A Pedagogy for ICT Education in Mixed Mode Studies

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ABSTRACT

This paper explores an appropriate pedagogy for teaching the information and communication technology (ICT) students in mixed mode studies, particularly in teaching a first-year-first-term undergraduate course 'Systems Development A'. For the purpose of this research, mixed mode studies refer to the studies that students undertake with a mixture of different enrolment patterns i.e. on-campus (on multiple campuses) and flexible learning (or distance education) study modes. To explore this unique phenomenon, qualitative case study research method was adopted. In particular, it compares the expectations and performances of all on-campus and flexible learning students. The findings indicate that many flexible learning students are working in the ICT industry and could easily grasp the concepts in their study contents without very much of the face-to-face guidance. In comparison, the majority of on-campus students need guidance from their teaching staff members and classroom interactions. A proposed ICT pedagogy is developed to explain how to effectively help and guide the first year first term undergraduate ICT students in a mixed mode study.

Keywords: pedagogy, information and communication technology education, mixed mode study.

INTRODUCTION

This paper explores a suitable pedagogy for teaching an information and communication technology (ICT) course to the first-year-first-term undergraduate students in mixed mode studies. As this is a unique phenomenon, this research adopted qualitative case study method. The research investigated a multi-campus university that offered mixed-mode studies, where ICT undergraduate students undertook a core course in the ICT program. The students were largely located in seven different campuses and some studied as flexible learning (or better known as distance education) students.

The findings indicate that many flexible learning students are working in the ICT industry. Hence, they could easily grasp the concepts in their study contents without very much of the face-to-face guidance. Some occasionally seek advice from the teaching staff. In comparison, on-campus students, with many as fresh senior high school graduates, need classroom interactions and guidance from their immediate teaching staff members.

Having the students with different backgrounds and learning needs, it would need an appropriately developed pedagogy to effectively facilitate teaching and learning in a mixed mode study context. A useful pedagogy has been developed in this research for sharing with a wider technology education community, especially amongst the teaching members with the same interests. The articulated pedagogy fulfills the purposes of creating an effective mixed mode studies learning environment. It is effective if used for the mixture of student cohorts who are on the different learning need levels, with different prior study backgrounds, and may or may not be new in higher education institution. The findings support that for the pedagogy to be effective, learning and teaching needs to be grounded on the learning theory of constructive alignments in higher education.

The research findings are currently based on a single case study. A proposed ICT pedagogy is developed to explain how to effectively help and guide the first-year-first-term undergraduate information and communication technology (ICT) students in a mixed mode study. For future work, more case studies that involve students in different higher institutions or university in different countries should be conducted to strengthen the research findings, which will help to improve the pedagogy for ICT education in mixed mode studies.

This paper is structured as follows. The next section introduces 'Systems Development A' as a core course in ICT education that involves mix mode studies about this research context. The third section is about reviewing the related work of this research particularly in the pedagogy and learning & teaching area to establish a background of this research. Section four discusses the methodology that this research adopts for data collection and analysis. Section five provides some discussions based on the data collection and analysis results. It also reports the important findings in this research. Section six concludes this research paper.

'SYSTEMS DEVELOPMENT A' IN ICT EDUCATION

Systems Development A (SDA) was an undergraduate core course taught in the first year first term of an Bachelor of Information Technology program to both internal on-campus domestic and international students at 3 regional campuses and 5 international campