowest score (4.25). It seems odd that Mariam, who had a five-year degree in dentistry and was in the second year of a master's degree in oral pathology, had rated her ability to control her attention while studying as only average.

Comfortable with learning in a foreign cultural context

Most of the participants were comfortable with studying in a foreign cultural context, with seven having experience in doing so. Huseyin and Anna had spent some of their high school years in the US, and Monica had migrated to Spain from Romania when she was 15. Four participants had experience of studying at higher levels in foreign countries: Arjun was

studying at an English-speaking university in Ukraine and Federico was in a preparation program for the United States Medical Licensing Examination in the US at the time of this study. Layla had gained her degree in radiography at an English-speaking university in India and Walter had spent some of his doctoral studies in the US. Only Antonio and Mariam had no experience of studying in a foreign country, though Mariam had studied at an English-speaking university in Sudan. These findings suggest that these nine non-native English-speakers were familiar with studying in a foreign cultural context and, perhaps because of this, comfortable studying in a MOOC delivered in English from a foreign university.

Histories of academic success

Academic success at school was a common theme for nearly all the participants. Four of the participants (Monica, Arjun, Antonio, Walter) spoke of being near or at the top of their class at school. Two participants (Mariam, Federico), whilst not reporting that they were top of their class, indicated that they were good at school. Mariam reported that she was a good student at school who "always wanted to know things", and that because of her marks in her undergraduate degree she was offered teaching work in that program (Interview 2). Federico indicated that learning and doing well at school was "natural" to him (Interview 1). Others spoke of their school success in terms of the courses they went on to study. For example, Anna said that it was not easy to get into medicine in Bulgaria, and Layla that her marks were good enough to win a scholarship to study at university overseas. The one exception was Pablo, who considered himself a "B plus student" (Interview 1). He recognised that his academic performance needed to improve if he was to get into medical school, but also spoke of some bad habits, such as procrastinating and a reluctance to ask for help, which were hindering his progress. In general, though not explicit in all cases, there was a sense that education was valued in the families of all the participants. This was exemplified by Monica's memory of her mother absolving her of house chores, saying, "Your work, you have to study, that's your work" (Interview 1), and by an Arabic saying that Mariam recalled from her childhood: "We don't know when a piece of information will do help for us [come in handy]" (Interview 1). Even Pablo, whose family was of a lower socioeconomic status than those of other participants, indicated that his parents were "excited" (Interview 2) by the fact he was studying.

The nine participants who had a history of academic success also spoke of doing the work necessary to succeed in their studies, and of applying effort. These participants' effort-regulation scores for the most part support their assertions. For example, Walter and Antonio, who spoke about how they could apply themselves to their schoolwork and achieve, rated themselves as very strong effort regulators (Table 29). In contrast, Mariam's average effort-regulation score of 4.00 was at odds with her description of herself as "a committed student" who could "concentrate well during lectures" (Interview 1), and who "worked very hard to get high marks" (Interview 2) in her undergraduate studies. Mariam revealed that she could not always manage the distraction of social media, referring to her phone as a "weapon of mass distraction" (Interview 1). Perhaps in managing social distractions, Mariam believed she was weak, although there was ample evidence that she was highly capable in other areas of self-regulation. The same cannot be said of Pablo, and his relatively low effort-regulation score of 4.25 is supported by his verbal accounts. He indicated that he was "easily distracted by Facebook or YouTube or texting" (Interview 1), and unable to control his effort on homework: "When I arrive home I turn on the TV, eat a meal and surf the web. Hours later is when I begin to start my homework" (email interview). Of all the participants in this study, from the evidence provided here, Pablo was perhaps the weakest self-regulated learner.

The influence of others

A common theme that emerged for the nine strongly self-regulated learners was the influence of at least one significant person in their early lives. Four of these participants (Monica, Anna, Arjun, Layla) acknowledged that their mother had been a strong influence on their study habits in their school days. For example, as noted above, Monica recollected that from the age of eight, her mother, a nurse, would recite to the mantra of "Your work, you have to study, that's your work" (Interview 1). Anna similarly reported that her mother, a microbiologist, would push her to study and do her best, and Arjun credited his mother, a retired school principal, with his academic success. Layla also reported that her mother, who had not finished high school, would say, "Now go and do your homework. If you want to make it in life, you need to learn" (Interview 2). The other five strongly self-regulated learners were influenced in less direct ways. For example, Antonio's mother was a teacher at his primary school, so he "had to be an example for the rest of the students" (Interview 2). Three of the participants (Husyein, Federico, Mariam) grew up in households where at least one of the parents had a university education and a professional

career, as well as older siblings who had followed similar paths. For Walter, this influence on learning came in the form of a physics teacher at high school, a retired academic, who became a quasi-mentor who, he reported, "was the key guy for my academic skills [and] who unconsciously gave me the rules to be followed" (Interview 1). The only participant who did not have a strong positive influence on his learning was Pablo. In fact, Pablo had a negative role model in his early years, as he spoke of an older brother who had got into trouble at school. Pablo reflected that his parents were both supportive of his studies, but they had also left him to his "own devices" at school; he wondered how different things may have been if he had been "pushed just a bit in my early years" (email interview, 26.07.2015). Altogether these findings highlight the importance of the family and immediate environment on the development of effective learning skills.

Summary

The 10 participants in this study were experienced at higher education levels, and the majority were highly educated, with at least one degree. Nine were non-native English-speakers and were familiar with studying in English or other foreign language, which may have contributed to their enrolling in a MOOC delivered in English. The same nine participants could be classified as strongly self-regulated learners who had histories of academic success, and had had a strong significant influence on their learning in childhood. The only exception was Pablo, the least academically successful of the participants, who appeared to also be a poor self-regulator. Pablo also did not have the same positive influence of significant people on his learning when he was young.

Help-seeking and achievement

Participants were asked to complete a learning journal on the days that they engaged with the MOOC. Three items in the journal related to help-seeking (Table 30). *Forum search* referred to instances when participants had searched the forum for specific information; *Forum post* refers to when a participant had posted to a forum; and *Personal networks* refers to when participants had asked someone they knew for help (e.g. face-to-face, email, social media). The table also shows the number of days each participant reported activity in the MOOC, as well as each participant's overall grade, which is the average of all quizzes (both attempted and not attempted). Unattempted quizzes were assigned 0 and included in overall results.

Table 30

Help-Seeking, Days of Activity and Achievement

Case	Forum Search	Forum Post	Networks	Days	Achievement
Walter	1	0	0	10	90%
Antonio	0	0	0	12	83%
Layla	0	0	0	8	88%
Mariam	2	0	0	11	92%
Federico	0	0	0	10	88%
Arjun	2	2	0	15	47%
Anna	1	0	0	10	73%
Monica	0	0	1	7	80%
Huseyin	0	0	0	5	74%
Pablo	3	0	1	31	50%

Learning-journal data shows that participants engaged in help-seeking strategies infrequently. The 10 participants recorded 119 days of activity in total in the MOOC, but only 13 instances of help-seeking overall. Of the three help-seeking strategies recorded, searching the forum for specific information was the most popular (nine instances), followed by forum posts and personal networks (2 instances each). The five participants with the most academic experience (top five rows) achieved higher grades than the less academically experienced participants (bottom five rows). The two lowest achievers were Arjun (47%) and Pablo (50%), who only attempted the first three of the seven quizzes, although their results for those grades were good: Arjun scored 70, 100 and 90, and Pablo scored 90, 100 and 90). Data collected in the learning journal was used as a basis for interviews with participants at the end of the MOOC about their experiences in the MOOC. These accounts offer explanations for how and why they did or did not seek help during the MOOC.

Help-seeking within the MOOC

A forum was provided within the environment of the MOOC for learners to interact with each other. As this was the only means within the course that learners could seek or provide help, it was of importance to investigate how participants used this tool. Overall, this study

found that participants used the forums infrequently. Participants described using the forums to either search for specific information or find out what was trending in discussions.

Searching the forums for specific information

Learning-journal records and follow-up interviews revealed that fewer than half of the participants (4/10) searched for specific information in the MOOC forums. These participants had three different reasons for searching the forums. Two indicated that they used the forums to follow up on a topic of special interest: Federico spent 20 minutes at the end of the course reading discussions on nuclear diagnostic medicine, and Walter looked for discussions on X-rays, a topic that he described as "surprising", in Week 3 of the course. The second use of the forum related to a need to resolve issues relating to assessment; for example, though this was not recorded in the learning journal, Layla indicated, and forum archives confirm, that she used the forum to find other learners who were asking about the answer to an assessment question, which resulted in the answer being corrected. The third use of the forums involved finding help to resolve unanswered questions or problems of understanding. Mariam reported that on one occasion she "looked [in the forums] for the questions that came up into my mind when I studied" (Interview 2) to save her the trouble of asking the same question, which on that occasion resulted in the answer she was looking for. On another occasion she searched the forums for help on the topic of MRI, a component of the course she found very difficult. On this occasion, however, her search was unsuccessful, and she described MRI as a "mission impossible to understand" (Interview 2). Overall, these findings highlight that the use of forums were a bit hit-or-miss when it came to resolving specific issues. Though these findings tentatively suggest that forums may be useful for access to discussions on specific topics, when it comes to resolving a problem of understanding, they may be less effective.

Forum browsing out of curiosity

Another motivation to use the forums that emerged in interviews was curiosity, rather than a specific need. Four participants used the forum in this way, to find out what others were talking about or experiencing in the course. Anna reported, "I just check them out of curiosity…to see what things people ask" (Interview 2). Similarly, Monica was curious "to see what they say, what they answer" (Interview 2). Layla and Pablo were curious to see if others were experiencing problems: "[I used the forums] to check what other people

were saying, to see if they had the same concerns" (Layla, Interview 2) and "I just wanted to see what other people's opinions were, like, what trouble they were having relating to the course" (Pablo, Interview 2). Though he did not acknowledge it, Pablo's forum visits probably stemmed from a need for help, as the course – "Well, to be honest I kind of underestimated the course. I thought it was going to be a bit easy but it wasn't" (Interview 2). Unfortunately for Pablo, like Mariam, he was unsuccessful in getting what he wanted in the forums: "When I went to the forum I was even more lost" (Interview 2).

Rare use of forums for posting

Posting to a forum was rare. Only one participant, Arjun, recorded in their learning journal that they had posted to the forum. However, this activity was a response to what he believed to be course requirements; as he explained, "I thought it was more like a mandatory thing to do, so that was the only reason why I did it" (Interview 2). This was not an act that could be categorised as self-regulated; he thought he was following instructions. Though she did not record it in the learning journal, Layla, the only participant to have a bachelor's degree in the MOOC topic, was also the only participant to actively post to a forum. Layla reported in an interview that she answered others' questions at the beginning of the course when she was confident with the content, but "when it got more difficult I couldn't really answer other people's question" (Interview 2). Altogether, these findings highlight the rare use of the forums to connect with others in this MOOC.

Forums of no value to some

Three of the participants indicated that they did not use the forums at all to search for help or information. Though Arjun posted in response to an instruction to introduce himself, which he believed was mandatory, he did not use the forums if he needed help because it would be like "searching for a needle in a haystack" (Interview 2). Antonio held a similar view about forums. He had completed several MOOCs prior to this study, and had developed a strong aversion to MOOC forums: "I'm not very comfortable with a lot of people in the forum…. I can't follow, I can't control the forum" (Interview 2). He also had concerns about the quality and quantity of help in forums, characterising them as "a lot of people wanting to give me some solution" (Interview 1). For these reasons he avoided them altogether. The other participant who recorded no forum activity was Huseyin, who explained that he did not "have a need" (Interview 2) to use the forums in this MOOC.

This lack of need may be explained by the fact that the course was only of peripheral interest to him and thus he was less willing to expend time and effort in it.

Help-seeking outside the MOOC

Outside the MOOC, learners were free to engage with other resources or with members of their social networks to assist with their learning. As the MOOC providers did not set up these platforms or suggest to learners that they could do so themselves, all learning-related activities outside the MOOC could be regarded as self-generated.

Googling for help outside MOOC

Findings suggest that participants' preferred strategy for seeking help was outside the MOOC; they specifically mentioned Google. Though the learning journal did not collect data on online searches, half of the participants (Arjun, Federico, Mariam, Layla, Antonio) indicated in interviews that they preferred to search the Internet when they needed help, rather than use the course forums. Arjun's comment, "If I had a problem of understanding any concept, I straightaway went and searched Google" (Interview 2), was typical of all five seekers of online help. This strategy was not always successful when dealing with problems of understanding. For example, Federico and Mariam reported that their Internet searches did not help them with the difficult topic of MRI. Federico observed, "I actually needed someone who sat beside me and explained to me these basics. I couldn't understand by myself" (Interview 2). Two of the participants (Anna, Antonio) reported that they searched online when they wanted to follow up on a topic of interest to them. Anna reported finding a website on interpreting CT scans that she found useful, and Antonio reported that he searched for more information on the drugs used in nuclear diagnostic medicine. Besides searching the Internet for help, there were two other reports of help-seeking strategies outside the MOOC: Anna reported that she used books in her native language to help her, and Pablo reported that he used an online flash-card app to memorise some terms in the course. In both cases, the participants indicated that these were helpful strategies.

Isolated use of personal networks with mixed outcomes

The use of personal networks as a source of information or help was even less frequent than the use forums for this purpose. Only two of the participants engaged with their personal networks in this way. Monica, the PhD candidate studying wireless sensor networks,

recorded in her learning journal that she had sought social assistance once during the MOOC. In an interview she reported that she did not actively seek help but that she had an opportunity to discuss an aspect of MRI with her supervisor, who had studied physics, while she was watching a video on the subject at her desk at university. This indirect request for help was successful, as she reported that her supervisor was able to explain how the electrons behaved, and that she was happy with what she was learning. Though Mariam did not record an instance of social help-seeking, in an interview she indicated that she actively sought help from her colleagues at the university dental hospital in which she worked, although they could not answer her questions. She reasoned, "…the basics, the scientific basics of magnetics, I could not get from them. Maybe because they themselves do not know it well in a deep way" (Interview 2). Although Pablo, the college student, recorded in his learning journal one instance of seeking social assistance, it was unclear what this record referred to, as later, when answering a question about whether he had sought help outside the MOOC, he replied, "Not much. Unfortunately I'm one of those students that has problems of admitting that you want help from someone else and I go and do everything myself" (Interview 2). Pablo had indicated in the pre-MOOC interview that he could seek help from his professors at college if he needed it; however, his reluctance to actually go through with this was too ingrained, and he later admitted, "That's one of my greatest problems" (Interview 2).

Summary

Overall this study found that participants engaged in help-seeking strategies either within or outside the MOOC infrequently. The forums were used by fewer than half the participants to seek specific information or to browse discussions out of curiosity. Posting to a forum was rare, and two of the participants reported no interaction with forums at all. Interview data suggested that help-seekers preferred to use the search engine Google to find help when they needed it. The use of other information resources, such as books and personal networks, was far less common.

7.5 Discussion

Broadly speaking, the participants in this study engaged in little social help-seeking at all. Their help-seeking behaviours were mostly limited to online searches for information, with some isolated instances of searching the forums for answers to questions and interactions

with others. Help-seeking is a self-regulated learning strategy (Zimmerman & Martinez-Pons, 1986, 1988) that requires self-awareness, in that the learner needs to be aware that they need to help, and then an act of self-direction to get the required help to meet they need. As the background evidence suggested that all the participants in this study, except for Pablo, were capable self-regulated learners, why was help-seeking such a limited learning activity? One possible explanation is that these learners' sense of autonomy translated into a sense of wanting to work things out on their own. A study of 49 psychology students solving statistics problems in an online environment found that students with a mastery orientation to learning rarely used online text-based help, even when it was easily accessible (Huet et al., 2011). This was surprising, as learners with a mastery orientation to learning are focused on developing skills and increasing their understanding of what they are learning (Pintrich, 2003), and help-seeking would assist in achieving that goal. However, these mastery-oriented students were also found to have a high sense of autonomy: they were driven to solve problems on their own and derived some satisfaction from that. The participants in this study may have also had a similar sense of autonomy.

A simpler explanation is that the participants in this study were not motivated to seek help. As Zimmerman and de Groot (1990) noted, a person capable of self-regulated learning will not necessarily regulate their learning across all contexts. In the following discussion, participants' help-seeking behaviours are explained with reference to the *expectancy-value* model of motivation (Eccles, 1983), which theorises that a learner's motivation to perform a task, such as to seek help, is driven by their expectancies for success in achieving that task and their perceived value of the missing piece of information that they are seeking, weighed against the cost, in terms of time and effort, of performing the task.

Forums rarely used for help-seeking

In this study, the forums were rarely used for help seeking. The isolated instances of help-seeking within the MOOC were limited to searching for the answers to questions that arose in the participants' minds. Those few who did use the forums tended to read others posts in a random way or, less frequently, searched for answers to specific questions. A study of 35 healthcare professionals in a MOOC related to their work revealed a richer use of the forums for help-seeking (Milligan & Littlejohn, 2016). Around half of these professionals engaged in forum discussions, and most these reported having positive experiences, with

some describing the value of engaging with others for broadening their learning. The MOOCs in both studies were similar in design, highly structured and focused on content transmission rather than knowledge creation. It was somewhat surprising then that the 35 healthcare professionals seemed to engage in significantly more help-seeking than the participants in the present study. This may be explained by the differing contexts of participants in both studies. In the present study only two of the 10 participants were professionals, whereas all the participants in the Milligan and Littlejohn (2016) study were professionals. Professionals in a MOOC may be more motivated to interact with others for the opportunity of professional development and the possibility of expanding their professional networks. These possibilities may have enhanced the subjective task value of interacting with others in forums relative to other users who had different, non-professional contexts.

Lack of discussion in MOOC forums

The use of forums to interact with other learners was rare in this study. Only one of the nine participants, Layla, engaged with others by providing answers to questions when she was confident she knew the answers. Forums are provided for learners in MOOCs to engage in social learning, to interact and construct knowledge together. However, it may be that learning in MOOCs does not conform to this widely-accepted pedagogical approach. In a study of 29,882 MOOC learners it was found that not posting to a MOOC forum did not predict dropping out (Balakrishnan, 2013), which indicates that engagement with others in a MOOC is not a factor in completion. It may be that people who enrol in MOOCs are happy to interact with the content and leave it at that. Perhaps, as was found in this study, a lack of social learning in a MOOC is not inherently a bad thing, but just a characteristic of this kind of learning, like reading a book on one's own.

Of course, the lack of social learning in this study could also be related to the effectiveness of MOOC forums for this purpose. A study of forum participation in two successive instances of a popular business MOOC found that MOOC forums were ineffective for dispersing knowledge (Gillani et al., 2014). A study of forum activity in a MOOC with 87,000 enrolees found that forum participants formed *crowds* that assembled and disbanded quickly, rather than *communities* where participants developed relationships over time (Gillani & Eynon, 2014). On the surface MOOCs seem to offer a rich potential for social learning, as there are so many others to engage with who have been found to have varied

backgrounds (DeBoer et al., 2013). However, the reality may be that social learning is a challenge to promote in MOOCs for the same reasons. Furthermore, the MOOC forum may not be an effective tool to encourage learners to engage with each other. One possible direction that MOOC providers could explore is the use of intelligent information communication technologies that could group learners based on demographic data collected in a pre-course survey. Lim et al. (2014) reported on the preliminary results of an online chat tool that provided scaffolded discussions for small groups of learners to engage in, and the findings were encouraging. More research of this type is required.

Isolated instances of social learning outside MOOC

This study also found that most participants did not seek social assistance or engage with others outside the MOOC. Only two participants sought help from others in their personal networks, and there were no reports of engaging with others outside the MOOC through online social media platforms. There was no evidence that the university team that delivered this MOOC encouraged enrolees to engage with each other through social media channels, so this may have been a factor in the absence of such activity in this study. This finding was similar to that of a study of 35 healthcare professionals in a MOOC related to their work, which found little evidence of participants engaging with others in their personal networks outside the MOOC (Milligan & Littlejohn, 2016). By contrast, a study of 13 participants enrolled in a range of MOOCs revealed that a number of them interacted with others in their social networks, and that these interactions took place before, during and after a course (Veletsianos, Collier, & Schneider, 2015). These interactions were described as meaningful, and took place in a variety of online settings such as email, Twitter and Facebook, as well as face-to-face study groups. Altogether these participants were extraordinarily agentic in seeking out others, and sophisticated in their use of digital technologies. However, the 13 participants in Veletsianos et al.'s (2015) study were unlikely to be representative of the wider population of people who had enrolled in the same MOOCs, as these participants had been selected through social-media channels. They were therefore already predisposed toward interacting with others and using digital technologies for this purpose. As the number of people who enrol in MOOCs is typically in the thousands, it would not be surprising if in every MOOC there are *some* learners who are motivated to interact with each other in online and face-to-face settings. The advice for MOOC providers is to be aware of this type of learner and make provisions for them by

promoting the use of social-media channels and face-to-face study groups. A team member who has skills in social media and communication should be part of every team involved in creating and delivering MOOCs.

Limitations

Several factors limited the inferences that can be drawn from this study. Although this study provided a rich account of the help-seeking behaviours of learners in a MOOC, because of the small number of individuals studied and the fact that this was only one MOOC of distinct content and design, general conclusions about help-seeking in MOOCs cannot be drawn. The cases selected for this study were highly educated, with the least academically experienced participant having around two years of college. Although this does reflect wider trends in MOOC enrolment, no cases were selected who had only a high-school education. The study of learners with little experience of learning in environments without tutor support would be of value to the study of learning in MOOCs. Other limitations relate to participant inconsistencies between learning journal records and verbal accounts. Where possible, a separate data source was used to verify what actually happened. For example, the forums from the archived MOOC could be cross-checked to verify if a participant had posted to a discussion. Another limitation that may have influenced participants' accounts of their learning was social-desirability bias, which is the natural tendency to put oneself forward in the best light. This has been found to be prevalent in social-science research (Fisher, 1993). In fact, participation in this research may have influenced some of the cases' behaviour. A number of participants indicated that receiving the daily reminders to complete the learning journal boosted their motivation to engage in the MOOC.

Implications for further research

The study of learning in MOOCs through the lens of self-regulated learning is only beginning, and more research needs to be conducted in this area to better understand how learners successfully navigate these environments. The present study investigated the help-seeking behaviours of learners who had experience of learning at higher education levels. Future researchers should investigate how individuals without any experience of higher education fare in MOOCs. Ideal candidates could be high-school students, high-school leavers and others who have never entered a university. This study found that participants'

help-seeking behaviours were limited. Participants' motivations for engaging in help-seeking were particular to their contexts. However, another influence was the course design. A study that investigated the quality of 76 MOOCs through the lens of Merrill's first principles on instruction (Merrill, 2002) found that though these courses were well-packaged in terms of content, they were poor in instructional quality (Margaryan et al., 2015). Research is required that could shed light on how different types of MOOC design and pedagogical approaches influence social learning.

7.6 Conclusion

This paper investigated the help-seeking behaviours of 10 MOOC learners who were selected on the basis of their differing levels of academic experience. Help-seeking is a particularly important self-regulatory strategy in MOOCs, as one-to-one learner support is absent. If a learner needs help in a MOOC, they need to find it themselves. This study found that these 10 participants, who were, with one exception, strong self-regulated learners, engaged in limited help-seeking strategies that mostly involved searching for information outside the MOOC and engaging in isolated interactions with others. Though the findings of this study are not generalisable to other MOOCs, they do highlight what happens in MOOCs that Bartolomé and Steffens would term "content systems without tutor" (2015, p. 97), in which social learning is not embedded in the pedagogical intent of the course. Though some people who enrol in MOOCs do so only to engage with content (Glance & Barrett, 2014; Kizilcec et al., 2013), for MOOCs to realise more of their potential as a means of delivering quality learning, they need to offer more than just content. Raising the awareness of MOOC providers and designers as to the benefits of social learning and exploring ways of encouraging this approach in MOOCs would be a good start.

Paper 4 References

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CHAPTER 8: CONCLUSION

This chapter presents a summary of the outcomes of this study. This study adopted a mixed-methods approach to investigate how people of differing backgrounds regulated their learning in a MOOC. The approach was realised in the form of a sequential-explanatory design in which data was collected and analysed separately in quantitative and qualitative phases, with the findings from both phases mixed at various points. In the first quantitative phase, an analysis of data collected from an online survey addressed the first research question *Who enrols in MOOCs and what are their characteristics?* Ten cases were purposively selected from interested survey respondents for the following qualitative phase of the research, which took the form of a multiple-case study. An analysis of evidence collected through interviews, experience sampling, digital artefacts and surveys addressed the questions *How do learners self-regulate in a MOOC?* and *What outcomes do MOOC learners achieve?* This chapter responds to the three research questions with reference to the empirical literature, and considers the implications of these findings to lifelong learning, higher education and research. The chapter concludes with an outline of the limitations of this study and suggestions for future research.

8.1 Who enrols in MOOCs and what are their characteristics?

MOOCs attract a narrow band of society

In this study, the majority of MOOC participants were found to be highly educated. An analysis of survey data, with a response rate of 22.3% of all those enrolled in the MOOC, found that 75.1% of respondents had already gained a bachelor's degree or higher. This figure did not include respondents who were concurrently studying towards their first degree, which would make the proportion of respondents who had accessed or were accessing higher education even greater. A high level of tertiary education in MOOC learners has been found elsewhere. A report of engagement and demographic patterns from 290 MITx and Harvardx MOOCs on edX over the first four years, found that 73% of participants had a bachelor's degree or higher (Chuang & Ho, 2016). Christensen et al. (2013) found that 79.4% of 34,779

survey respondents who enrolled in Coursera MOOCs already had a bachelor's degree, and Zhenghao et al. (2015) found that 83% of 52,000 respondents who completed a Coursera MOOC were similarly educated. These findings suggest that the people who are attracted to MOOCs are familiar with studying at university level. If MOOCs are to widen their appeal they will need to find strategies to encourage people with no experience of university study to enrol.

Findings from an investigation into the learning of 10 research participants revealed a shared value for learning. Eight of the participants (Huseyin, Monica, Anna, Arjun, Federico, Mariam, Layla and Antonio), learned this value at an early age through the influence of family. Their mother, who would direct and control their study activities in the family home, was the main source of influence for Monica, Anna, Arjun and Layla. The other four (Huseyin, Federico, Mariam and Antonio) were surrounded by family members who had university degrees and professional careers. Walter was a special case, as he had been a gifted student at school, and found learning exciting and effortless. Pablo also came from a family that valued education, as his parents were incurring significant debt to put Pablo through college. It seems that MOOCs attract people who value learning, and this characteristic was a factor in their enrolling in a MOOC. Learning throughout one's lifetime is widely accepted as providing benefits to the individual, society and nation (Department of Education and Science, 2000; Faure et al., 1972; Medel-Añonuevo et al., 2001). For individuals to learn the value of education, it needs to be valued at the highest levels of society, including government. This should be a priority for governments if they wish to reap the benefits of lifelong learning.

Experience of the topic a factor in motivation

This study also found that experience of the MOOC topic was a factor in enrolees' motivational mindsets. Findings from a statistical analysis of survey data found evidence for three types of people in the MOOC based on their experience of the MOOC topic: those whose experience came from formal sources, such as their work (Work) or their formal studies (Formal Study), and those whose experience came from informal sources, from a general interest in the topic (General Interest). An analysis of survey data found that the Work and Formal Study groups were more intent on completing the MOOC, and scored higher for academic self-efficacy and

achievement goals than their General Interest counterparts. These findings are in line with the literature. In one study MOOC enrolees who were working professionally in the area of the MOOC topic had higher levels of general academic self-efficacy than others, and that these professionals and students in higher education measured higher for self-regulated learning than others (Hood et al., 2015). In a related study, learners who had experience of the MOOC topic or previous experience of MOOCs were found to have higher levels of self-efficacy than others (Littlejohn et al., 2015). These findings suggest that experience of the MOOC topic may be an important factor for learning in a MOOC. The five Work research participants in the current study (Federico, Mariam, Layla, Antonio and Walter) were the highest achievers in the MOOC, having completed the MOOC with the highest overall grades of all participants. As expected, their higher levels of motivation translated into superior levels of academic performance. Altogether, these findings suggest that people who enrol in MOOCs with substantive experience of the topic through their work are the most likely to persist and succeed in meeting their personal learning goals.

8.2 How do learners self-regulate in a MOOC?

Probably the most important factor that contributed to progress and achievement in this study was how participants used their time in the MOOC. Their behaviour and results suggest that it is not how much time a person spends in a MOOC that matters, but *how* they spend that time. The following summary focuses on four aspects of self-regulated learning found to be instrumental for effective learning in a MOOC. Though forum use was not found to be a strategy that the participants used to any extent, as the forum is provided for learners to engage in social learning, a summary of participants' forum use is presented and reasons for its infrequent use are discussed.

A flexible and opportunistic approach to MOOC study

This study found that the more effective learners approached their use of study time in the MOOC in a flexible and almost opportunistic way, rather than holding to a fixed schedule. In general, the participants in this study fitted their MOOC learning around other things that were happening in their lives, which reflects the lower priority of the MOOC in that context.

Although only two of the participants, Pablo and Mariam, had declared at the beginning of the MOOC that they would structure their study time in the MOOC, there was in fact little evidence of them following through with this plan; instead they studied when they could. A lack of a rigid schedule for studying in the MOOC characterised nearly all the completers in this study. Only Layla, who was not working for the most part during the study, followed through with her early plans to schedule her study. Records show that she kept to this plan. For the other seven completers (Huseyin, Monica, Anna, Federico, Mariam, Antonio and Walter), learning-journal records and follow-up interviews showed that they studied in a flexible way, but that they were focused and used their time efficiently to learn. An efficient and effective use of time was characteristic of these successful MOOC learners. In contrast, the two lowest achievers, Arjun and Pablo, were unable to control the time they spent in the MOOC. Their learning-journal records show they spent more time in the MOOC than all the other participants, even though neither one progressed past the MRI episode. These findings are in line with another study that found that learners who scored high for self-regulated learning tended to engage in MOOC activities in a random and unscheduled way, rather than adhering to a set plan, and that they were more efficient with their use of time (Littlejohn et al., 2015). Altogether, these findings suggest that effective time management in the context of MOOC learning may involve the learner being able to quickly respond to the availability of free time and personal resources and employ effective and time-efficient study strategies at these times, rather than the adoption of a rigid schedule for learning. Time management is a key issue for successful learning in MOOCs, as most people who enrol are either working or studying full-time, and thus available time is limited. Perhaps MOOC providers could provide resources that help learners make better use of their time for learning in MOOCs.

Proximal goals for effective learning

The most common study strategy that participants used to help them study in the MOOC was the setting of proximal goals. A proximal goal describes a short-term goal that can be achieved in the near future, such as “I will finish reading this chapter”, rather than a distal goal, which is long-term and may involve several steps, such as “I want to be a doctor”. Learning-journal records showed that all the participants, except for Huseyin, set goals of some kind at least once to help them study during the MOOC. In fact, goal-setting was indicated as the most

common learning strategy for Pablo, Elena, Federico, Mariam and Walter, and the second most common strategy for Arjun and Alejandro. The two top achievers, Mariam and Walter, provided an insight into how goals were used in the context of MOOC learning. They described how at the beginning of a session they would set a target of completing a certain amount of content or of reaching a set point in the course, and then do what was necessary to achieve that target. The setting of proximal rather than distal goals has been found to develop self-efficacy and intrinsic motivation in low-performing children (Bandura & Schunk, 1981), and to enhance task engagement and perceptions of performance in undergraduate students (Manderlink & Harackiewicz, 1984). Proximal goals have also been found to help young adults focus on appropriate task strategies whilst trying to perform a moderately complex task (Latham & Seijts, 1999). The findings from the present study and the literature suggest that the use of proximal goals may be a useful strategy for learning in MOOCs.

Structuring study time with rewards and breaks

As well as making full use of their available study time, this study found that effective learners used rewards as a strategy to structure and focus their study time. A common theme for some of the participants in this study was the granting of a reward for reaching a self-set goal. Six of the participants (Pablo, Anna, Arjun, Mariam, Layla and Alejandro) indicated in their learning journals that they used rewards to help them study at some point in the MOOC. In follow-up interviews they provided examples of the types of rewards they gave themselves: watching television, looking at social media, going for a walk and having a coffee with a friend, amongst others. Similarly, another way the effective learners punctuated their study time was by taking breaks. Anna and Federico, for example, described scenarios in which they knew they were no longer being effective in their study, and at that point they would stop and do something else. The use of rewards and punishments for the achievement of goals is known as *self-consequating*, and has been identified as a strategy employed by high-achieving secondary school students (Zimmerman & Martinez-Pons, 1986, 1988). The present study found that participants solely used self-consequating as a positive rather than negative motivator; in other words, as rewards rather than punishments. The use of rewards, such as granting oneself five minutes looking at Facebook or even just a look out the window, may be an effective strategy to assist learning in MOOCs.

Searching online the most efficient use of time for help-seeking

This study found that participants preferred to seek help by searching online rather than asking others. Whilst in general the learners in this study tended to focus on the content provided within the MOOC, some ventured outside the MOOC to search for related content on the web at specific times. There were three reasons learners engaged with content outside the MOOC: when they needed to refresh their memory on a topic, when they found a topic particularly interesting or when they encountered problems. In all these instances the default position was to use Google to search for such content. Layla, Arjun, Federico and Antonio described instances in which it was second nature to *just Google it*. This finding was in contrast to another study of learners who had enrolled in a health-sciences MOOC for professional development purposes, who seldom explored beyond course materials (Milligan & Littlejohn, 2014). The learners in the Milligan and Littlejohn (2014) study enrolled to earn formal credit towards their professional development, and this extrinsic motivation may have influenced their focus on doing only what was necessary to earn the certificate. The learners in the present study may have been more intrinsically motivated, and their interest in the subject may have influenced them to do their own research outside the MOOC. This finding highlights the importance of the design of activities and assessments in MOOCs if they are to be used as a means of assigning formal credit to learners enrolled for professional development. If individuals are required to do a MOOC to earn points, the activities in the course need to be appropriate to encourage deep learning and integration of new knowledge into professional practice. As well, MOOC designers should consider activities that encourage learners to venture outside the confines of the MOOC and engage with similar content from different perspectives to help learners gain a richer perspective on what they are learning.

Social learning not a priority for MOOC learners

Participants used the MOOC discussion forums infrequently and in a limited way when they needed help of some kind. Nine participants used the forums provided within the MOOC in response to their specific needs. Huseyin was the only participant to record no instance of using the forums in this study. In general, of the nine other participants who used the forums, their use was constrained to reading rather than contributing. Only three learners indicated that they contributed in some way to the forums. Layla, the sole participant who had a

university degree in the MOOC topic, explained that she had answered others' questions in the earlier part of the course when she felt confident with the content. Mariam reported that she had voted for an answer to a question in the forum so it would raise that post's visibility. Arjun posted to a forum but only did so as he believed it was mandatory to introduce himself. The participants in this study rarely contributed to the forums, but this is not necessarily indicative of a lack of motivation or progress. Elsewhere in a quantitative study of observable behaviours in a MOOC, it was found that not posting to a forum did not predict dropping out (Balakrishnan, 2013). Some people who enrol in MOOCs are happy to interact with the content and leave it at that. Perhaps we should not view a lack of social learning in a MOOC as necessarily a bad thing. It may just be the way many people tend to learn in this environment.

For the most part, however, forum users in the present study preferred to read. Pablo, Anna and Monica reported that they would go into the forums out of curiosity, to see what people were finding difficult or what they were talking about. Other uses of the forum were less frequent. Layla reported that she used the forum once to query the answer to an assessment question, which subsequently resulted in an erroneous answer on one of the quizzes being corrected. The use of forums, rather than Google, to follow up on content that was of interest to the learner was rare. Only two learners in this study did this. Walter searched the forums for conversations on X-rays, and Federico did the same for conversations on nuclear diagnostic medicine, which were both topics that interested them. The only other way that forums were used, and again this was far less frequent than using Google for help, was when a learner encountered a problem of understanding. Only two learners who experienced this problem (Pablo and Mariam) reported using the forum as a means of seeking help. In both these instances these learners did not post to a forum for help, but rather read others' posts; in both cases this strategy was unsuccessful, and both expressed a sense of defeat when they could not find what they were looking for.

The limited and infrequent use of forums in this study suggests that MOOC forums are not effective at encouraging or facilitating social learning. MOOC forums have previously been found to be ineffective platforms for community forming and information sharing (Gillani & Eynon, 2014; Gillani et al., 2014). Perhaps it is the massiveness of MOOCs that is the problem.

A study of college students, who are typically in much smaller groupings on campus, found that they preferred seeking help online rather than in person, and also found this to be an effective strategy (Kitsantas & Chow, 2007). A recent review of the literature (Bartolomé & Steffens, 2015) found that the experience of being in a massive course delivers no learning or psychological benefits. It remains to be seen if massive courses can facilitate and support social learning. This would be a valuable line of research and development.

8.3 What outcomes do MOOC learners achieve?

All but one of the case-study participants earned a certificate. This result was in stark contrast to the average completion rate for MOOCs which, was reported as 6.5% in 2014 (Jordan, 2014). However, should not be too surprising, as these participants had volunteered to be part of the study, so it would be reasonable to assume they would be more engaged and motivated than the many learners who did not volunteer, or those who did not even return the survey.

Professional-development learners the highest achievers

The highest achievers of the participants in this study had enrolled for professional-development reasons. Five of the 10 participants, Federico, Mariam, Layla, Antonio and Walter, had enrolled to benefit their careers, which either were in the field of imaging (as in the case of Layla and Alejandro, who were working in biomedical imaging) or used imaging within other fields (Federico as a doctor, Mariam as a dentist and Walter as a neuroscientist). These five learners achieved higher overall grades than the other participants, who had enrolled for either personal reasons (Pablo, Huseyin and Monica) or to support their formal studies (Anna and Arjun). This result is not surprising, as prior knowledge is considered to be the main determinant of academic achievement (Ausubel, 1968) and prior educational experience has been found to predict success in MOOCs (DeBoer et al., 2013). Learners who have professional experience of a MOOC topic would be more likely to have accrued more prior knowledge of the topic because of this. This extends the findings by Hood et al. (2015), who found that learners who were working as professionals in the area of the MOOC topic had higher levels of academic self-efficacy and self-regulated learning than others. Altogether, this evidence suggests that learners who enrol in MOOCs for professional-development reasons

are better equipped to learn effectively than others, and in fact are more motivated to apply these skills and achieve than those who enrol for other reasons.

There was no real pattern of achievement for those participants who had enrolled for personal reasons or to support their formal studies. The lowest achiever among this group was Arjun, a medical student who was successfully progressing in his course, and the highest achiever was Monica, a PhD candidate who had enrolled out of curiosity for the subject. Reporting achievement in terms of overall grades only tells a part of the story in terms of what these individuals achieved in the MOOC. To get a deeper understanding of the outcomes that these participants achieved, it is more useful to focus on their personal contexts and goals.

Nearly all reported benefits related to their reasons for enrolling

Nearly all of the case-study participants were satisfied with what they had gained from the MOOC. Four of the five learners who had enrolled in the MOOC for professional-development reasons reported specific benefits related to their reason for enrolling. Walter and Federico both reported that they had learnt new things related to X-rays and nuclear diagnostic medicine respectively. Antonio reported that he was able to participate in clinical discussions involving imaging with a greater understanding, and Layla indicated that she had refreshed her knowledge in her field of imaging, which was the field she had trained to work in. Only Mariam expressed disappointment that the MOOC had not delivered what she had hoped: clinical applications of imaging. Even though Mariam expressed regret that she had enrolled in the MOOC and persisted to the end without her needs being met, she conceded that there were some useful things she had learnt from the MOOC. The two medical students who had enrolled for reasons related to their formal studies reported benefits related to that purpose. Anna indicated that the course had helped her prepare for a radiology exam and that she was happy with the results, and Arjun reported that even though he did not complete the MOOC, he was able to participate in and better understand discussions of images in his clinical practice with what he had learned from his participation.

The General Interest learners also reported benefits, but these varied depending on their contexts. Monica, a PhD candidate working in wireless sensor networks, had hoped the course

might be more related to her field and was disappointed that it was not. Like Mariam, she completed the MOOC despite this and was able to find a positive outcome by identifying that what she had learnt may help her in future interactions with doctors when discussing images. Pablo had enrolled in the MOOC to find out if biomedical imaging could be a possible career choice. Pablo did not progress past the MRI episode, and decided that biomedical imaging was not for him. For Pablo, then, who was at the beginning of his adult life, the MOOC served as a taste of a possible career. Pablo reflected on his poor performance and declared that some of his study habits (in particular, an ingrained habit of procrastination) needed to change if he was to achieve his goal of becoming a doctor.

In contrast, Huseyin, a 44-year-old family man in the family construction business, was at a very different point in his life to Pablo. Huseyin had enrolled in the MOOC to get some basic knowledge of the topic, and these modest expectations were easily met. The completion of this MOOC provided Huseyin with a sense of accomplishment and added to his developing sense of confidence in his ability to succeed in his larger life goal: to return to study and transition into a new career. Huseyin's use of this MOOC, and of MOOCs in general, show how MOOCs can be used as a means of returning to formal study by providing knowledge and confidence in studying university-level content. Huseyin's enterprising use of MOOCs was similar to another MOOC enthusiast who took this idea a step further. Jonathan Haber, an educational researcher and blogger, enrolled in 32 MOOCs over a year to see if he could learn the equivalent of a four-year arts degree. Haber argued that though he had made significant knowledge gains in that year, he may have only been able do so because he could draw upon the considerable skills that he had already developed through the experience of studying for a degree on campus (Haber, 2013). These findings highlight how individuals who have already developed competent skills in self-regulated learning can use MOOCs to transition into – and even perhaps provide an alternative to – formal programs of study.

Overall, this study found that each participant was able to identify some learning gain from the MOOC, be it an improved performance in a professional context, assistance in a specific aspect of formal course of study, some knowledge that may be of future use, an insight into a personal habit that may have a deleterious effect on learning or a sense of accomplishment at earning a

certificate. These findings support the view that individuals enrol in MOOCs for diverse reasons (DeBoer et al., 2013; Koller et al., 2013), and extends it by finding that the knowledge gains individuals make in MOOCs may only be revealed through an understanding of the personal contexts of the learner. This finding suggests that the reporting of completion rates may not be an appropriate measure of the learning that takes place in MOOCs, and raises questions about how such learning could be better measured, as "in the MOOC context, learning is more nuanced" (Littlejohn et al., 2015, p. 47). The measurement of learners' expectations and outcomes is one way to the measure of quality of MOOCs (Hood & Littlejohn, 2016). Qualitative evaluations of MOOCs through the pairing of specific learners' expectations and outcomes would be time-consuming and expensive. How to measure learning and the quality of MOOCs in a valid and efficient way is an important question for future researchers.

Positive attitudes to MOOC learning

All the participants in this study had positive perceptions of MOOCs as a vehicle for learning, and intended to do more of this type of learning. They expressed either a desire to enrol in another MOOC or had already enrolled in at least one other MOOC by the time of the last interview. Even the two lowest achievers (Pablo and Arjun), who had not enrolled in a MOOC previously, expressed enthusiasm in their final interviews about doing more MOOCs. Arjun reported that he was looking forward to enrolling in MOOCs that were more clinically oriented, and Pablo had already enrolled in a MOOC on epidemics in the period after the imaging MOOC finished. This suggests that even though they may have experienced difficulties the first time around in a MOOC, this did not put them off this type of learning. The two learners whose expectations were not met in the course of this study were likewise disposed to continuing with MOOCs. By the time of the last interview, Monica had enrolled in a MOOC that she believed would assist with her work as a researcher and Mariam had already enrolled in and completed a MOOC on biology.

Some of the learners in this study believed MOOCs were providing them with a unique opportunity to learn. Federico believed that MOOCs provided him access to information that would not normally be available to him, and Mariam appreciated the ability to access courses

from universities that were geographically distant. Antonio indicated that MOOCs provided him with the opportunity to experience an academic culture that was different to that in his native Spain, which could bring a new perspective to a topic. This study also found that all the participants were enthusiastic about MOOC learning and intended to continue. These findings provide some detail as to why MOOCs continue to attract learners from around the world in significant numbers. A recent article reported that enrolments in MOOCs doubled from 2014 to 2015, and that MOOC activity was predicted to grow (Flamig, 2016). This suggests that the MOOC phenomenon may persist for the foreseeable future.

8.4 Implications for Lifelong Learning

The MOOC is perhaps the most significant innovation in lifelong learning in recent times. Lifelong learning describes all forms of learning that an individual engages in after their compulsory schooling. The need to continuously learn throughout one's lifetime is amplified in the 21st century as globalisation and technological change drive the need to upksill or reskill to remain employable. Lifelong learning also confers benefits to the societies in which it flourishes, such as social inclusion, active citizenship, personal development and competitiveness (Department of Education and Science, 2000). It is the key to a successful individual and society. MOOCs have been extraordinarily successful at attracting people into lifelong learning, and this trend is predicted to continue (Flamig, 2016). In this study, all 10 participants had at least one degree or were on their way to their first degree, which supports the view that most people who enrol in MOOCs are already lifelong learners. However, more could be done to attract people who have not ventured past their compulsory schooling into enrolling in MOOCs.

Using MOOCs to widen access to higher education

One way that MOOCs could promote lifelong learning to a wider audience is to target people interested in a career in a specific field. At the moment, MOOCs are based on existing university courses that are geared towards fee-paying students enrolled in a degree program. Perhaps this is why MOOCs are attracting people with degrees, who are familiar with study at this level. MOOCs do not have to be this way. They could target a different kind of audience

altogether. For example, a MOOC that was designed to promote the study of and careers in dentistry attracted a much younger than normal cohort of learner than the typical MOOC enrolee (Stokes et al., 2015). In this MOOC over 4,200 individuals enrolled, and over 10% of these completed the course, which is high by MOOC standards. This project highlights that MOOCs can and should do more than replicate on-campus courses. As Stokes et al. (2015) concluded, "there is genuine potential for MOOCs to involve people from disadvantaged backgrounds in higher education by offering free, accessible, enjoyable and engaging educational experiences" (p. 81). Perhaps if more MOOCs are designed with this intent and used to target those who may not be thinking that study at this level is for them, MOOCs may attract more people into becoming lifelong learners.

While attracting different types of people into MOOCs is important, the learning experience that the MOOC provides is crucial to their continuing to completion. The findings from this study suggest ways in which the MOOCs could be improved to deliver a better learning experience.

Improving the quality of MOOCs

The findings from this study suggest ways MOOCs could be improved to meet the diverse needs of learners. As was highlighted in the case of Pablo in this study, the unrestricted nature of entry into MOOCs may result in individuals attempting to study a subject without the requisite knowledge to understand it. Typically, this information is already provided in a syllabus document provided in a MOOC, as was the case in this study, but this can be overlooked by people who enrol, and potentially not understood by those who do read it. MOOC providers and designers could consider a self-assessment quiz that provided prospective learners with some feedback about their understanding of the subject matter before enrolling. A diagnostic tool such as this would provide would-be MOOC enrolees with feedback about their knowledge level and likely success in the subject.

The open nature of MOOCs means that they attract people with diverse backgrounds and motivations. This study found evidence of three types of MOOC learner: those with experience of the MOOC topic from their work or from formal studies, or those participating

out of general interest. MOOC providers should try to identify the typical profiles of learners that a MOOC might attract and design content and assessment tasks that would be relevant to these differing profiles. This may mean providing alternative tasks for learners or even parallel learning paths, such as one for learners who are working or formally studying in the field of the MOOC and one for more informal learners. For example, in this MOOC Mariam wanted more emphasis on the clinical applications of biomedical imaging, and was disappointed that the course did not deliver it. Providing alternative content and tasks that may meet the needs of different types of learner, such as professionals, students and general-interest learners, may improve the effectiveness of MOOCs as a vehicle of learning.

Central to the learning experience is, of course, the learner. The findings from this study also have implications for people interested in using MOOCs for lifelong learning.

Tips for MOOC learners

Individuals contemplating enrolling in MOOCs should think about what they want to achieve at the outset and set achievable goals. This study found that time was a precious commodity for the majority (9/10) of participants, who were either working or studying full-time at some point. The successful learners were those who could use their study time efficiently and effectively. As completion, in the formal academic sense, is not mandatory in MOOCs, prospective learners have the freedom to choose whether they wish to engage with all the content or only parts of it. If only parts of the course interest an individual, it may be better to set clear and reachable goals and aim to complete them rather than follow the dictates of the course structure. This strategic approach may result in a sense of achievement about reaching one's personal learning goals.

Further, people interested in learning in MOOCs could use effective strategies to make best use of their MOOC study time. For example, the more effective learners in this study used proximal goal-setting and rewards to get the most out of their limited study time. As time management can be learnt (Claessens, van Eerde, Rutte, & Roe, 2007; Nadinloyi, Hajloo, Garamaleki, & Sadeghi, 2013), prospective MOOC learners could consider developing this skill. A rudimentary web search for courses on time management unearthed numerous online

courses and resources on the topic. This finding is also relevant to people with full-time jobs thinking about enrolling in a postgraduate program delivered online or in blended mode. These types of learners would experience similar time-related challenges as the participants in the present study, who were also trying to fit study in around their main activity. The need for effective time management for part-time students in formal programs is supported in the literature. A study of part-time college students found that time management was linked to achievement (MacCann, Fogarty, & Roberts, 2012). These findings highlight the need for effective time-management skills for people wanting to study online on a part-time basis in either non-formal or formal contexts.

Also, MOOC learners could consider how they might engage in social learning inside and outside the MOOC. Opportunities for social learning were found to be limited in this study. Only two of the participants (Monica and Mariam) reported interaction of some kind about the course content with other people outside the course, and only two participants (Mariam and Layla) actively engaged in the forums within the MOOC. Although in the literature there is evidence of MOOC learners interacting with each other in person or through social media outside the physical space of the MOOC (see Veletsianos et al., 2015), elsewhere it has been found that social learning, as intended through the MOOC forums, is difficult to realise in MOOCs (Gillani & Eynon, 2014; Gillani et al., 2014). People intending to enrol in the MOOC for the first time should prepare themselves for some challenges regarding certain aspects of the course that may feel overwhelming. For example, one of the participants in this study (Antonio) had an adverse reaction to the MOOC forums and would not even contemplate looking at them, as he found them overwhelming and chaotic. There are other social-learning possibilities that MOOC learners could consider. Enrolling in a MOOC with a colleague or friend with a similar interest could set up opportunities for discussion about the course content. Alternatively, MOOC learners could simply explain what they are learning in the MOOC to a – hopefully – curious partner or friend. It has been found that the retrieval of studied material has a positive effect on learning (Karpicke & Roediger, 2008), so the act of trying to make sense of what one has studied in a MOOC may help the learner to better understand and retain the content.

First-time MOOC learners should be aware that the experience of learning in a MOOC may be challenging. The two lowest achievers in this study (Pablo and Arjun) happened to also be first-time MOOC learners. A study of learners who were working professionally in the area of the MOOC topic found that prior experience of learning in MOOCs was a factor in participants' self-efficacy for learning (Milligan et al., 2016). These findings suggest that new MOOC learners may experience some difficulties. First-time MOOC learners could consider preparing themselves by taking part in orientation programs if offered by the MOOC provider, or even enrolling in a short MOOC on a topic with which they are already familiar. Such preparations may help them get a feel for what happens in these environments.

This study investigated how people learned independently in the online environment of a MOOC. As university students at the undergraduate and postgraduate level are increasingly required to engage in online environments in their studies (Wallace, 2003), the findings from this study also have implications for educators, designers and students in higher education.

8.5 Implications for Higher Education

The need to self-regulate one's learning is amplified in online environments. This study found that the more strongly self-regulated learners were more efficient with their use of MOOC study time, used more-effective learning strategies and achieved more academically than the weaker self-regulated learners. This finding confirms what has been found in the literature: online environments are best used by people who can regulate their learning (Bernacki et al., 2011) This study also found that the higher achievers were better able to deal with the distractions of being online by remaining on task and engaging in social-media activities like looking at Facebook as rewards or breaks from learning. Three of the participants in this study (Pablo, Arjun and Mariam) had difficulties dealing with online distractions of this nature, which led to an inefficient use of time for Pablo and Arjun and a sense of exasperation for Mariam. Failure to regulate one's attention while studying has been found to have negative outcomes on learning. A study of university students found that those who accessed Facebook while they were studying had lower GPAs than those who did not (Rosen, Mark Carrier, & Cheever, 2013). Misconceptions about effective ways of studying independently can also affect learning. For example, Pablo had the misconception that watching television while he

was studying was not deleterious to his learning, when in fact the literature has confirmed that multitasking impairs memory encoding in undergraduate students (Judd & Kennedy, 2011). For university students in the digital age, in which everyone is connected and self-gratifying activities are just a click or a button push away, the need to regulate one's attention is amplified.

Educators in higher education need to ensure that their students have the self-regulated learning skills to be successful in this context. As the ability to self-regulate can be learned and taught (Pintrich, 1995), educators could consider providing training courses to help students understand the most effective ways of learning at this level. Training of this kind could deal with some commonly held misconceptions about learning, such as the myth that the brain can do multiple tasks simultaneously. Also, it has been found that online environments have the capacity to promote self-regulated learning through the embedding of design features (Bernacki et al., 2011). Specific tools or digital assistants could be made available to students to model and support self-regulated learning. For example, one study that aimed to promote self-regulated learning in a MOOC involved the use of a mobile application that guided their interactions with content and replaced some of the functions of a tutor (Gutiérrez-Rojas, Alario-Hoyos, Pérez-Sanagustín, Leony, & Delgado-Kloos, 2014). The idea of promoting self-regulated learning strategies in online environments through design features alone would not be expensive to implement, and could help university students develop this key skill for academic success.

8.6 Implications for MOOC Research

The findings from this study contribute knowledge about how learners with varied backgrounds and motivations learned in a MOOC. Though research into MOOCs in general is still in its early days, the majority of research so far has been quantitative in approach and has revealed little of what people actually do in MOOCs. Research that has adopted qualitative or mixed approaches to investigate how individuals learn in MOOCs is only beginning (e.g. Littlejohn et al., 2015; Milligan & Littlejohn, 2014). This study adopted a mixed-methods approach to fill this research gap by providing detailed accounts of how people learned in a MOOC; it used a theoretical framework that could explain how the interconnected and

mutually determining forces of personal, behavioural and environmental factors influenced learning.

The quantitative phase of this study confirmed what has been reported elsewhere: that the majority of people who are enrolling in MOOCs are highly educated. This raises some concerns about the claims that MOOCs are democratising education (e.g. Koller, 2013; Koller & Ng, 2013). Some critics argue that they may be in fact widening the gap between the haves and have-nots (e.g. Christensen et al., 2013; Emanuel, 2013; Hansen & Reich, 2015) rather than narrowing it. In response to these criticisms, authors of a report who work either for Coursera, the world's biggest MOOC platform, or for universities that have delivered Coursera MOOCs, claimed that individuals from poorer countries were more likely to report benefits from taking MOOCs than people from rich countries (Zhenghao et al., 2015). Though it may be that people from poorer countries report benefits from taking MOOCs, this study found that the people from less developed countries were from the already educated classes. If MOOCs are to realise the ideal of democratising education, more needs to be done by the MOOC providers and platforms in collaboration with local schools, universities and governments to encourage individuals of lower socioeconomic status in both poor and rich countries to enrol and benefit from MOOCs.

The qualitative phase of this study provided rich contextual detail on what motivated individuals to learn in MOOCs and how they actually learned in this environment. Through the use of learning journals and interviews, this study was able to probe how individuals with a range of academic experience learned in a MOOC at a situated and contextual level. In particular, this study revealed how effective learners self-regulated their time – a valuable commodity in the context of their lives – by using efficient and effective strategies to make the best use of their time. Also, this study contributed new knowledge about how learners used resources within and outside the MOOC to assist their learning when they needed help. In general, learners preferred to Google when they needed help rather than search the MOOC forum, and efforts to use the forum for information-searching and interactions with others were infrequent and usually unsuccessful. Other MOOC researchers who have grounded their work in social cognitive theory have found a link between the learner's context and motivation and

self-regulated learning; that individuals with high and low levels of self-regulated learning had qualitatively different strategies for learning (Milligan & Littlejohn, 2015); and that individuals' conceptualisations of the purpose of a MOOC informed how they learned in it (Littlejohn et al., 2015). These studies highlight the complexity of the interrelationships of personal, behavioural and environmental factors that influence learning in MOOCs. However, even at this early stage of MOOC research some patterns are emerging. The reason why individuals enrol in a MOOC is key to how they perceive its value and influences how much effort and time they are willing to expend on it. This study found that three different types of individuals – those who had enrolled for professional development, support for formal study or personal reasons – learned in different ways and with different outcomes. Much more research needs to be conducted to investigate how pedagogical approaches within MOOCs can help learners with differing motivations achieve their personal goals.

Implications for theory

This study was grounded in a social cognitive theoretical framework, which enabled an investigation of the interconnected and reciprocally determining internal and external factors that influenced learning in a MOOC. Within this grounding, Zimmerman's triadic view of self-regulated learning (Zimmerman, 1989) was applied to probe the personal, behavioural and environmental factors that influenced each other and learning in a MOOC. The triadic view of self-regulation, which closely mirrored Bandura's model of *triadic reciprocal causation* (Bandura, 1986), was of particular use in this study, as it afforded both an event and aptitude view of self-regulation that could be aligned to the mixing of quantitative and qualitative methods.

The grounding of this study in social cognitive theory was found to be a particularly useful framework to investigate how participants learned in a MOOC in a detailed and nuanced way. In particular, the social cognitive approach highlighted the role that environmental factors influenced how participants regulated their learning. For example, in this study the participants were found to engage in the MOOC in a limited way, for the most part reading and doing quizzes and occasionally doing some Google searches for more information. The lack of engagement in self-directed learning may be explained by the contributing influence of the

MOOC. The instructional design of the MOOC consisted of content and automated quizzes. This instructivist approach emphasised the content-centric focus of the course; it was what Bartolomé and Steffens would term a "content system without tutor" (2015, p. 97). This rudimentary pedagogical approach may have been a contributing factor as to why the participants engaged in a limited way with the MOOC and were not motivated to contribute to forum discussions. This finding is in line with another study of how health professionals learned in a MOOC, which also took a social cognitive approach. Milligan et al. (2016) found that the basic and repetitive nature of the course may have influenced participants to adopt shallow learning strategies. The findings from these studies demonstrate how a social cognitive framework is of particular use when investigating learning in MOOCs by highlighting the internal and external influences and how they interact and influence learning.

This study has highlighted the limitations of investigating general academic self-efficacy in the context of MOOC learning, and has identified some key domains of performance that may be relevant to the study of self-efficacy in MOOCs. The quantitative phase of this study confirmed what has been found elsewhere (e.g. Hood et al., 2015): that the context of the learner has a bearing on their measure of general academic self-efficacy. For example, this study found that enrolees who had substantive experience of the MOOC topic measured higher for academic self-efficacy than those who had less substantive experience of the topic. The subsequent qualitative phase of this study highlighted some limitations imposed by focusing solely on general academic self-efficacy when considering the salient factors that influence learning in MOOCs. A qualitative investigation of data professionals in a data-science MOOC found that prior exposure to the MOOC topic and prior experience in MOOCs were factors for those professionals who scored very high for academic self-efficacy (Littlejohn et al., 2015). This may explain why the two lowest achievers in the present study were also the only two who were new to MOOCs. As has been claimed in the literature, self-efficacy in the context of online learning is not yet well understood, and there is little consensus as to what components of self-efficacy make for effective online learning (Hodges, 2008; Pintrich, 2000). Self-efficacy researchers adopting a quantitative approach need to develop instruments that relate to the skills and capabilities that learners in MOOCs use to learn successfully. This study has revealed some key skills that may be relevant for the development of valid instruments to

measure self-efficacy in MOOCs, such as autonomous learning, time management, goal-setting and information-searching.

This study contributed new knowledge in the field of achievement-goals research in the context of MOOCs. The present study applied the 2x2 achievement-goal framework proposed by Elliot and McGregor (2001), which enabled an investigation into how differing achievement-goal orientations influenced learning in a MOOC. This investigation produced a detailed account of how an individual with a strong performance-avoid orientation learnt in a MOOC. Pablo, who scored high on the performance-avoid orientation (6.67 out of a possible 7.00), reported being reluctant to ask questions or to submit assessment quizzes he had been working on, thus avoiding negative assessments of his performance. Little has been written about achievement goals and how they influence learning in MOOCs. A review of the literature revealed two studies that found that a general mastery-goals orientation contributed to participants' persistence and performance, but provided no insight into how other goal orientations affect learning (see de Barba et al., 2016; Wang & Baker, 2015). The present study has demonstrated that performance feedback is an influencing factor in MOOCs, as it can have a negative impact on performance and learning. More needs to be understood with regard to how individuals orientate their learning in MOOCs and how achievement goals that promote adaptive learning can be supported.

8.7 Limitations of this Study

As with all research, there are several factors that limit the generalisability of findings from this study. First, the context of this study was only one MOOC, which was highly specialised with a professional focus. Survey data showed it appealed mainly to individuals studying the topic or working in a related field much more than to others who had more personal reasons for enrolling. It is impossible, therefore, to generalise the findings from this study to other kinds of MOOCs, which may attract different kinds of learner. It should be noted as well that the sample used in the quantitative phase of this study was not representative of the whole population of individuals who enrolled in the MOOC. Even though the survey response rate was relatively high at 22.3%, the enrolees who chose to complete the survey were likely to be

the more engaged and active of the cohort. The findings from the analysis of survey data does, however, say something about the more engaged learners in MOOCs.

Another limitation is the small number of participants who participated in the qualitative phase of the study. Ten willing survey respondents were selected to take part. Although these participants were located in countries from all over the world, and had a range of academic experience, it is not possible to draw wider conclusions about how people learn in MOOCs based on these cases. In fact, the completion rate of the research participants (9/10 earned a certificate) was in stark contrast to the wider population of MOOC participants in this study (9.8%) and of MOOCs in general (6.5% as reported by Jordan, 2014). It may have been that of those who completed the survey, those who were also willing to give up some of their time to participate in the study were an even more enthusiastic and engaged sub-population of the wider cohort enrolled in the MOOC. This may explain the unusually high completion rate for the participants in this study. Lastly it should be noted that social-desirability bias, the tendency to put oneself forward in the best possible light, was an issue. To minimise this bias, where possible evidence collected by one method was triangulated with another source to enhance the credibility of the findings.

8.8 Suggestions for Future Research

MOOCs have been constantly evolving since they first appeared in 2008. The first cMOOC was driven by a notion of connectivism which prioritised the value of social learning, whereas the latter wave of xMOOCs that started in 2011, were driven by instructivist principles which framed the teacher as the source of authoritative knowledge. A recent European initiative has even developed new type of sMOOC which emphasises the value of social learning through social media on mobile devices (see Ballester, 2016). The context of this study was an xMOOC in which learners could complete the course, and achieve their personal learning goals, without interacting with others. These kinds of rudimentary content driven xMOOCs are appropriate for courses in which the knowledge to be learned is of a hard science nature, in which there is agreement on what is true in a knowledge domain. Though this study focussed only on one MOOC, the findings from this study suggest several lines of future research that

may help us to better understand how people learn in any online course in which large numbers of learners are enrolled.

How do inexperienced self-directed learners fare in MOOCs?

First, it would be of value to investigate how individuals with no experience of higher education fare in MOOCs. In this study, the least academically experienced participant (Pablo) was also one of the lowest achievers. His performance was due, in part, to his poor self-regulatory skills. It is not surprising that a poor self-regulated learner would struggle in a MOOC, as they offer little explicit tutor and peer support. They are also environments in which the learner is more or less left to their own devices to actively seek help when needed and solve their own problems. It may be that individuals only develop this self-regulatory capability after they leave high school and enter higher education. At this level, individuals have more freedom to choose what they want to study, how to manage their time and in what activities they wish to engage. An investigation into how less academically experienced individuals learn in MOOCs may shed some light on the capabilities of MOOCs as they are currently realised and provide some insight into how MOOCs fit into the learning landscape.

The selection of a MOOC that would attract less academically experienced learners could also be considered. The context of the present study was a highly-specialised MOOC, which attracted a relatively small cohort relative to most MOOCs, who tended to be working professionals or students of the topic. A MOOC on a subject and at a level that would be typically found in the first year of an undergraduate program, such as psychology, communications or accounting, may attract learners with less academic experience. In the first few years of MOOCs, there was considerable interest in the MOOC as part of a solution to the problems facing higher education, such as the escalating cost of a degree. A study of this type might provide insights into the viability of MOOCs as an alternative or adjunct to traditional higher-education provision.

The influence of design on learning

Future MOOC researchers could investigate the influence of instructional design on learning. The context of the present study was a MOOC designed around the delivery of content in five

episodes, each capped with a 10-question multiple-choice quiz, followed by two assessment-scenario quizzes at the end of the course. All learners needed to do to complete the course was to interact with the content and attempt the automated quizzes. This study found that participants used the forum intermittently and mostly in a passive way, rather than contributing to discussions, and that a fair number of the participants (4/10) did not take notes of any kind. A study of learners in a MOOC of similar design, which involved videos, readings and closely linked assessment quizzes found that this repetitive and basic instructional format encouraged a rigid learning approach (Milligan et al., 2016). Furthermore, in a review of 76 randomly selected MOOCs, Margaryan, Bianco and Littlejohn (2015) found that though most MOOCs scored highly along Merrill's first principles of instruction (Merrill, 2002) for content organisation and presentation, they scored poorly on instructional quality. Future researchers need to focus on specific design features in MOOCs and how they influence learning. For example, it would seem feasible that automated quizzes used as summative assessment may encourage a different learning approach to more-open assessment tasks that involve feedback from one's peers. Research of this kind would assist designers and providers improve MOOCs.

Massive numbers – a hindrance or an untapped resource?

Though the massive numbers who enrol in MOOCs indicate their appeal, little is understood about how having thousands of learners in a virtual space influences learning. In MOOCs, it is within the discussion forum that one becomes aware of the presence of others. The physical appearance of the forums and the many discussion topics and posts may result in a sense of chaos and being overwhelmed. For example, in the present study Antonio reported an emotional aversion to them. In contrast, the two most experienced MOOC learners in this study (Huseyin and Walter) perceived MOOC forums as being of value to learning, reporting that if learners have a question, all they need to do is ask to get help. In this study, however, forums were infrequently used and in a limited way. The literature suggests that MOOC forums are ineffective tools for social learning (Gillani & Eynon, 2014; Gillani et al., 2014), and some studies have even claimed that massive numbers do not provide any added educational or psychological value to MOOCs (Bartolomé & Steffens, 2015). This being said, the numbers of people who enrol in MOOCs are a potential resource for social learning that should be investigated. For example, a recent pilot experimental study that involved an online

chat tool as a means of facilitating social learning looked promising. Technological innovations, in the form of intelligent and adaptive tools, could help learners find like-minded others with whom they could interact. This would be a useful line of investigation.

8.9 Conclusion

This thesis has reported on the findings of an investigation into how people of differing backgrounds learned in a MOOC. Using a mixed-methods sequential-explanatory design and a social cognitive theoretical framework, this study applied the lens of self-regulated learning to address the research problem that *very little is known about how people actually learn in MOOCs*. The findings from this investigation were presented in the form of four manuscripts in progress. Paper 1 (*Who Enrols in MOOCs?*) reported on the findings derived from statistical analysis of survey data. Paper 2 (*Learning and Achievement in a MOOC*) compared the learning of a high and low achiever; Paper 3 (*Topic Experience and Learning in a MOOC*) investigated the learning of six participants who were grouped according to their experience of the MOOC topic; and Paper 4 (*Help-Seeking in a MOOC*) reported on an investigation into how the 10 participants sought help when they encountered difficulties in the MOOC. A summary of the research findings was presented in this concluding chapter in response to the three overarching research questions that guided this study. The implications of these findings to the areas of lifelong learning, higher education and research were then discussed, and suggestions made for future research.

This study has contributed detailed knowledge about how 10 highly educated individuals learned in a MOOC. From the findings of this study, it would seem that MOOCs are especially attuned to learners who want professional development, as these individuals are highly motivated and have the ability to regulate their learning by virtue of the study that they have done to enter a profession. In the challenging environment of a MOOC, the ability to direct and control one's own learning is key.

MOOCs are an important new vehicle for lifelong learning and have the potential to reach many more millions of people in the future. Yet challenges remain. Massiveness is good from the viewpoint of marketers, but not of learners. If MOOCs are to become more than content

systems, serious thought needs to be given to how to deal with the overwhelming nature of large enrolments and the impediments this presents to social learning. MOOCs appeal to a narrow band of society: those who have university degrees. There is no reason why MOOCs cannot attract different types of audiences, and it would seem that moving beyond replicating existing university courses in MOOC format would be a good start. The *Discover Dentistry* MOOC (Stokes et al., 2015) is proof that a MOOC can reach new audiences if it is designed with that intent. If MOOCs can reach new audiences, then maybe they can start to deliver on the promise of providing education for all.

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APPENDICES

Appendix A: HREC Ethics Approval

10/5/2016 RE: HS Ethics Application - Approved (5201300798)(Con/Met) - adrian.norman@students.mq.edu.au - Macquarie University Student Email and Calenda…

Fhs Ethics <fhs.ethics@mq.edu.au> 12/5/13

to Prof, me

Dear Prof Lockyer,

Re: "Goals and Learning in MOOCs: An investigation into the lifelong learning goals, achievement orientations and self-regulated learning strategies of individuals in massive open online courses"(5201300798)

Thank you for your recent correspondence. Your response has addressed the issues raised by the Faculty of Human Sciences Human Research Ethics Sub-Committee and approval has been granted, effective 5th December 2013. This email constitutes ethical approval only.

This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:

http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.

The following personnel are authorised to conduct this research:

Mr Adrian Martin Norman
Prof Lori Lockyer

Please note the following standard requirements of approval:

1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).

2. Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 5th December 2014
Progress Report 2 Due: 5th December 2015
Progress Report 3 Due: 5th December 2016
Progress Report 4 Due: 5th December 2017
Final Report Due: 5th December 2018

NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Sub-Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. All amendments to the project must be reviewed and approved by the Sub-Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5. Please notify the Sub-Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:

http://www.mq.edu.au/policy

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/

https://mail.google.com/mail/u/0/#search/fhs.ethics%40mq.edu.au/142bff73bcab151d 1/2

human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

If you need to provide a hard copy letter of approval to an external organisation as evidence that you have approval, please do not hesitate to contact the Ethics Secretariat at the address below.

Please retain a copy of this email as this is your official notification of ethics approval.

Yours sincerely,

Dr Peter Roger
Chair
Faculty of Human Sciences Ethics Review Sub-Committee
Human Research Ethics Committee

Appendix B: Survey 1

MACQUARIE UNIVERSITY
SYDNEY ~ AUSTRALIA

FACULTY OF HUMAN SCIENCES

Learning in MOOCs

Thank you for taking the time to complete this survey on learning in *massive open online courses* (MOOCs). MOOCs are an important recent development in the world of online learning but as they are relatively new, we don't know much about them. Your completion of this survey, which should take no more than 10 minutes, will provide us with valuable information on who is enrolling in MOOCs and how they like to learn.

NOTE: All survey responses will remain anonymous and will have absolutely **NO** impact on your personal achievement or course records.

1. How old are you?

- ○ 17 or under
- ○ 18-25
- ○ 26-35
- ○ 36-45
- ○ 46-55
- ○ 56-65
- ○ 66 or over

2. What is your gender?

- ○ Male
- ○ Female

3. In which country do you reside?

4. Are you a native English speaker?

- Yes
- No

4a. Which of the following statements best describes your level of English.

- My English is not very good.
- My English is good but I might find studying at an English speaking university difficult.
- I am sure my English is good enough to study at an English speaking university.
- I have an IELTS or TOEFL score that is high enough to get into an English speaking university.

5. What is the highest level of education you have completed?

- Less than High School
- High School
- College or Vocational Qualification
- Bachelors Degree
- Masters Degree
- Doctoral Degree

6. Learning that takes place over the Internet is called *online learning* and can range from **casual**, like learning how to knit by watching a YouTube video, to **formal**, like participating in online discussions as part of a course at school or university, to **structured** like the ***Introduction to Biomedical Imaging*** course you have signed up for.

	1 (Novice)	2	3	4 (Neutral)	5	6	7 (Expert)
How would you rate your expertise as an **online learner**?	○	○	○	○	○	○	○

7. People who register for these types of courses have different reasons for doing so. Select your **main reason** for signing up for this course.

- ○ I'm still at school. I'm thinking about biomedical imaging as a career.
- ○ I'm just curious about online learning.
- ○ To get learning opportunities not otherwise available to me.
- ○ To advance my career.
- ○ To earn a certificate.
- ○ To participate in an online community.
- ○ To continue learning throughout my life.
- ○ To better serve my community.
- ○ To advance my formal education.
- ○ Other - *please describe in a few words.*

8. How familiar are you with the course topic *Biomedical Imaging*?

- ○ Extremely familiar
- ○ Very familiar
- ○ Somewhat familiar
- ○ Slightly familiar
- ○ Not at all familiar

9. My experience of imaging is:

- ○ As a patient or relative of a patient
- ○ As a technologist, who has made imaging my career
- ○ As a health professional, who uses imaging
- ○ As a student, for whom imaging is part of the requirements of my course
- ○ As a television drama viewer
- ○ As a teacher on the look-out for new course material
- ○ Negligible. I just have a general interest in it.

10. How much do you intend to do in this course?

- ○ I am **not sure** how much I will do in the course.
- ○ I'll probably watch **some videos**, but that's all.
- ○ I'm planning to watch **all the lectures** but that's all.
- ○ I'm planning to watch **all the lectures** and I might do **some of the assessment tasks**.
- ○ I'm planning to do **everything** but I **don't care about getting the certificate.**
- ○ I'm planning to do **everything** so I can **get a certificate**.

Goals and Beliefs

The following questions relate to your learning goals and your self-beliefs relating to the MOOC you have enrolled in.

If you think the statement is VERY TRUE OF YOU, select 7; if a statement is NOT AT ALL TRUE OF YOU, select 1. If the statement is MORE OR LESS TRUE OF YOU, find the number between 1 and 7 that best describes you. Please answer the following questions as accurately as possible and keep in mind that there are no right or wrong answers.

	1 (Not at all true of me)	2	3	4 (Neutral)	5	6	7 (Very true of me)
11. I believe I will receive an excellent grade in this course.	○	○	○	○	○	○	○
12. I will try to understand the content of this course as thoroughly as possible.	○	○	○	○	○	○	○
13. I'm confident I can understand the most complex material presented by the instructor in this course.	○	○	○	○	○	○	○
14. I will try to avoid an incomplete understanding of the course material.	○	○	○	○	○	○	○
15. I'm certain I can master the skills being taught in this course.	○	○	○	○	○	○	○
16. I will try to do well compared to other students.	○	○	○	○	○	○	○
17. I'm confident I can understand the basic concepts taught in this course.	○	○	○	○	○	○	○
18. I expect to do well in this course.	○	○	○	○	○	○	○
19. My aim is to perform well relative to other students.	○	○	○	○	○	○	○
20.Considering the difficulty of this course, the teacher, and my skills, I think I will do well.	○	○	○	○	○	○	○

21. I'm confident I can do an excellent job on the assignments and tests in this course.	○	○	○	○	○	○	○
22. My goal is to avoid performing poorly compared to others.	○	○	○	○	○	○	○
23. My goal is to avoid learning less than it is possible to learn.	○	○	○	○	○	○	○
24. My aim is to avoid doing worse than other students.	○	○	○	○	○	○	○
25. My goal is to learn as much as possible.	○	○	○	○	○	○	○
26. My goal is to perform better than other students.	○	○	○	○	○	○	○
27. My aim is to completely master the material presented in this course.	○	○	○	○	○	○	○
28. I will try to avoid performing worse than others.	○	○	○	○	○	○	○
29. I'm certain I can understand the most difficult material presented in the readings for this course.	○	○	○	○	○	○	○
30. My aim is to avoid learning less than I possibly could.	○	○	○	○	○	○	○

Interest in Ongoing Study

Would you like to be the subject of an in-depth study into how people learn in MOOCs? From all the interested candidates, **ten (10)** will be selected to continue as **in-depth case studies**.

$100 Amazon Book Voucher

Participation in this research will help us understand how people learn in MOOCs. If you are selected, you will be sent the research findings in easy-to-read summaries which may provide you with valuable insights into how to study more effectively. Also, as way of acknowledging your valuable contribution to educational research, you will receive a **$100 Amazon book voucher**.

NOTE: Participation in this research will have absolutely NO impact on course achievement or records.

If you are selected, you will be required to:

- complete an online questionnaire on your attitudes to learning (less than 5 minutes)
- participate in three recorded interviews via Skype or equivalent (30, 45 & 20 minutes) which will be transcribed verbatim and sent to you for checking
- record your activities during the MOOC by completing an online learning journal (around 4 minutes per record).

If you are interested, please indicate below.

Would you be Interested in becoming the subject of an in-depth case study?

○ Yes

○ No

What is your first name?

What is your last name?

What is your preferred email? (So we can contact you if you are selected)

Skype will be used for interviews with selected participants. Are you willing and able to use Skype for this purpose?

- ○ Yes
- ○ No

Thank you for your contribution to the *Learning in MOOCs Research Study*!

<< >>

Appendix C: Recoding of Item 7: ‘Other Responses’

In Survey 1 respondents were asked to answer the following People who register for these types of courses have different reasons for doing so. Select your main reason for enrolling for this course. Respondents were provided with a list of nine response options and one Other option in which they could type in their reason. One hundred and ninety-six respondents typed in their own reason for enrolling. These ‘Other’ responses were then analysed and where appropriate added to the existing reasons for enrolling. Where the ‘Other’ responses that did not fit into existing categories of reasons, new reason categories were created. Following this process, 13 new reasons for enrolling were discovered, resulting in 22 distinct reasons for enrolling.

‘Other’ responses to existing reasons for enrolling

As can be seen in Table B1 below, 12 ‘Other’ responses were assigned to 6 existing reasons for enrolling.

Table B1

Assigning of Original Other Responses to Existing Reasons for Enrolling

Existing reason for enrolling (‘Other’ responses)
To advance my career. (2) 1. i would really want this to help me in my career,also to learn online for the first time...and being in the health care industry...as a novice i want to expand my opportunities. 2. Learning opportunities/advance carrier/Cont. learning throughout my life/to advance my formal education
To advance my formal education. (1) 1. Stay at home mum of 3 keen for some outside interest. Study of (I hope) reviewed information in an online world where anyone can write anything and who knows if it's well thought through or not or even factual!
To earn a certificate. (1) 1. also to earn certificate

To continue learning throughout my life. (3)

1. I am, by nature, curious and believe that gaining knowledge or education is a life long process. Online courses like these give me a easy access to information from experts in their chosen field of study along with the flexibility of learning from home/wok at anytime. What I also like about these courses s that the forum consists of people from different backgrounds as well as from across age groups - so there's a wealth of experience that the course community brings with itself and interaction is an adde bonus.
2. and also to keep on learning throughout life
3. To learn without time pressure and so on, in your own time
4. to gain knowledge

To get learning opportunities not otherwise available to me. (4)

1. We haven't time and money to get further education in this field so we search our problems alternatives.
2. In my country, medical imaging field is not developed at all but I would like to havea career in this field
3. am intrested in biology subjects. bt i didnt get oppurtunity to study after my marrage even i got 92% marks in plus 2
4. I want to continue learning throughout my life, and it is difficult to take regular classes with my job. I normally travel 2-5 days a week for my job which makes any regular classes almost impossible.

To better serve my community. (1)

1. Though my field is far away from medicine (I am a CS teacher) I am interested in this course cause I like medicine in general and I think it will really be useful in my life and that of my community.

‘Other’ responses to new reasons for enrolling

As can be seen in Table B2 below, 184 ‘Other’ responses were assigned to 13 new reasons for enrolling.

Table B2

Assigning of Original Other Responses to New Reasons for Enrolling

New reason for enrolling (‘Other’ response)
Thinking of a career change to this field. (19)
1. I'm trying to figure out the right career for me - medical imaging could be an option
2. Thinking of a career change to this area.
3. I'm thinking about biomedical imaging as a career and my research subject.
4. I was a college student in Biology but I didn't succeed so I'm trying to seek another career path
5. I'm not at school and thinking of a career in biomedical imaging
6. Career change to medical
7. I'm study medicine. I'm thinking about biomedical imaging as a career.
8. I am a professional but I am interested in biomedical imaging as a career
9. I am thinking about a career as bioinformatic
10. Relevant to GCSE and A level physics, which I teach, personal interest, possible change of career
11. I'm thinking about biomedical imaging as a career.
12. To investigate a new career option without leaving my job.
13. Planning to switch to biomedical engineering and using this as a middle step
14. Planning to move career to biomedical engineering
15. Not currently in school, but thinking about new career pathways.
16. I am working part-time and I am on a learning sabbatical to decide what to do next full-time.
17. Unemployed, looking at career options, medical interest
18. unemployed, looking at new career, and personal interest in topic from career-ending injury
19. Thinking about a career change.
Interest in course content or design. (6)
1. Curiosity on how it is organized
2. I am a biomedical imaging engineer/physicist by education. I am curious to see my subject from a different perspective.
3. As a Technical Medicine student, I would love to see the level of education at EdX.org
4. To find best practices for online learning

5. Evaluate EdX instructional material
6. i received my master's degree in biomedical engineering; was curious to see what this course included.

To support my work. (35)

1. to understand my current position better
2. I'm a dentist and I'm doing post-grad, so I think that in my career it's very import.
3. I am a Medical Physicist, so this subject is important to my work
4. The course is related with some aspects of my job
5. I joined a medical imaging company. Want to learn more about what we do.
6. this course will help me with my research studies
7. Because of my career
8. Research And Development!!
9. I work for a Medical device company that uses info from CT scans to create surgical tools.
10. My workplace is considering branching out into biomedical imaging applications (we already do work in image processing)
11. to improve knowledge of biomedical imaging which helps in career
12. i am a radiology technologist (CT&MRI)
13. to help myself with my research
14. it will be a good learning experience which will also help in my profession
15. Being a health database administrator I am interested to implement modern medical Imaging technologies in my city...
16. It would help me in my research in Cognitive Science
17. We are into new hospital set up
18. I am a nurse and I hope this course will help me better understand biomedical imaging
19. I want understand how NDT applied to pipelines' welding applies to biomedical imaging.
20. Because i'm working with technics of tomography and algorithms
21. I work as a service technician at medical industry
22. I'm planning the project concerns human brain abitities and I think that this couse will be useful for me.
23. I manage IT projects related to medical imaging
24. Content relevant to my professional role

25. Broaden my scope and learn aboutdifferent medical fields
26. Working on the medical imaging field; Also to keep learning throughout life.
27. i am trying to plan my methods for my research project which involves reading MRI's
28. To learn something relevant to my career
29. I work and a firm that produces CT syringes.
30. I work in a healthcare organization, supporting and administering the information systems including PACS. I come from IT background and I strongly believe this course will help me understand the clinical aspects of the imaging technology.
31. To possibly expand my research field to biomedical imaging
32. career enrichment
33. To increase my understanding of imaging in my current job.
34. To better understand imaging to help students who come to me as a medical librarian
35. for research application

Requirement for CPD (6)

1. Continuing Professional Development activity
2. CPD Points for my employment
3. To attain my yearly professional development points quota.
4. To attain the compulsory education hours to register as a nurse.
5. as part of my continued education required for my job
6. revision and cpd portfolio work

To support my formal learning (63)

1. at university, thinking of changing degrees
2. Final year medical student interested in a career in Radiology
3. I'm currently studying Medicine and need to review imaging modalities
4. To complement my current learning in medicine
5. To advance my formal education because I am studying master degree in MRI and looking forward to phd
6. I am a 1st year medical student at the University of Queensland, Australia
7. I have started a PhD in an area of Speech Pathology and I need to understand more about medical imaging for my project
8. learn imaging interpretation
9. I need that course for my diploma thesis.
10. To get additional information to topics I've learned or heard already.

11. update my knowledge about this topic
12. To help me in my master program.
13. I have a bachelor’s degree in Computer Science and I want to mix this formation with biomedical field
14. I'm interested in exercise's neuroscience and I want improve my knowledge
15. To support my formal education.
16. I am a medical student and I want to learn more to develop my career
17. Learning more about Biomedical Imaging. Understand and decifrate the biomedic images
18. I a veterinary studant and I whink this course will be really helpfull for me.
19. To improve my professional knowledge.
20. Currently at school, internship in high speed electronic for SPAD array used in CT/PET scan
21. i´m at university studying biomedical imaging and medical physics, and i want to complement mi education with the experience from other countries.
22. Im Studying that Career on my University
23. I'm a medical student. This course will help me enrich my medical knowledge.
24. estoy realizando mi especialidad en diagnostico por imagenes
25. It is complements to my academic master formation
26. To expand my knowledge on biomedical imaging
27. I like studying and some courses like this one is really great,informative,fun and helpful.I am also pursuing my medical career and this is going to help me.
28. to learn different imaging techniques available and possibly make a better technique to image many other factors that are not feasible now.
29. I have just finished graduation in Biomedical Engineering. I intend to strengthen my basics and learn deeper via this course
30. I am interested in doing research on medical image processing. I have worked on bio-medical signals (ECG's) . I feel that I need to have a good understanding of biomedical imaging before I delve into image processing.
31. I am currently a student in the paramedical field. I am interested in developing myself as a professional
32. currently i am pursuing BACHELOR OF SCIENCE,MEDICAL LABORATORY SCIENCE and i found relevant to my field.
33. I'm at medical school, so I take this course to enrich my knowledge.

34. I'm studying medicine and find this particular subject to be very interesting
35. We are not taught Biomedical Imaging at our medical school and this course can help me in the clinical diagnosis of diseases
36. To complement the information I have in order to clarify the practical use of imaging.
37. to better learn things I study at my university
38. I have a subject "Medical Imaging" at my University. I want to know more and understand better things that the Teacher is telling us during the lectures.
39. as a medical student I'm interested in the subject
40. medical school
41. To learn more about a subject which I am somewhat familiar with from a physics (the scientific area) perspective.
42. Being a medical student, I was not satisfied with my Radiology class. Therefore, I want to go deeper
43. I am considering radiology as a specialty once I recieve my MD degree
44. I have a B.sc in medical physics and Biomed.Imaging is an important part of MPh
45. I'm interested in getting to know more about medical imaging since it might help me in my career.
46. To supplement what i have learned in my degree in Biomedical Engineering
47. i'm still at school. i'm a biomedical student on University
48. I am studying a similar module at university this semester. The edX course will serve as a supplement and revision aid.
49. Add a unit in my master degree
50. Review knowledge
51. Prepare myself for a career in the medical field
52. To expand my scientific knowledge
53. Furthering my neurosurgical dream.
54. To stay on top of my knowledge.. this will most likely be more of a refresher.
55. I'm a microscopist and I'd like insight into other imaging techniques
56. I'm still in school. But I like to learn all different parts of the medical field.
57. To better understand my Undergraduate Research Opportunity Program
58. I will be a Dr in the near future.
59. I am an Imaging RN and looking to have a greater understanding to Imaging.
60. Current imaging student
61. To able to read imaging studies well which will help me a lot in my medical speciality

62. i'm a student, majoring in biomedical engineering
63. I will become an bio-medical engineer in the future, so this course is beneficial for my major.

To support future studies (12)

1. I would love to study neuroscience next year and know that this course would be invaluable
2. I intend use this knowledge in my master degree course
3. Getting into medicing and thinking about specialising in Radiology
4. Im specializing in biomedical engineering , I will be starting next year although I don't know much about that field .. so I got interested in the course topic
5. to prepare myself for a distance education degree and / or another study program;
6. I would like to use biomedical imaging in my future studies
7. I hope to study medicine; this course will be relevant if I do.
8. iwant to major in biomedical imaging/ radiology
9. Interested in medicine, wants to become a doctor.
10. I'm a pre-medical student who wants info on these fields
11. I will be going to medical school
12. Study naturopathic medicine, this is another method of learning while waiting for acceptance to school.

Relates to my PhD research (6)

1. To improve my thesis.
2. I am PhD student and working on Digital Pathology that uses digital images
3. this course is useful for my PhD in neuropsychology
4. I m working on a doctoral thesis related to biomedical imaging.
5. I make my doctoral thesis in the field of biomedical imaging and I'm thinking about a career in this field.
6. medical images processing is part of my PhD studies. maybe i learn something interesting ?

To help understand personal health issues (6)

1. As a cancer survivor (hopefully) I am interested in better understanding what is going on with my medical treatment
2. to better understand the Biomedical Imaging,maybe help for my healthy
3. To try and understand my undiagnosed neurological problem

4. To better understand biomedical imaging as a patient of a neuro-degenerative disease
5. to understand results of my own scans
6. Since developing Complex Regional Pain Syndrome, I find it beneficial to be better educated in the field of medicine.

Interest in topic (23)

1. interested in interesting things
2. Curiosity
3. I'm just curious about biomedical imaging.
4. Interest in the topic.
5. i want to see some of practical applications
6. I find this field pretty interesting.
7. I am desperate to learn in depth about biomedical imaging
8. To get an idea how medical imaging techniques work
9. I find the field of Imaging Science pretty interesting.
10. To get knowledge of respective subject
11. To learn more about medical imaging.
12. I am an ardent lover of clinical medicine and Neurology . radiology is so vital for understanding brain anatomy in disease
13. curious abt imaging
14. To learn something more about the course contents.
15. I'm just curious about biomedical imaging.
16. Interest in the subject matter
17. To learn more about this subject
18. interest in image processing
19. i am interested in the technology
20. Interest
21. I want to understand better the different types and uses of biomedical imaging.
22. Learn more about different biomedical imaging techniques
23. my daughter is a Radiologist. I am a Retired Dermatologist _ I need info.!

To improve my English (4)

1. In order to improve my English skills and I am still graduated in Technology in Radiology.
2. to improve my English skills as well as learning about good topics in that way

3. learning English
4. to immprove my english skills in medicine

For fun (1)

1. For fun

To help teach others (2)

1. To teach my students
2. Fulbright acholar helping Other students

To surprise others (1)

1. To surprise my parents

Appendix D: Research Information Sheet

MACQUARIE UNIVERSITY

FACULTY OF HUMAN SCIENCES
Department of Education

MACQUARIE UNIVERSITY NSW 2109 AUSTRALIA

WHAT'S IT LIKE TO LEARN IN A MOOC?

A research study on how people learn in massive open online courses

What is this research about?
The *Learning in MOOCs* research study investigates how people learn in massive open online courses (MOOCs) – like the *Biomedical Imaging* course you've enrolled in. Insight into what people actually do in MOOCs will contribute much needed knowledge about how these online courses can be improved. Far from being a quest to discover the 'right' way to learn in a MOOC, this study is interested in the full range of experiences that typical people have in MOOCs.

Who is conducting it?
The study is being conducted by Adrian Norman, PhD candidate at Macquarie University, Sydney, Australia under the supervision of Professor Lori Lockyer (Macquarie University) and Associate Professor Susan Bennett (University of Wollongong).

What do the case study participants have to do?
If you consent to participate you will need to:

- Complete an online questionnaire on your attitudes to learning (4 minutes)
- Participate in three recorded interviews, which will be transcribed verbatim and sent to you for checking. These interviews will take place:
  - At the commencement of the course (30 minutes)
  - At the completion of the course (45 minutes)
  - Three months after completion of the course (20 minutes)
- Record your activities during the MOOC by completing an online learning journal (around 4 minutes per record).

NOTE: All case study subjects will receive a $100 USD Amazon book voucher for participating in this research.

How do I give my consent?
If you are sure you can commit yourself to this research please complete the online consent form that will be sent to you in a separate email.

ETHICS OF THIS RESEARCH: The ethical aspects of this study have been approved by the *Macquarie University Human Research Ethics Committee*. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the *Director, Research Ethics* (telephone +61 2 9850 7854; email: ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

If you have any questions please contact:
adrian.norman@students.mq.edu.au

SCIENCE OF LEARNING RESEARCH CENTRE

Macquarie University: Learning in MOOCs Research Study Information Sheet

Appendix E: Participant Consent Form

MACQUARIE UNIVERSITY
SYDNEY ~ AUSTRALIA

FACULTY OF HUMAN SCIENCES

LEARNING IN MOOCS

Please read the following statement carefully and indicate below if you consent to participate in this research.

Personal Statement

I have received the ***Learning in MOOCs*** email with the ***Information Sheet*** attached. I have read and understood the ***Information Sheet*** and any questions I have needed to ask have been answered to my satisfaction. I understand that data collected will be used for research purposes only and all research participants will remain anonymous. I understand that I can withdraw from this research at any time without giving a reason and without consequence other than being then ineligible for the $100 Amazon book voucher.

Ethics of this Research

The ethical aspects of this study have been approved by the *Macquarie University Human Research Ethics Committee*. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the *Director, Research Ethics* (telephone +61 2 9850 7854; email: ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

Please type your first name

Please type your last name

Consent to Participate in Research

Indicate below if you **agree** to participate in this research.

I consent to participate in this research.

- ○ I **agree** to participate.
- ○ I do **not agree** to participate.

Appendix F: Survey 2

MACQUARIE UNIVERSITY
SYDNEY ~ AUSTRALIA

FACULTY OF HUMAN SCIENCES

Attitudes to Learning

Hello , thank you for taking part in the *Learning in MOOCs Research Study*. The following questions relate to your attitudes to learning. It contains 29 questions and should take around 5 minutes to complete.

If you think the statement is **VERY TRUE OF YOU**, select **7**; if a statement is **NOT AT ALL TRUE OF YOU**, select **1**. If the statement is **MORE OR LESS TRUE OF YOU**, find the number between **1** and **7** that best describes you. Keep in mind that there are **no** right or wrong answers but answer the questions as accurately as possible.

	(Not at all true of me) 1	2	3	(Neutral) 4	5	6	(Very true of me) 7
1. I feel my heart beating fast when I take an exam.	○	○	○	○	○	○	○
2. I have a regular place set aside for studying.	○	○	○	○	○	○	○
3. I often find that I have been reading for class but don't know what it was all about.	○	○	○	○	○	○	○
4. During class time I often miss important points because I'm thinking of other things.	○	○	○	○	○	○	○
5. When I take tests I think of the consequences of failing.	○	○	○	○	○	○	○
6. I try to change the way I study in order to fit the course requirements and instructor's teaching style.	○	○	○	○	○	○	○
7. In the courses I have taken, I attended classes regularly.	○	○	○	○	○	○	○
8 When studying for a course I try to determine which concepts I don't understand well.	○	○	○	○	○	○	○
9. Before I study new course material thoroughly, I often skim it to see how it is organised.	○	○	○	○	○	○	○
10. If course materials are difficult to understand, I change the way I read the material.	○	○	○	○	○	○	○

11 When I study for a class, I set goals for myself in order to direct my activities in each study period.	○	○	○	○	○	○	○
12 I have an uneasy, upset feeling when I take an exam.	○	○	○	○	○	○	○
13. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.	○	○	○	○	○	○	○
14. When I take a test I think about items on other parts of the test I can't answer.	○	○	○	○	○	○	○
15. If I get confused taking notes in class, I make sure I sort it out afterwards.	○	○	○	○	○	○	○
16. When reading for classes, I make up questions to help focus my reading.	○	○	○	○	○	○	○
17. When course work is difficult, I give up or only study the easy parts.	○	○	○	○	○	○	○
18. I ask myself questions to make sure I understand the material I have been studying in the courses I have taken in the past.	○	○	○	○	○	○	○
19. When I become confused about something I'm reading for a class, I go back and try to figure it out.	○	○	○	○	○	○	○
20. When I take a test I think about how poorly I am doing compared with other students.	○	○	○	○	○	○	○
21. I made sure I kept up with the weekly readings and assignments for courses I have taken in the past.	○	○	○	○	○	○	○
22. I rarely find time to review my notes or readings before an exam.	○	○	○	○	○	○	○
23. In the past, I made good use of my study time for courses.	○	○	○	○	○	○	○
24. In the courses I have taken, I attended classes regularly.	○	○	○	○	○	○	○
25. I usually study in a place where I can, concentrate on my course work.	○	○	○	○	○	○	○
26. I find it hard to stick to a study schedule.	○	○	○	○	○	○	○
27. I often feel so lazy or bored when I study for a class that I quit before I finish what I planned to do.	○	○	○	○	○	○	○
28. I work hard to do well in a class even if I don't like what we are doing.	○	○	○	○	○	○	○
29. Even when course materials are dull and uninteresting, I manage to keep working until I finish.	○	○	○	○	○	○	○

Thank you for your contribution to the *Learning in MOOCs Research Study*!

>>

Appendix G: Interview 1 Guide

Interview 1 Guide

Semi-Structured Interview Protocol

NOTE. PRESS RECORD TO START THE INTERVIEW

REMIND INTERVIEWEE THAT THEY ARE BEING RECORDED

Introduction to the research study

1. Remind participant that the interview will be recorded and how long it will take.
2. Aims of the interview:
    a. Find out about you (as a learner/your life goals)
    b. Explain about the main part of the study – the Learning Journal

About me and this research

Introduce myself and explain what the research is about

About you – Tell me about you

1. Age
2. Work or student status – current activity
3. Educational background

Lifelong learning goals

1. Why have you signed up for this course?
2. Is it important for you that you get the certificate for this course? Why?

Online learning/MOOC experience

1. Tell me about your experience of studying online?

1

2. Have you done any MOOCs before? What were they? How did you study for those courses?
3. Tell me about how you approach studying in online courses?
4. Tell me what you've done so far in the Biomed course? How would you describe this course?
5. How will you approach study in this course?
6. Do you see any challenges with this course?
7. How do you think you deal with them?

Self-Awareness

1. What are you good at when you study?
2. What do you find difficult when you study?
3. How do you deal with these difficulties?

Time and environment

1. For this course, do you have any plan for when you are going to study? Number of sessions a week? What time of day?
2. For this course, do you have any plan for where you are going to study?

Planning, monitoring and regulating at task level

1. Do you have a particular method of study when you watch video lectures?
2. Do you have a particular method for reading in a course?
3. How do you normally prepare for exams?
4. How do you approach doing assignments?
5. If you are reading something and you don't understand something, what would you normally do?

Effort regulation

1. Do you think you will find this course interesting? If some things are boring, what do you think you will do?
2. If some bits of the course are difficult, what do you think you will do?
3. If you don't feel like studying, do you have any strategies to deal with that?

Anything else

Is there anything else you would like to tell me?

Learning journal explanation

1. Preferred time to receive daily email
2. Only fill out on days of activity
3. **Need mobile number for text reminders!**

Conclusion of interview

1. No pressure to complete the course even though you are in this research
2. $100 USD Amazon book voucher only for people who **remain** in the research, in other words do all the interviews and the LJ on days of participation
3. Post-MOOC interview at course completion
4. FINAL interview 3 months after Post-MOOC

Appendix H: Learning Journal Form

MACQUARIE UNIVERSITY
SYDNEY ~ AUSTRALIA

FACULTY OF HUMAN SCIENCES

's Learning Journal - Week X Day X

Hello ! What did you do today in your course? Please answer the following questions.

1. How many separate study sessions did you do today? *(if you take a break from study for half an hour or more, regard these as separate study sessions. Insert a number in the box below, e.g. 2)*

2. In total, approximately how long did you study today? *(insert the number of hours below; e.g. 0.5 = 30 minutes; 1 = 60 minutes; 1.25 = 75 minutes; etc.)*

3. When did this / these study session(s) take place? *(tick all that apply)*

- [ ] Dawn: 5:00 - 8:00am
- [ ] Morning: 8:00am-12:00pm
- [ ] Afternoon: 12:00 - 5:00pm
- [ ] Evening: 5:00 - 11:00pm
- [ ] Late night: 11:00pm - 2:00am
- [ ] All night: 2:00 - 5:00am

4. Where did you study today? *(tick all that apply)*

- [ ] At home in a private room
- [ ] At home in a room shared with others
- [ ] At my workplace
- [ ] At my school/university/place of learning
- [ ] On public transport
- [ ] In a public place (e.g. library, cafe, train station, etc.)
- [ ] Other - *(please describe in a few words)*

5. What did you do today in the course? *(tick all that apply)*

- [ ] Watched some course videos
- [ ] Read some course readings
- [ ] Did a quiz.
- [ ] Worked on an assignment
- [ ] Submitted an assignment.
- [ ] Assessed others' assignments.
- [ ] Other - *(please describe in a few words)*

6. What strategies did you use today for learning? *(Tick all that apply. If you did NOT use any strategies at all for learning today, select the LAST option.)*

- [ ] I changed my immediate environment I was in so I could better study.
- [ ] I set myself some goals.
- [ ] I rewarded myself for reaching self-set targets (e.g. with a coffee, a break, watching TV, etc.) .
- [ ] I interacted with course content to help me learn (e.g. drew diagrams, highlighted readings, made notes, etc.) .
- [ ] I revised my previous notes, readings and lectures.
- [ ] I searched the forums for specific information.
- [ ] I posted to a forum.
- [ ] I made a plan or outline for an assignment.
- [ ] I asked someone I know for help (e.g. face-to-face, email, social media, etc.).
- [ ] Other *(please describe in a few words)*
- [ ] I did NOT use any strategies today for learning.

7. Did you experience any of the following difficulties or problems today with study? *(Tick all that apply. If you did NOT experience any problems at all, select the LAST option.)*

- [ ] A lack of motivation to study
- [ ] A feeling that the course is too difficult
- [ ] A distracting **online** environment (e.g. Facebook, Twitter, YouTube, email, etc.)
- [ ] A distracting **physical** environment (e.g. people, mobile phone(s), TV, etc.)
- [ ] A feeling of being bored with the course
- [ ] A lack of time to study
- [ ] Other *(please describe in a few words)*
- [ ] I did NOT experience any difficulties with studying today.

8. How did you deal with these difficulties today?

9. How confident are you feeling at the moment in successfully completing this course?

(Not at all confident)			(Neutral)			(Totally confident)
1	2	3	4	5	6	7
○	○	○	○	○	○	○

<< >>

Appendix I: Learning Journal Summary

Mariam - Summary									
Week	Day	Location/s	Duration mins (Sessions)	When	Activities	Strategies	Difficulties	Response	Confidence in completing
1	?	?	?	?	?	?	?	?	?
2	Friday	INTERVIEW							
	Friday	Home-private	90 (2)	M, Aft	Video, read, quiz	Cont Int.	Phys Env, New different accent	I depended much on transcripts.	7
	Saturday	Home-private, shared	90(3)	M, Aft,Eve	Video, read, quiz, sub assessment	Goals, Cont Int., Env Reg, Revision	Phys Env, Online Env,	I took a long break to deal with distracters and then restarted.	7
	Sunday	Home-private	30 (1)	Late	Reading, WorkAss	Forum search	None		7
3	Monday	Home-private	30 (1)	Late	Video, read, quiz	None	Course too difficult	I did nothing, but planned to rewatch the videos and search the forum.	6
	Tuesday	Home-shared	75 (2)	Eve	Video	Goals, Cont Int.	Phys Env, Time	NULL	NULL
	Friday	Home-shared	180 (4)	M, Aft ,Eve	Video, read, quiz, sub assessment	Goals, Cont Int., Forum info search	Phys Env, Online Env	Regarding online distractors: I interacted with only important e-mails and tried to ignore notifications from social media . However, I was not 100% successful. / Regarding physical distractors: the only thing I could do is take 5-10 minutes breaks so as to respond to who called me.	7
6	Monday	Home-shared, Uni	480 (5)	Aft, Eve, Late	Video, read, assign, quiz	Goals, Cont Int, Assess Plan	Phys Env, Onl Env, Time, 'slow internet connection'	Slow internet that I had at university: I stopped and resumed again from home. / Online and physical distractors: I replied to only important things, but some times I was taken from the course!! / Lack of time: I passed fast through a relatively easy material.	7
	Tuesday	Home-shared	400 (4)	M, Aft, Eve, Late	Video, Read, Ass, Quiz, Submit Assess - 'I submitted assignment of two episodes.'	Goals, Cont Int, Rewards, Assess Plan	PhysEnv, Motivation, Difficulty,	I skipped areas which I couldn't understand.	7
8	Saturday	Home-shared	20 (1)	Morn	Video, "I scanned the episode"	NONE	NONE		7
10	Friday	Home-private, shared	210 (1)	Morn, Eve	Video, Read, Assess, Quiz	Goals, Rewards, Assess Plan	Time	I strictly schedule my activities of today.	7
	Saturday	Home-shared	180 (2)	Aft	Video, Read, Assess, Quiz, Submit Assess	Rewards	NONE		7
	Sunday	Finish							
		Total Days	11 days of activity		Total Time	29 hours 45 mins			

Appendix J: Interview 2 Guide

Greeting and overview

4. *Greeting: "Hello……it's great to see you again! Thanks for completing the Learning Journal pages. I've gone through your entries and tried to detect your learning patterns and habitual strategies and I'd like to talk to you about them today"*

5. *Explain purpose of today's interview and advise length (45 minutes)*

6. *Remind participant the interview is being recorded*

Interview 1 follow up

Follow up questions to Interview 1 also enquire about family, schooling, role models, etc.

MOOC outcome

How did you go? Was it what you expected? Did you get what you wanted?

Learning journal investigation

1. *Ask participant to explain or describe what happened at specific times in the MOOC.*

2. *Why did you do that? Was it effective? Follow up questions as necessary.*

Finish up

1. *Remind participant of final interview in three months*

2. *Remind participant of $100 Amazon gift card for their contribution – delivered after Interview 3.*

Appendix K: Interview 3 Guide

Greeting and overview

1. *Greeting: Great to see you after all this time!"*

7. *Remind interviewee that interview will be recorded and take around 15 minutes.*

8. *Catch up "What have you been doing since I last saw you?", "In the last interview you said you were planning to do X, how is that going?"*

Reflection on MOOC experience

1. *Looking back on the MOOC, did you get what you wanted from it?*

2. *If you could do it again, what would you do differently?*

3. *If someone you knew was planning to do a MOOC, what advice would you give them?*

Life goals

1. *What do you see yourself doing in three years?*

2. *What do you want to achieve in your career?*

Thank you, wrap up and look forward

1. *Thank participant for contribution*

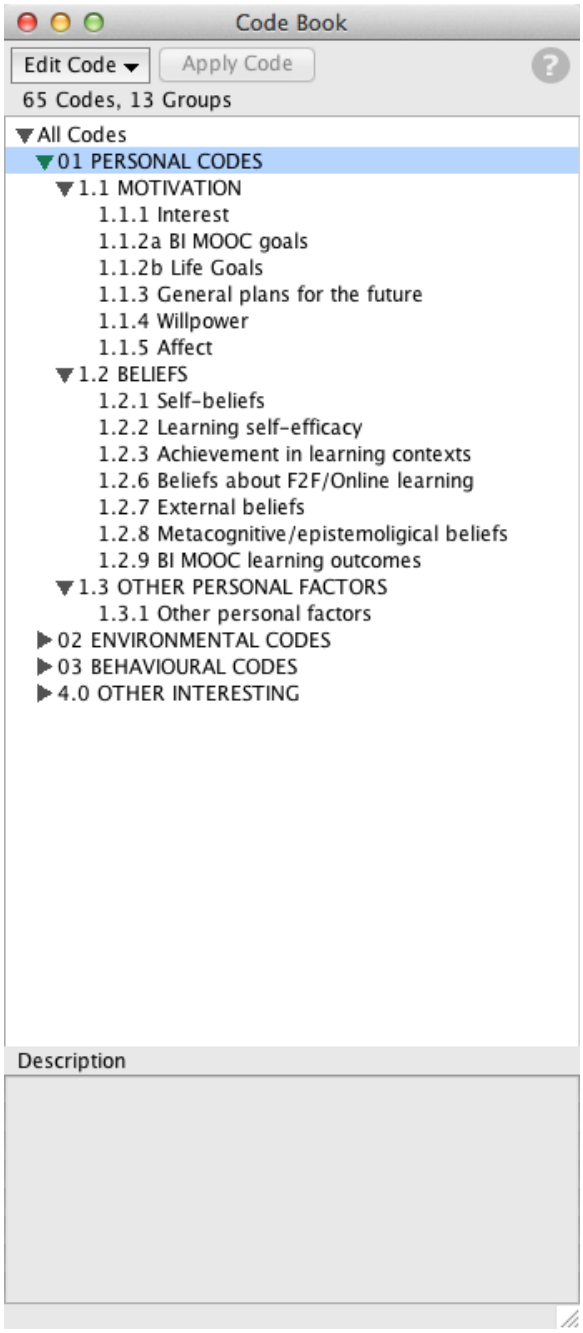
2. *Check email details for delivery of Amazon gift card*

9. *Remind participant that research findings will be shared with them*

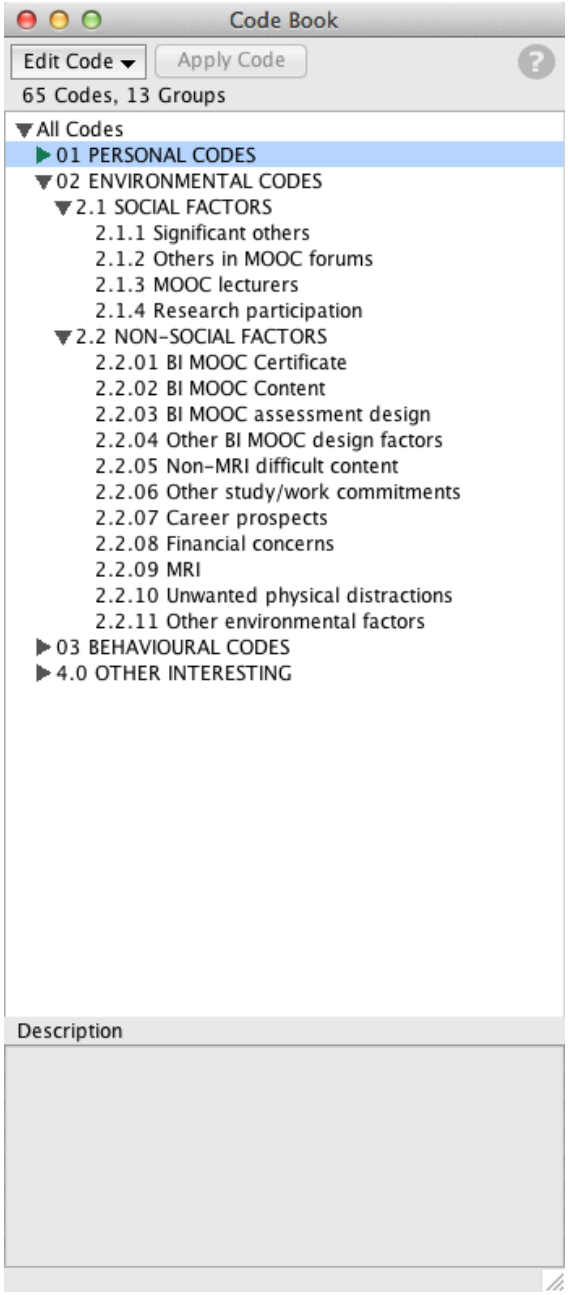
10. *Sign off: "Good luck for the future!"*

Appendix L: HyperRESEARCH Code Book

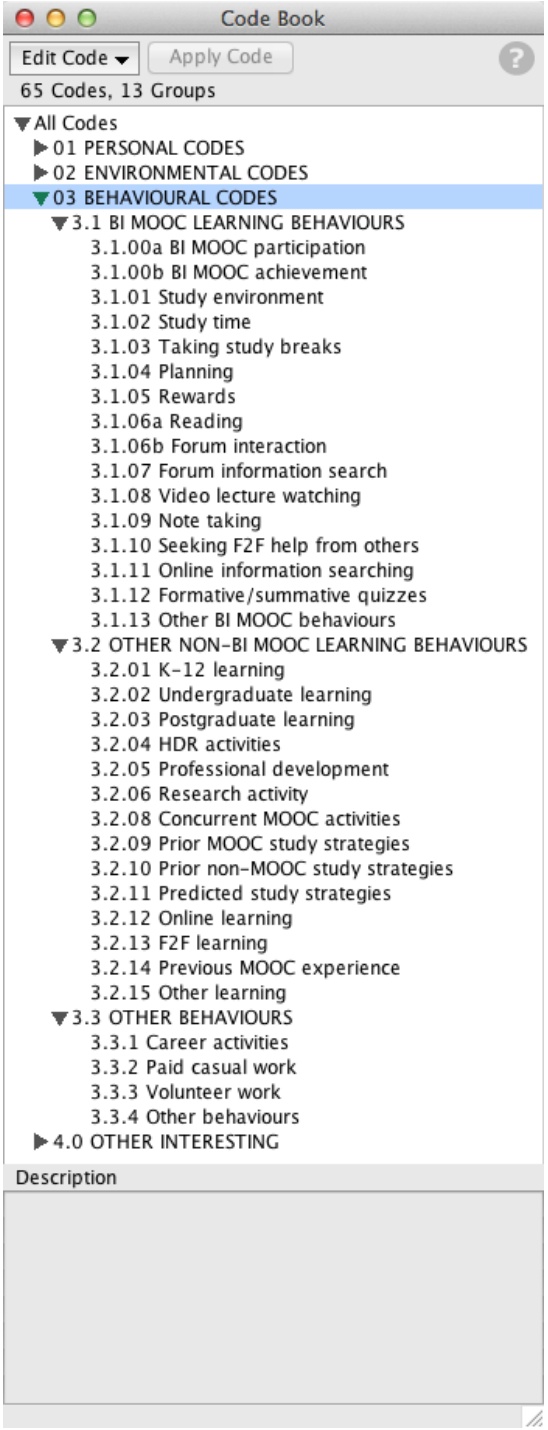
Code book top level.



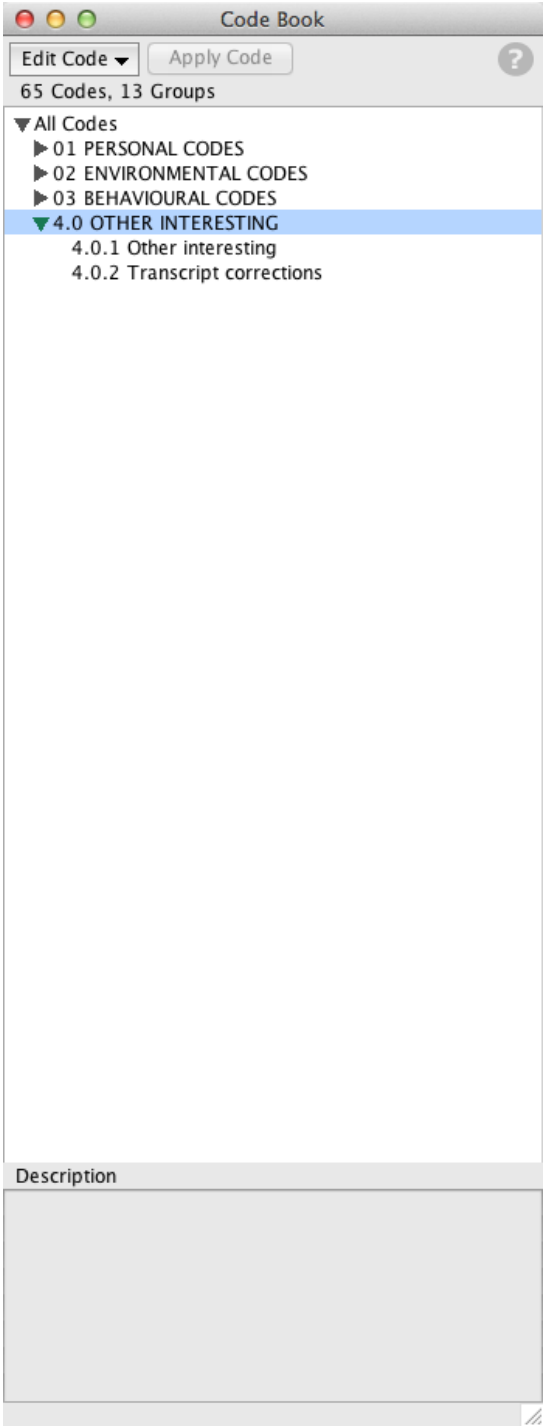
Personal codes



Environmental codes



Behavioural codes


Code Book
Edit Code
Apply Code
65 Codes, 13 Groups
All Codes
01 PERSONAL CODES
02 ENVIRONMENTAL CODES
03 BEHAVIOURAL CODES
4.0 OTHER INTERESTING
4.0.1 Other interesting
4.0.2 Transcript corrections
Description

Other codes

Appendix M: Coding Framework

The coding framework consisted of (1) personal codes, (2) environmental codes and (3) behavioural codes.

1. Personal Codes

Personal codes describe internal influences on an individual, such as mental activities and states as well as biological factors. These codes are divided into three categories: (1) **motivation factors** pertaining to internal mental states or processes that generate activities towards a set goal that is related to learning; (2) **belief factors** pertaining to propositions held or taken by the individual about the self or the world with or without empirical evidence and (3) **other personal** factors, a category for all personal factors that do not fit into the first two categories.

1.1 Motivation factors

ID	Code	Definition	Examples
1.1.1	Interest	The feeling of wanting to know or learn about something or someone. In the area of learning an individual may have a main interest, which may relate to their current or prospective career or some other aspect of their life.	"take the first week and see if the material that is covered is something that they're actually interested" (Anna, Final); "we're all interested in, just in the knowledge of this courses, that's like that's enough for us…" (Federico, Final); "Usually I'm not interested in all the course; usually I'm interested in only some parts of the course" (Walter, Final); "I would like to dedicate my life to research because it's the thing I like the most." (Antonio, Final)

ID	Code	Definition	Examples
1.1.2	Life goals	A specific desired result or target brought about by an individual's ambition or effort, this may relate to any aspect of an individual's life such as a MOOC, career, and other life goals. These are big life changing goals. Targets.	"So that's just not going to happen with me. I won't spend five years of my life or six years of my life and end up not getting a degree. That's just not possible." (Arjun, Final Interview); "I will try to apply for a scholarship to go to Denmark three months." "...for the next three years would be getting my residency here, taking… well, first of all taking all my steps for the USMLE and then apply for my residency programs." (Federico. Final)
1.1.3	BI MOOC goals	Self-set goals or deadlines within the BI MOOC.	" As I remember I was late for the deadline that I set for myself." (Mariam, Post); "Yes, my primary goal in each every case was to finish the assignment," (Arjun, Post); "...so that was the day when I decided I would finish everything that I had left to do in the course" (Anna, Final): "So I selected video from this section and after I finish it, I'm finished with my revision." (Federico. Post); "So, the reason why I subscribed myself for this course, it's because I don't want to… okay I finish my PhD, I'm (0:05:21.1) right now but I don't want to be too far away from the step of learning." (Walter, Pre)
1.1.4	General plans for the future	A feeling or idea, or intention, perhaps not yet thought through or executed, of wanting to do something in the future. Strategies to achieve goals.	"Well, I had a plan. I had talked to the course director but the admission office did not agree." (Layla, Final); "I previously mentioned that I was planning to apply for a Master's program and in the summer periods I did and I got accepted from several places" (Huseyin, Final); "It's something I always had

ID	Code	Definition	Examples
			an interest in and maybe I'm going to go into that field later on. " (Pablo, Pre); "I will try to apply for a scholarship to go to Denmark three months." (Monica, Final)
1.1.5	Willpower	Anything related to an individual's abilit–or failure– to overcome, short-term temptations OR mental/emotional/physiological states in order to achieve a future self-relevant goal.	"Yes, just do it because I think that my education…" (Monica, Pre); "I'm very committed and I concentrate well during lectures. " (Mariam, Pre); " hear the "bing" but I keep on doing what I'm doing." (Layla, Pre); "you have to spend some time, watch some videos and do some stuff and it makes me happy to learn some extra stuff but also it seems that you have to make some dedication, spend some time...."(Huseyin, Final)
1.1.6	Affect	Relates to emotional states, such as pride, satisfaction, disappointment, anxiety, etc.	"I only get nervous with two exams in my life. " (Monica, Post); "I was a little surprised, a little dumbfounded by that. Yes, it was great. I had a smile." (Pablo, Final); "Sometimes, especially in university, you're required to find ways to force yourself to study because you don't always have enough time or a place to study or a perfect environment; you have things around you that may or may not distract you in some ways. That's why I need to feel inspired." (Anna, Post)
1.1.3	BI MOOC goals	Self-set goals or deadlines within the BI MOOC.	" As I remember I was late for the deadline that I set for myself." (Mariam, Post); "Yes, my primary goal in each every case was to finish the assignment," (Arjun, Post); "...so that was the day when I decided I would finish everything that I had left to do in the course" (Anna, Final): "So I selected video

ID	Code	Definition	Examples
			from this section and after I finish it, I'm finished with my revision." (Federico. Post); "So, the reason why I subscribed myself for this course, it's because I don't want to… okay I finish my PhD, I'm (0:05:21.1) right now but I don't want to be too far away from the step of learning." (Fab. P, Pre)

1.2 Belief factors

ID	Code	Definition	Examples
1.2.1	Self beliefs	Propositions about the self, be they considered or instantaneous, taken by an individuals regarding own abilities, habits, strengths, weaknesses, performances etc. with or without empirical evidence to support them. Note: These self-beliefs do NOT relate to learning.	"I didn't think at this point in my life I'd be starting over but some people have done it much later so not a problem I guess." (Huseyin, Final Interview); "When I have determined something, I generally do it, always. Always." (Arjun, Final Interview); "...when I learn algebra I'm not very confident because I know that some basics I don't have them" (Monica, Final Interview); "Well, I always had a feeling that I just liked helping people." (Pablo, Final);" I think I have a creativity in me which I feel the need to express" (Anna, Final)
1.2.2	Learning self-efficacy	Beliefs about an individual's capability to achieve a certain goal or perform to a certain standard. Also includes accounts of mastery experiences or of excelling in a learning context.	"since I'm from an electrical engineering background I do not have much information about biomedical but, you know, things make sense so I just either understand them or figure that I already know or imagine what things were" (Huseyin, Pre); "You know, I think I was always a good student" (Monica, Pre); "Yes I am [a good student]" (Layla, Pre)

ID	Code	Definition	Examples
1.2.3	Achievement in learning contexts	An individual's orientation to what is valued in a learning context: broadly speaking either an orientation to mastering the knowledge (mastery orientation) OR getting top marks and doing better than others (performance orientation).	"my competitive nature kicks in and it's like "Okay, I need to up my game" (Arjun, Pre); "Well I like to score well or to perform well depending on the thing I'm doing. I don't know, I like competition." (Anna, Post); "In that time I didn't care about these things; it's not a competition for me." (Walter Post)
1.2.4	Beliefs about F2F/online learning	Beliefs about either online or face-to-face learning including comparisons of the two modalities.	
1.2.7	External beliefs	Propositions about the world outside the self, be they considered or instantaneous, held or taken by an individual regarding other people, things, events and phenomena with or without empirical evidence to support them. This code also includes beliefs about others.	"medicine is more straight-forward and conservative in some ways…" (Anna, Final Interview); "[on MRI section] No, no, it was much higher than in high school so they started with supposing that you had a basis of electromagnetic fields" (Antonio, Post); "This is an Australian University called the Australian National University. It's a good university." (Antonio, Post); "Mostly medicine is about common sense" (Dip, Pre); "I was pretty much born into the public education system which unfortunately has as many problems...so I pretty much had to teach myself many subjects" (Pablo, Pre)
1.2.8	Metacognitive and epistemological beliefs	Beliefs about thinking and learning, knowledge creation.	" I don't know, but I think I could not imagine how things work in magnetics field. I think there is an imaginary part of it that we cannot sense." (Mariam, Post); " if I have a topic, I need to know what I need to learn from the topic, I make my

ID	Code	Definition	Examples
			notes based on that so a bit systematic to my study approach." (Layla, Pre); "I try to make connections and link different things that I learn so I can easily remember something by connecting it with something else." (Anna, Pre)
1.2.9	BI MOOC learning outcomes	Relates to what the individual perceives that they learnt from the BI MOOC.This also includes perceived learning from discrete parts of the course, such as the forums.	"No. [I didn't learn anything from the forums] No because I think there were a lot of technicians, medical technicians in the course so they had their own vocabulary and I don't understand it. " was able to understand everything and even I made some questions of the kind of contrast they used and all that so it's been very, very useful for me and it's been very, very good. I really enjoyed." (Antonio, Post): "So, now that I know how it works and how the measures are being taken and what can be done to make it better or worse, I can actually participate and impart ideas into the discussion." (Dip, Post)

1.3 Other personal factors

ID	Code	Definition	Examples
1.3.1	Other personal factors	Any other personal–such as biological or emotional factor–that is related to learning.	" I feel more that I have more energy during the night; when things comes later I start to be more awake I would say. (Walter, Final); "I feel like in most of the classes I already know the subject" (Huseyin, Final Interview); "I'm very activity in terms of political as well and I love to get in touch with political discussions and maybe sometimes this is a kind of problem that I

			faced because of my personal point of view in terms of this political" (Walter, Final)

2. Environmental Codes

Environmental codes are divided into two categories: (1) **social factors**, pertaining to the influence of other people on the individual, and (2) **non-social factors**, pertaining to influences emanating from the BI MOOC or MOOCs in general and from other non-social environmental sources.

2.1 Social factors

ID	Code	Definition	Examples
2.1.1	Significant others	Relates to people who are important in some way to an individual's life in the past or present: family, role model, colleagues, teachers, etc	"The only thing I would do different is to before the course I would encourage and invite some other friends to take the course so we could discuss from person to person content of the course."(Federico., Final);
2.1.2	Others in MOOC forums	Relates to an individual's perception of the presence of others as well as the interactions of others, in the form of posts, in MOOC forums. NOT about what the individual does in a forum.	"…I can see a lot of like… 70 messages and I say “Oh this is awful”. (Antonio, Post);
2.1.3	MOOC lecturers	Anything related to the perception of lecturers in MOOC video lectures.	"I wasn’t really getting that much energy from them. It was just like they’re in a video and they’re just lecturing. It wasn’t being exciting. They were just reading from a script but it wasn’t really nothing special." (Pablo, Post)

2.1.4	Research participation	Relates to role and responsibilities, felt or otherwise, of being a research participant	"I just studied the course and then I went to the email and I filled in the form but I wanted to be as truthful as possible. I didn't feel influenced about that." (Alejandro, Post): "Okay, so the emails evoked a sense of guilt in me every time I saw them. " (DB, Post)

2.2 Non-social factors

ID	Code	Definition	Examples
2.2.1	BI MOOC certificate	Relates to the earning of the certificate in the BI MOOC	"I was looking for to do it but then I think it was in the third week and they removed the option…" (FH, Post); "in the country where I live, in Spain, it's all about papers" (MC, Pre);
2.2.2	BI MOOC content	Relates toindividual's perceptions of quality, difficulty or other characteristics of BI MOOC content.	"I noticed that it was harder but not very very hard for me." (Mihaela, Post); "x-rays, it was completely a surprise for me." (FP, post)
2.2.3	MOOC assessment design	Any feature of the assessment design that influences learning: deadlines, feedback, focus, etc.	"I don't really like the pure assignment-based courses so I guess you can say that it did influence me" (MC, Post); "Yes but I did it in order. After I finished every section content, I did my quiz." (FH, Post)
2.2.4	Other MOOC design factors	Any other physical characteristic or affordance of a MOOC in particular, (including the BI MOOC) or MOOCs in general that influences learning. This code includes the feedback delivered to the	"I think this is one of the disadvantages for me for a MOOC – that there are a lot, a lot, a lot of people and there are so many people that perhaps I think that it's very, very impersonal" (Alejandro, Final); "I expected that I would be able to well,

		individual in the form of assessment or quiz results.	read the images in a very good way but I did not catch that from the course." (Omayma, Final)
2.2.5	Non-MRI difficulties	Relates to MOOC content that the individual finds difficult to understand.	"Okay, I found the X-ray part, the advanced section on X-ray quite difficult but after that, it was easy, pretty easy." (DB, Post): "They taught it better but at the end I think I liked it but it's also a pretty difficult section. This nuclear medicine and all this physics content and theories and these things" (FH, Post)
2.2.6	CHECK ME! Other study/work commitments	Relates to other commitments in an individual's life. Could be formal exams, general coursework etc. Typically an individual will talk about a "lack of time".	"It's about me and it's about the course. Me – I was very busy." (OS, Pre); "I didn't have time. At that moment I was with all these things in Venezuela, moving from my country to Chicago, finding an apartment. Many things." (FH, Post)
2.2.7	Career prospects	Relates to concerns over where to find work in the future in one's chosen career.	"Germany is one of the most powerful countries in Europe so a lot of Spanish people are going there for looking for a job" (AC, Pre); "…students are graduating with good degrees and sometimes even them, like engineering, are having trouble finding careers or having troubles trying to find jobs fast enough." (JC, Post)
2.2.8	Financial concerns	Relates to worries or influence of money, such as going into debt for higher education.	" then I had a job that I applied because I needed more income. " (JC, Post); "It was a little bit expensive for them and for our family to pay for them to continue their studies so the main reason because they quit it was because of the price of the university they had to pay." (FP, Post)

2.2.9	MRI	An individual's perception of or response to the problematic MRI episode in the BI MOOC. Although this code overlaps with 2.2.5 I thought it was that salient a characteristic of the course that it was worth looking how each case dealt with it.	"it was because of MRI – that was very complex and very theoretical." (AC, Post); "I think I had the most difficulty with the section on MRI." (EI, Post)
2.2.10	Unwanted physical distractions	Environmental distractions, such as social or physical, at the time of MOOC study	"I study and then something or the other comes up and I have to deal with it." (DB, Post); "t was related to people who were texting me on Facebook or somewhere and that's what was trying to distract me." (EI, Post)
2.2.11	Other environmental factors	Physical and cultural environment, including reinforcers, punishers, models of behaviour (Duchesne et al. 2013) that are related to learning.	"I feel like in most of the classes I already know the subject" (Hakan, Final Interview); "I've been occupied by a lot of things." (Omayma, Final)

2.3 Other environmental factors

ID	Code	Definition	Examples
2.3.1	Other environmental factors	Physical and cultural environment, including reinforcers, punishers, models of behaviour (Duchesne et al. 2013) that are related to learning.	"I feel like in most of the classes I already know the subject" (Huseyin, Final Interview); "I've been occupied by a lot of things." (Mariam, Final)

3. Behavioural Codes

Behavioural codes describe any observable human activity. These codes are divided into three categories with an emphasis on behaviours that relate to LEARNING and, in particular to self-regulated learning, in the MOOC and MOOCS in general: (1) **MOOC learning behaviours** for those behaviours related to learning within the BI MOOC or any MOOC in general; (2) **other non-MOOC learning behaviours** for learning outside the MOOC. All behaviours that may relate to learning but do not fit into the first two categories are assigned to (3) **other behaviours**.

3.1 MOOC learning behaviours

ID	Code	Definition	Examples
3.1.01	BI MOOC participation	Relates to the general activities within the BI MOOC and NOT the completion of aspects of the course.	"No. [I did not use the course wiki]" (Monica, Post); "I did all sections. I mean everything in every section except there was one section on MRIs and it started very heavily on physics and, although I was interested, I was willing to learn it." (Huseyin, Post)
3.1.02	BI MOOC achievement	Relates to the completion of the whole or parts of the BI MOOC.	"I think I did good; completed it (Layla, Post); " I actually did receive a certificate for the course." (Pablo, Final)
3.1.03	Study environment	Relates to where an individual studies, could be place (home, university, work, etc) or room (bedroom, living room, office, etc.) or the study environment itself (desk, dining room table, etc), also use of headphones to control noise.	"I use headphones to listen to music or the videos in order to concentrate." (Antonio, Post): "I just ordered my desk because I always have a lot of papers and books which I am working with so when I want to do the MOOC, I just take them all and put them so I don't see them." (Monica, Post).

ID	Code	Definition	Examples
3.1.04	Study time	Relates to when an individual studies.	"Yes, I did more afternoons rather than evenings in the end." (Anna, Post); "Yes, at night it's better studying when there's not many hassles with the outside world. Like most people are asleep." (Pablo, Post)
3.1.05	Taking study breaks	Relates to taking breaks from study - being planned or instantaneous, adaptive or maladaptive.	"So, according to the length of the episode, I try to divide it and when I finish one division, one virtual division, then I perform some tasks to relax." (Antonio, Post): "I usually stop when I don't feel I can study anymore. You know that feeling when you try, you study, but it just doesn't go to your brain?" (Anna, Post)
3.1.06	Planning	Relates to the deliberate management or conceptualising of time in order to perform set tasks. If this performance is aimed at achieving a certain milestone then it should be coded as a GOAL.	"So, according to the length of the episode, I try to divide it and when I finish one division, one virtual division, then I perform some tasks to relax." (Antonio, Post); " Well I did the x-ray one and I did half of the computer tomography part of week two and I was planning to finish the second week" (EI, Pre)
3.1.07	Rewards	Relates to the planned or instantaneous self-administering of rewards or any kind such as coffee, watching TV. Must be seen as a 'treat' by the individual.	"Watching TV and I think the reward of Saturday was going to the swimming pool. I went to the swimming pool on Sunday as a reward for my Saturday work." (Mariam, Post); "When I finish an assessment I just run to the store and buy Skittles" (Pablo, Post)

ID	Code	Definition	Examples
3.1.08	Reading	Relates to the specific behaviours individuals use to read course related content, on the screen, printed off, on a device, etc.	"I was watching and reading. I have the sub-titles on just to use more than one sense at a time. " (Anna, Post); "You know when I said there is time lost in downloading that you've used in watching them and meanwhile I try to read the materials that are in the course." (Layla, Post)
3.1.09	Forum interactions	Anything related to interacting with other students in a MOOC forum NOT just searching and reading. It relates to interaction with others such as replying to a post, voting on a post or posting a new topic.	"And I also noticed in the forum, people discussed that that module was very difficult." (Mariam, Post); "I did write stuff in the forum sometimes but most of the time I did not because I was too busy reading and completing the courses" (Arjun, Post)
3.1.10	Forum information searchiing	Video lectures, readings, note taking, organisation or study notes. Also includes reading and voting on forum posts.	" if I were to go to the forums, I would have to read the entire threads that were posted and then find out, like the immediate problem that I was looking for so it would be more like searching for a needle in a haystack." (Arjun, Post); "I looked out for the discussions but I didn't post anything on them" (Federico, Post)
3.1.11	Video lecture watching	Relates to the watching of video lectures and includes pausing, rewinding, rewatching.	" At the moment it was so difficult for me to handle that I actually had repeat (some of those videos at the moment)." (Federico, Post); "Back in Ukraine it was very easy for me to watch the videos because the internet was much faster." (Arjun, Post)

ID	Code	Definition	Examples
3.1.12	Note taking	Relates to how an individual takes notes as a strategy to learn. Includes copying and pasting, summarising and paraphrasing, use of online tools such as spreadsheets and Evernote. Also includes the organisation of notes as retrievable records for later on.	" Yes, I love taking notes and it helps me to remember and understand what I'm reading. Whatever I do, I take notes, even if I'm watching a video or reading on screen." (Arjun, Post); "I take out the key points that I want to remember...On paper but I'm not an organised book kind of person. I keep all my papers together." (Layla, Pre) "I didn't take notes." (Monica, Post)
3.1.13	Seeking F2F help from others	Seeking help from another person face-to-face.	"I asked them several questions about it but I did not find the answers that I searched for because all that they told me was about the clinical applications of MRI" (Mariam, Post); "My supervisor studied physics and I comment about how I am watching some videos about how MRI works and it's a bit confusing with the electrons that are moving there and here. " (Monica, Post)
3.1.14	Online information searching	Use of Google, Wikipedia or other websites to find information related to the MOOC.	"Yes, I wrote on the internet the electromagnetic fields and I found some links in Wikipedia." (Antonio, Post); "I Google it." (Layla, Post); "Basically the information I was looking out for was basics on MRI so you can find big information, a lot of information about it only by google." (Federico, Post)
3.1.15	Formative/summative quizzes	Any activity involving formative and summative quizzes in the BI MOOC.	"I would do the assignments week-by-week. This is very important." (Mariam, Pre); "After I finished every

ID	Code	Definition	Examples
			section content, I did my quiz. I I'm curious as to why they did it that way." (Federico, Post)
3.1.16	Other MOOC learning behaviours	Any other behaviours related to the BI MOOC or MOOCs in general that do not fit into above categories.	"If I was very tired, I had to do something in the course although it is a very small part of the course" (Antonio, Post); "I tried to find the thing that was giving me trouble in my Bulgarian textbooks because I felt that maybe the reason I didn't understand it was because I didn't understand what they were really trying to say" (Anna, Post)

3.2 Other non-MOOC learning behaviours

ID	Code	Definition	Examples
3.2.1	K-12 education	Relates to education from kindergarten to leaving school.	"I studied in the British School for 12 years." (Arjun, Pre); " At high school I did have an notebook for every subject (Federico, Post)
3.2.2	Undergraduate learning	Related to first degree.	"when we started the electronics engineering degree, an interesting thing happened." (Huseyin, Post); "Well I studied a five year telecommunication engineer degree."(Monica, Pre)
3.2.3	Postgraduate learning	Relates to any postgraduate study after first degree.	"I previously mentioned that I was planning to apply for a Master's program and in the summer periods I did and I got accepted from several places and I picked one and started

ID	Code	Definition	Examples
			going to classes there so right now I'm part-time working, part-time student, mixing it all up" (Huseyin, Final); " made a one and a half year of the masters – the master is called masters in multimedia and communication." (Monica, Pre)
3.2.4	HDR education	Relates to the study towards a doctoral degree.	"n the meantime I got some kind of fellow in Berkeley with Professor Esposito in 2009 and then I finished my PhD and then I applied for a post-doc here in France." (Walter, Pre); "I have my PhD in computer science" (Antonio, Pre)
3.2.5	Professional development	Activities that relate to professional (career) activities engaged in by the individual, this includes the USMLE Kaplan prep for medicine grads.	"we had a meeting with the people who was… I don't know if this is the word, cardiologist… And I was able to understand all the processes they follow" (Antonio, Post); "it was very difficult to communicate with them[Cuban doctors in Seychelles] because their English was minimal and my Spanish was minimal so it was a lot of sign language so I decided if I learned basic Spanish it will help." (Layla, Post)
3.2.6	Professional research activity	Relates to academic research activity,	"Yesterday we were acquire some MRI data in Boston and I was waiting until just things have been done and the guy there was sending me the data to process the data here." (Walter, Final); "I've been working very busy in my job as always, doing some projects related to 3D but not with medical images." (Antonio, Final)

ID	Code	Definition	Examples
3.2.7	Concurrent MOOC activities	Relates to activiies engaged in on other MOOCs taking place at same time as BI MOOC.	"I joined another MOOC." (Mariam, Final); "I took one other MOOC. It was on Coursera.... It was called “The Addicted Brain”, about the effects of different drugs and medications on the brain." (Anna, Final)
3.2.8	Prior MOOC study strategies	Strategies used in MOOCs enrolled in prior.	"I usually watch them and try to read it out and try to comprehend everything I can as much as I can." (Antonio, Pre); "Well usually I would like to use with the video lecture some basic information paper be helpful." (Federico, Pre)
3.2.9	Prior non-MOOC study strategies	Learning strategies used in any non-MOOC learning context.	"the exam itself serves as a motivation in order not to fail. All my distractions are kind of kept at bay, at least for that period of time." (Arjun, Pre);"I have a subject that I’m interested in, I studied very, very fast." (Monica, Pre)
3.2.10	Predicted study strategies		"When I signed up for this course I made a commitment with myself that I will watch the lectures of the course week by week" (Mariam, Pre); " if I ever need some extra help… usually I try to do it myself but if I’m unable to I’ll just ask for help from other people" (Pablo, Pre)
3.2.11	Online learning	Any type of online learning activity including of course MOOCs.	"Well in my college there are several classes you can take online for example, or calculus or college algebra and in my opinion it was a bit easier taking that course online than in class because online, you know, you have your own pace, there are no interruptions and there’s more flexibility." (Pablo, Pre)

ID	Code	Definition	Examples
3.2.12	F2F learning	Relates to face-to-face learning outside of MOOC context.	"when you're face-to-face you're able to challenge what the professor's saying and ask questions…" (Pablo, Pre) "I didn't tell you in past interviews that since May I've been taking Japanese lessons here in Chicago." (Federico, Final)
3.2.13	Previous MOOC experience	Any experience of studying in a MOOC prior to the MOOC.	"I just completed last month statistics basics from Berkeley University." (Federico, Pre); "It was also offered by EDX. It's called "qualitative research" (overtalk 0:12:37.2) about research methodology and it was more than a year ago" (Mariam, Pre)

3.3 Other behavioural factors

ID	Code	Definition	Examples
3.3.1	Other behaviours	Any observable physical, verbal or mental activity an individual engages in that may influence learning. This may also relate to their work or career.	"… I go to work very early." (Mariam, Final); "I draw. I like to experiment with music; I mean I listen to different sorts of music, I try to go out with people that are not my classmates that study different subjects or in different universities and somehow can diversify my experience." (Anna, Final)

Appendix N: Master Data Table

Sample of master data table showing quantitative and coding analysis summaries for Pablo and Huseyin.

		Pablo	Huseyin
SELP	Self-efficacy for learning and performance	6.38	6.63
TA	Test anxiety	5.50	2.25
PApp	Performance approach	6.67	4.00
PAvo	Performance avoid	7.00	1.67
MApp	Mastery approach	7.00	6.67
MAvo	Mastery avoid	6.67	4.33
MSR	Metacognitve self-regulation	4.83	4.75
T&S	Time and study environment	5.50	4.50
ER	Effort regulation	4.25	6.00
THEME	**DEFINITION:**		
World/Self View	Beliefs about self or the world, or how an individual sees themselves in the world.	Pablo viewed his schooling as having problems "**I was pretty much born into the public education system which unfortunately has as many problems...So I pretty much had to teach myself many subjects"1** He saw himself as having a special relationship with technology "**Well I've always been a science geek, I've always had an interest in technology, like I'm usually the first person who wants to buy something new."1** Pablo indicated that his academic performance was too low "**I would consider myself a B+ student... I need to be an A student but I'm working on it."1** He also was critical of teaching at college "**[online learning is] better than being in class or a boring professor, you know, who doesn't like his job."1** Pablo believed he was good at doing two things at once "**I'm pretty good at multi-tasking."1** He believed he was a fast learner "**I'm usually very good at learning concepts really fast"1** He observed that the 'tricky' nature of the questions in the quizzes was "part of life unfortunately."2	Huseyin spent a year in the US as a high school student and two years doing an MBA in the USA. He has had a life of privilege, but at the same time has worked for his success and has benefitted from a family environment where academic success was modelled. It seemed though that he did not need help as he found independent learning and getting good results easy from a young age. Huseyin had found the perfect learning opportunity in MOOCs "I **like the term "life-long learner". I think that applies well to me"1** In fact, it would be fair to say that he was a MOOC enthusiast "**I think whether I'm a strange person or not because I notice that I like watching MOOC lectures more than I like watching TV at the moment."1** Huseyin accepted that he might spread himself around a little too thinly " **I usually make bad use of my time and I want to do a lot of things"1**
Habits	Behaviours or cognitive processes that are ingrained, longstanding and automatic. These behaviours are automatic meaning they are effortless to execute.	He admitted he had a habit of leaving things to the last minute "**Well usually I'm those kind of students who usually study at the last minute and it's a bad habit of mine"1** He reported that he did not have a very structured sleeping pattern "It's **pretty much all over the place. I don't know if you could call it a "sleeping pattern" but usually I'll sleep like 2:00am and I wake up like at six or seven."2** and that he liked to study through the night. He recognised he needed help to change his habit of procrastination "**Well I'm going to need someone like to question me, to nudge me to make sure I get things done. So probably a (like a) professor or a close friend or family"2**	Hakan may have developed good study habits when he was in the exchange program in the US "**So if you want to study, you can spend more time on study; you have less distraction maybe because you have less things to do and you also stand on your own feet so you're responsible of what you're doing so you take more responsibility. So, in an educational matter/manner it was also a very different and useful experience for me."2** When he returned to study, he returned to his old habit of taking notes with pen and paper. He didn't want to "**stick out from the crowd**" when he noticed nobody else was using a computer to take notes.3

OTHER PUBLICATIONS: Conference Papers

This section contains two papers presented at conferences in 2014 and 2015. These papers focussed on findings derived from a statistical analysis of Phase 1 data.

Norman, A. (2014). The Who, Why and What of MOOCs. In B. Hegarty, J. McDonald, & S.-K. Loke (Eds.), *Rhetoric and Reality: Critical perspectives on educational technology. Proceedings ascilite Dunedin 2014* (pp. 717-721).

Norman, A., Lockyer, L., & Bennett, S. (2015). MOOCs: Free Education for Some (Vol. 2015, pp. 152–157). Presented at the EdMedia 2015: World Conference on Educational Media and Technology, Montreal, Quebec, Canada. Retrieved from http://www.editlib.org/p/151404/

Conference Paper 1: The Who, Why and What of MOOCs

Rhetoric and Reality
Critical perspectives on educational technology
ascilite2014
Dunedin, NZ

The who, why and what of MOOCs

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In the area of online learning *massive open online courses* have attracted much attention in recent years. In 2014, quantitative research into MOOCs is starting to appear but relatively little is known about the learner experience in these environments. This paper reports on an ongoing study involving a mixed methods approach with a multiple embedded case study design which investigates what people bring with them into MOOCs and how they self regulate their learning in these unique environments. A preliminary analysis of data collected in a survey administered to the registrants of a health sciences MOOC confirms what the recent research tells us about who signs up for MOOCs: that they are likely to be young, male, and educated. In particular, individuals enroll with learning intentions other than the traditional trajectory of 'completion'. The unique characteristics of individuals in MOOCs need be foremost in our mind if we are to better understand effective learning in massive courses.

Keywords: MOOCs, higher education, online learning, learning intentions

Background

Over the last few years massive open online courses, or MOOCs, have proliferated attracting considerable media attention over their capacity to deliver a quality learning experience. In 2014, with hundreds of MOOCs delivered, studies are starting to emerge that provide a clearer picture of what is happening in MOOCs.

A recent study of geographic data finds that participation in MOOCs is diverse with the US, India and Canada dominating enrolments and European registrants being the most successful at earning a certificate (Nesterko et al., 2013). Another study finds that MOOC registrant numbers are decreasing over time, with an average enrolment of 43,000, which is much less than early figures. Also, longer courses tend to attract more registrants whilst shorter courses tend to have higher completion rates (Jordan, 2014). Other research finds that the focus on completion rates does not take into account the range of learner goals and intentions that people bring with them into MOOCs (Kizilcec, Piech, & Schneider, 2013). Clearly the field of MOOC research is just beginning and much more is required to better understand the affordances and effectiveness of MOOCs. In particular research is needed to shed light on the individuals who sign up for these massive learning experiences.

This short paper reports on a on an ongoing study involving a mixed methods approach with a multiple embedded case study design. Within a framework of social cognitive theory, which takes into account the interplay of personal, behavioural and environmental factors that influence human behavior (Bandura, 1986), this study investigates what individuals bring with them into MOOCs and what they do in that environment. Specifically this paper discusses the results of a survey administered to MOOC registrants and compares these findings with the nascent body of MOOC literature.

Method

The site of this research is a 10-week health sciences course on the EdX platform delivered in 2014. As can be seen in the flow chart below, data collection and analysis proceeds in three stages: *Pre-MOOC*, *MOOC* and *Post-MOOC*. It should be noted that at the point of writing this paper, the research had just entered the *Post-MOOC* stage of data collection, so what is presented here is a very preliminary analysis.

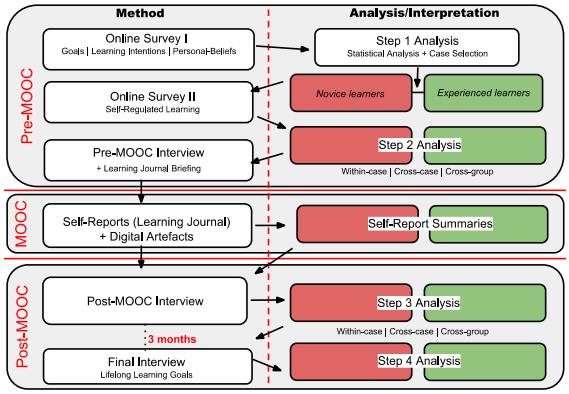

Figure 1: Flowchart of data collection and data analysis

Online Survey I collected data on registrants' goals, learning intentions and personal beliefs. Some of the findings of this analysis form the basis of this paper. This survey also served as a means of selecting the cases to be studied. According to Yin (2003) the case study research design is appropriate when seeking to understand complex social phenomena in a contemporary real-world context where the boundary between the case and the context is unclear. As learning in the context of a MOOC involves many dynamic and reciprocal internal and external factors the case study is an appropriate research design. Two design features were adopted to strengthen the integrity of the research. The choice of multiple cases increases the generalisability of findings (Miles & Huberman, 1994) and the selection of contrasting cases affords the testing of propositions deriving from the theoretical framework (Yin, 2003). For these reasons two groups of cases were selected: *experienced learners*, on the basis of the attainment of at least one post-secondary education qualification, and *novice learners*, on the absence of such a qualification. It is envisaged that such an approach will shed light on the relationships between personal characteristics and learning behaviours within MOOCs and may contribute to our understanding of individuals in these online environments.

Following this first step, the data collection methods are distinctly qualitative using instruments such as self-reports, digital artifacts and interviews to collect data with the aim of creating rich and detailed portraits of individuals who sign up for MOOCs. The self-regulated learning data collected from the cases in *Online Survey II* will be used qualitatively, as a reference point to other data collected through self-reports and interviews. The final interview will take place three months after the completion of the MOOC and will check in on each person's progress towards his or her goals. In short, this design is guided by the overarching research purpose which is to find out what individuals bring with them into MOOCs, in terms of their goals and beliefs, how they self-regulate their learning in that environment and what they achieve from such participation.

This paper will specifically report on some of the findings flowing from *Step 1 Analysis* and will answer the following questions:

1. Who signed up for this MOOC?
2. Why have they signed up?
3. What are they planning to do?

About the data

In week 8 of the MOOC, 3138 surveys had been returned. Empty and incomplete surveys were removed from the data set leaving 3104 surveys. This was a response rate of 22.4% of the total population of 13,841 enrolments at that time. Although this is a strong response rate for a voluntary survey, it is unlikely that this sample is representative of the entire MOOC population because those who responded are much more likely to be the engaged registrants rather than the disengaged ones. Therefore, inferences about the whole population from this sample are limited.

Findings and discussion

Who signed up for this MOOC?

This sample shows a dominance of male registrants with nearly six males for every four females (male: *n* = 1787, 59.4%; female: *n*= 1,223, 40.6%). This ratio is similar to general MOOC enrolments where men outnumber women (Nesterko et al., 2013) so it would be reasonable to infer that this MOOC has attracted more males than females. . In terms of the age, respondents indicated that they are either in the 18-25 or 26-35 age ranges (*n* = 969, 32.1%; *n* = 944, 31.3%) which is in line with the median age (28) for registrants for other MOOC enrolments (Nesterko et al., 2014). In terms of numbers by country, the United States accounts for nearly one in four registrants for this sample (*n* = 695, 23.1%), followed then by India (*n* = 291, 9.7%), Australia (*n* = 173, 5.8%), Spain (*n* = 130, 4.3%) and Canada (*n* = 117, 3.9%). Though the study of the geographic component of MOOC registrants is difficult due to confounding variables, such as population size and the proportion of English speakers to whole population just to name two, in general the enrolment numbers for this course are not dissimilar to wider MOOC enrolment trends. A study of all HarvardX courses up to September 2013 found that the top two countries for enrolments are the US followed by India (Nesterko et al., 2013). Similarly, numbers in this MOOC follow wider trends with the top five ranking Australia, Spain and Canada in this sample also feature in the top ten for HarvardX registrants. In contrast though Australians outnumber registrants from Canada and Spain in this instance, which may be due to the geographic location of the university providing the MOOC. A local MOOC may generate more local interest.

Respondents were asked to indicate their highest level of education and the results are shown in the table below.

Table 1: Academic level achieved

Group	Academic Level	*n*	Percentage	Group Total
Novice	Less than high school	59	2.0%	15.2%
	High school	396	13.2%	
Expert	College or vocational	284	9.4%	84.8%
	Bachelors degree	1,031	34.3%	
	Masters degree	855	28.4%	
	Doctoral degree	381	12.7%	

This sample is dominated by individuals who have a post-secondary education qualification - *experts*. In fact *experts* outnumber the *novices* by more than five to one. This sample is in line with a US-based study of MOOC participants, which found that 83% of respondents already had at least one two-to four-year qualification (Emanuel, 2013). Daphne Koller, one of the founders of Coursera, stated that the majority of registrants on that platform are well educated with 42% having a Bachelors degree, 36.7% with a Masters and 5.4% with a PhD (Koller & Ng, 2013). The dominance of individuals with a high level of academic expertise in this sample then is no surprise.

Why have they signed up?

Registrants were asked to indicate their main reason for signing up and the results are shown in the table below.

Table 2: Reasons for signing up

Reason	*n*	Percentage
Continue learning throughout my life	862	28.6%
Advance my career	597	19.8%
Advance formal education	587	19.5%
Get learning opportunities not otherwise available to me	347	11.5%
I'm still at school. I'm thinking of biomedical imaging as a career	218	7.2%
Earn a certificate	75	2.5%
Better serve my community	74	2.5%
Curious about online learning	66	2.2%
Participate in an online community	9	0.3%
Other	178	5.9%

Although most respondents indicated the main reason for signing up was lifelong learning (28.6%), around four in ten indicated that the course would benefit them in terms of either their career (19.8%) or formal study (19.5%). In the 'Other' category (5.9%), nearly all the respondents indicated reasons related to work or study. These results are confounded somewhat by professionals who attributed their reason for enrolling as lifelong learning or the advancement of their formal education, which also have career dimensions to them. In fact if the the findings of another study which found that 70% of MOOC registrants were doing so for professional reasons and were already in employment (Emanuel, 2013) are anything to go by, the proportion of professionals in this MOOC may be larger than these data suggest. Without a doubt though, the share of individuals who are accessing learning not normally available to them is small in comparison at 11.5%.

What are they planning to do?

Respondents were asked to indicate what they intended to do and results are displayed in the table below.

Table 3: Learning Goals

Learning goal	*n*	Percentage
Everything so I get the certificate	1,273	42.3%
Everything but certificate **not** important	776	25.8%
All the videos and some assessment	508	16.9%
All the lectures no assessment	90	3.0%
Some of the lectures	55	1.8%
Not sure	305	10.2%

These results show that 42.3% indicated that they intended to do everything in the course in order to get a certificate. This result is lower than a Stanford University study, which found that 63% indicated this learning intention (Koller, Ng, Do, & Chen, 2013). Clearly, not all people who sign up for MOOCs do so with the intention of doing everything and earning a certificate, some have other learning intentions at the outset and others are not sure how much they plan to do (Kizilcec et al., 2013). Considering the average completion rate of 6.5%, it is also clear that there is quite a disparity between intention and outcome MOOC participants. What individuals do in MOOCs and how their thinking, actions and environments influence their engagement in this learning context is the main focus of this ongoing study.

Conclusions

This analysis confirms what the recent research tells us about the individuals who sign up for massive open online courses. The people who sign up for MOOCs are likely to be young, male, and educated. Though MOOCs are often criticised for catering to those who least need it, the proposition that MOOCs can indeed go some way to democratising education should not be dismissed outright. These data indicate that there are 347 people, in this sample alone, who are accessing a high level of learning that would not normally be available to them. This is a good thing. In any case, the continued pulling power of MOOCs, even though enrolment numbers are declining over time (Jordan, 2014) are still massive. MOOCs are not going to disappear soon.

Another central criticism of MOOCs is the low completion rate which is 6.5% (Jordan, 2014). It is clear at even this preliminary stage of this study, that not all individuals who signed up for this MOOC had the idea of earning a certificate as their goal. In fact, these findings support the idea that people sign up for MOOCs with a range of goals and learning trajectories (Kizilcec et al., 2013). It is therefore invalid to report the completion rate of a MOOC as a measure of its effectiveness. This preliminary analysis suggests that this MOOC is in line with what we know of MOOCs in terms of enrolment and registrants' reasons for signing up and intended learning trajectories. This finding improves the generalisability of this study's findings on the motivating factors and learning behaviours of individuals who sign up for MOOCs.

This study now proceeds using more qualitative methods and will investigate at a case level, what specific individuals do inside MOOCs. With a better understanding of the learner, we may be able to design better MOOCs that can adapt to their intentions and enhance their experience.

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Conference Paper 2: MOOCs: Free Education for Some

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MOOCs: Free Education for Some

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Abstract: This paper reports on a quantitative component of a larger explanatory sequential mixed-methods study, which investigated how people learned in MOOCs. Responses from an online survey were grouped together using the *human development index* for each respondent's country. Statistical tests were then conducted to determine the demographic and motivational characteristics of these different groups. Findings indicate a large disparity in participation between developed and developing nations, and some differences in motivation but a similar level of education. These results suggest that it may be the well-educated from all nations who are taking most advantage of MOOCs.

Introduction

Massive open online courses have been the focus of considerable research since their emergence in 2011. The first wave of MOOC research was quantitative in approach, leveraging the big data that big courses afford. Researchers have reported on participation and completion rates (Ho et al., 2014; Jordan, 2014; Nesterko et al., 2013), use of resources (Breslow et al., 2013), communication patterns (Gillani & Eynon, 2014), patterns of engagement (Glance & Barrett, 2014; Kizilcec, Piech, & Schneider, 2013) and patterns of progression (Perna et al., 2014). This big data approach has contributed knowledge about engagement, but offered few insights into learning. The second wave of MOOC research is now starting to emerge. It is qualitative in approach and contributes knowledge about the learner experience. These studies have investigated pedagogy and practice (Forsey, Low, & Glance, 2013), the experience of learning in a MOOC (Adams, Yin, Madriz, & Mullen, 2014b) and the relationship between student and lecturer through video lectures (Adams, Yin, Madriz, & Mullen, 2014a). The field of MOOC research is young, however, and there is much more to know about the characteristics of people who enrol in MOOCs and how they learn in those environments.

Against this backdrop, a debate has arisen in the education media over the potential of MOOCs to either save or destroy higher education. Some have claimed that MOOCs were 'democratising education' (eg. Koller & Ng, 2013), while others that MOOCs were reaching only 'the educated few' (eg. Emanuel, 2013). This paper contributes to this discussion by reporting findings from research that investigated the differences and similarities between MOOC enrollees from rich and poor countries, which were grouped according to the *human development index* (HDI), a widely accepted measure of a country's development.

This paper also aims to address a gap in the literature by advancing understanding about the learning self-efficacy of enrollees. Self-efficacy describes an individual's belief in his or her own competence and plays a key role in motivation by influencing what individuals choose to do, the amount of effort they apply and their level of persistence (Bandura, 1993). Studying in a MOOC requires self-direction, suggesting that high self-efficacy is needed for effective learning.

The following research questions focused this part of the inquiry:

1. What are the demographic characteristics of the Low, Medium, High and Very High HDI groups?
2. Is there a relationship between HDI level and:
    a. course topic experience?
    b. course completion intentions?
    c. self-efficacy for learning and performance?

Method

An online survey was used to collect data from individuals enrolled in a MOOC on biomedical imaging. The complete survey consisted of 30 items and an extra section for respondents to indicate their interest in being considered for the ongoing case study. The analysis that forms this paper used data collected from 16 survey items. Nine ad hoc items collected demographic and personal data from enrollees. Demographic items such as age, gender, nationality and educational level were guided by reports based on data collected in the first year of MOOC delivery (See Koller & Ng, 2013; Nesterko et al., 2013). The other personal

characteristic items were informed by reports of learner intentions (See Kizilcec, Piech, & Schneider, 2013; Koller, Ng, Do, & Chen, 2013) and reasons for enrolling (The University of Edinburgh, 2013). The established items were derived from the *self-efficacy for learning and performance* scale from the Motivated Strategies for Learning Questionnaire (MSLQ), (Pintrich, Smith, Garcia, & McKeachie, 1991). Some items were modified to suit the context of learning in a MOOC (eg. "class" was changed to "course").

The survey was pilot tested with four individuals: three were enrolled in MOOCs and the fourth in a professional development online course. No items were changed. The survey was made available online to enrollees in a 10-week biomedical imaging MOOC delivered on the edX platform in early 2014. Email invitations were made through course announcements and sent six times throughout the course until Week 8.

Tests were conducted to investigate differences between participants grouped according to their countries' level of development as determined by the *human development index* (HDI). The HDI is a composite statistic measuring human achievement made up of longevity, education and standard of living (Malik, Jesperson, Kugler, & Kovacevic, 2014). It is a widely accepted measure of how 'developed' a country can be considered to be. The four HDI levels are Low, Medium, High and Very High.

A frequency distribution analysis was conducted for the variables of gender, age, and educational level for each HDI group. Chi-square tests for independence were used to determine whether there were relationships between HDI and course topic experience and course completion intentions. The mean score for the self-efficacy for learning and performance scale items was used in a one-way between groups analysis of variance (ANOVA) with post-hoc tests to determine whether there was a relationship between HDI and self efficacy for learning and performance.

Results

A total of 3,172 complete survey responses were received, corresponding to a response rate of 25.3% for this MOOC. Respondents were then assigned to one of the our HDI groups according to their indicated country of residence. Table 1 shows that respondents in the Very High HDI group outnumbered all lower HDI groups combined. The number of respondents in the Low HDI group was extremely small: only around 4 in 100 respondents were in this category.

	Low	Medium	High	Very High	% of Total
HDI Groups (*n* = 3,131)	3.5%	16.1%	20.4%	59.9%	
Gender					
· Male	73.9%	68.5%	64.1%	54.0%	59.1%
· Female	26.1%	31.5%	35.9%	46.0%	40.9%
Age					
· 17 or under	0%	2.2%	1.7%	3.4%	2.7%
· 18-25	48.6%	48.9%	45.5%	24.3%	33.5%
· 26-35	39.6%	31.1%	31.3%	30.7%	31.2%
· 36-45	9.0%	10.9%	10.9%	16.5%	14.2%
· 46-55	1.8%	4.2%	6.9%	13.5%	10.2%
· 56-65	0.9%	2.0%	3.4%	7.8%	5.7%
· 66 or over	0%	0.8%	0.3%	3.8%	2.5%
Educational Level					
· Less than high school	0%	0.6%	1.1%	2.5%	1.8%
· High School	17.1%	17.0%	19.8%	10.7%	13.8%
· Vocational or College	10.8%	8.1%	10.3%	9.2%	9.3%
· Bachelors	46.8%	36.6%	34.2%	33.0%	34.3%
· Masters	16.2%	30.9%	25.5%	29.4%	28.3%
· Doctorate	9.0%	6.7%	9.1%	15.3%	12.4%

Table 1: HDI group percentages and demographics

Respondents were asked to indicate their gender, age and educational level achieved. Table 1 shows this sample was predominantly male, young and highly educated. When analysed according to HDI, the gender

gap increased as the HDI group ranking decreased. In the Low HDI group, for every one female, there were three males. The majority (67.4%) were under 35 years of age. The most common age-range for the Low, Medium and High HDI groups was 28-35, whilst for the Very High HDI group it was 26-35. The age range of respondents in the Very High HDI group was wider too. This group accounted for most under 17s (3.4%) and over 66s (3.8%). The four groups had similar levels of education. The Low HDI group accounted for more Bachelor degrees than the other groups (46.8%) whilst the Very High HDI group had more postgraduates (44.7%). The number of PhDs in the Low and High HDI groups was similar (9.0% and 9.1% respectively).

Table 2 shows respondents' prior experience of biomedical imaging and their completion intentions. A chi-square test for independence found that there was a significant relationship between HDI level and course topic experience: c^2 (18, n = 3,116) = 162.18, p < .001, Cramer's V = .13). A similar test found a significant relationship between HDI level and course completion intention c^2 (9, n = 3,123) = 101.75, p < .001, Cramer's V = .10). In other words there were significant differences between the respondents' topic knowledge and how much of the course they intended to do when the country's level of development was taken into account.

	Low	Medium	High	Very High	% of Total
Course Topic Experience					
As a TV Viewer	0.9%	2.4%	1.9%	1.9%	1.9%
From General Interest	10.8%	13.5%	13.3%	19.6%	17.0%
As a Patient	4.5%	9.9%	10.0%	20.5%	16.1%
As a Student	34.2%	36.2%	40.1%	23.9%	29.6%
As a Teacher	0%	5.2%	3.8%	2.6%	3.2%
As a Health Professional	41.4%	24.9%	21.9%	22.0%	23.1%
As an Imaging Technologist	8.1%	8.0%	9.2%	9.5%	9.1%
Course Completion Intention					
Not Sure	5.4%	6.8%	8.0%	12.4%	10.3%
Low (some lectures)	0.9%	4.6%	5.2%	5.5%	5.1%
Medium (most lectures/some quizzes)	20.7%	37.3%	39.7%	46.0%	42.4%
High (all lectures/all quizzes)	73.0%	51.4%	47.1%	36.1%	42.1%

Table 2: Course topic experience (biomedical imaging) and course completion intention by HDI Level

A large proportion (83.7%) of the Low HDI group indicated that their topic knowledge came from professional or academic areas compared to a smaller proportion of the Very High HDI group (58.0%). In the Very High HDI group however, there was a larger proportion (42.0%) of respondents who had an informal knowledge of the topic gained through TV, general interest or as a patient compared to the Low HDI group (16.2%). The different groups were also found to have different course completion intentions. As the HDI level decreased, the course completion intention increased. A large majority of Low HDI respondents (73.0%) intended to do everything, compared with a smaller proportion (36.1%) of the Very High HDI group.

A one-way between groups analysis of variance (ANOVA) was conducted to determine if HDI was a factor in respondents' self-efficacy for learning and performance. See Table 3 for a comparison of group means.

HDI Rank	*M*	*SD*	Comparison Group	*p*
Very High	5.53	.98	High	.16
			Medium	.05*
			Low	.02*
High	5.63	.96	Medium	.72
			Low	.25
Medium	5.69	.96	Low	.61
Low	5.81	.86		

Table 3. Comparison of self-efficacy for learning and performance means between HDI groups (n = 3,131)
*Significant at the .05 level

This test found statistically significant differences between the Very High and Medium groups and the Very High and Low groups: F (3, 3,127) = 5.96, p <.001. The strength of the relationship between HDI ranking

and self-efficacy for learning and performance was weak (η^2 = .01). HDI ranking was not found to have a strong relationship with self-efficacy for learning and performance scores. This indicates that respondents had similar self-efficacy for learning and performance regardless of their HDI country ranking.

Discussion

This study found that the number of individuals enrolled in this MOOC from countries of higher human development far outnumbered those from countries of lower human development. The site of this research, a MOOC on biomedical imaging, was highly specialised and vocational in nature and required some knowledge of secondary or tertiary level science. Therefore only those with a good education would have been suitable candidates for this course. A study of Coursera MOOCs, found that 80% of enrollees from Brazil, Russia, India, China and South Africa came from the wealthiest and most well-educated 6% of the population (Emanuel, 2013). Although no socio-economic data was collected in this study, it is reasonable to infer from their education level that enrollees in this course came from the more advantaged levels of society.

Males outnumbered females in this study and the gender gap widened as the HDI of a country decreased, This finding is consistent with a general trend which found that males outnumbered females in MOOC enrolments (Nesterko et al., 2013). This is in contrast to the greater participation of women than men in formal higher education (ABS, 2014; OECD, 2014). This difference may have something to do with the types of courses that attract males and females. Males are drawn to subjects related to engineering and related technologies, whereas females gravitate towards society, culture and health (ABS, 2014). The gender bias in MOOC participation may be because there are more MOOCs that attract males. Another explanation for this gender gap is that males tend to have more discretionary free time than females, even in higher HDI countries. Women may be working and earning money more now, but in many societies it is also expected that they bear and raise children and do housework. The simple truth may be that women have less time to devote to studying an optional online course. Further research could investigate these possibilities and others that result in this differential uptake of MOOCs according to gender.

Different learners have different goals. Respondents were found to have a diverse range of knowledge about the course topic. Although no causal link was found between course topic knowledge and course completion intention in this study, different types of learners may have brought with them different learning intentions. Other studies have found that individuals enrolled in MOOCs with a diverse range of course completion intentions, not just the traditional goal of ‘completion’ (Glance & Barrett, 2014; Kizilcec et al., 2013; Koller et al., 2013). This study found that respondents with a professional or academic knowledge of the topic had higher course completion intentions than those with an informal knowledge of the topic. More research is needed in the area of motivation and goals in MOOCs. This knowledge may help designers create flexible learning environments that could meet individuals’ distinct learning trajectories. Knowing that MOOC enrollees have distinct levels of topic knowledge and intentions also has implications for research. To effectively investigate learning in MOOCs, it will be necessary to determine what specific individuals’ prior knowledge is on enrolling and what they actually achieve in that environment.

This study found a significant, but small, difference in learning self-efficacy measures between the Very High and Medium/Low HDI groups. The lower HDI groups had more confidence in their learning capabilities than the Very High HDI group. As academic self-efficacy has been found to be a predictor of motivation and learning (Zimmerman, 2000) and achievement (Ferla, Valcke, & Cai, 2009; Joo et al., 2013), it was surprising that the very high HDI group, which had the highest proportion of masters and doctoral degrees, would have a lower self-efficacy measure than respondents from lower HDI countries. This result may have something to do with the focus of the self-efficacy scale used in the survey. These items were developed prior to the advent of online learning, at a time when there was a uniform and familiar method of delivery: the classroom. In that context individuals would have responded to the statement “I expect to do well in this course” with regard to the content to be learnt and the tasks to be performed. In the context of MOOCs though, the conflation of content and delivery may have confounded the results. For example, an enrollee with a Masters degree from a very high HDI country with no MOOC experience might have interpreted the statement as referring to their performance in the *MOOC*, whereas an undergraduate student from a low HDI country, who had already successfully completed several MOOCs may have interpreted the statement to be about their ability to understand the *content*. Future quantitative researchers of self-efficacy in MOOCs may consider developing a scale that focuses on individuals’ self-efficacy for learning and performance in MOOCs in conjunction with a self-efficacy scale that focused on content.

Conclusion

This paper reported on the quantitative component of a larger mixed methods study that investigated learning in MOOCs. The analysis conducted sought to investigate Emanuel's claim (2013) that MOOCs were only benefitting those who least need them—'the educated few' To investigate this claim, survey data were grouped according to the level of development of each respondent's country of residence. A statistical analysis found that individuals from poor countries were indeed in a small minority in this course, but that they were of a similar education level as their counterparts in rich countries. This suggests that they were, as Emanuel claimed, representative of the advantaged members of their societies. This study has also provided some detail to what is known about the diversity of individuals who enrolled in a MOOC, in terms of their differing motivations and goals for learning. From the growing MOOC research, it is becomingly increasingly clear that a MOOC is not homogenous, like a university course, in which all learners share relatively similar goals to attain a particular qualification. MOOCs are many things to many people and further research is needed to understand how MOOCs can promote learning in different ways. Research into MOOCs is in its early days. Big data approaches tell us little about learning processes and outcomes. It is time to turn to the more qualitative approaches, situated in theoretical frameworks, that allow us to investigate the factors that determine learning in MOOCs.

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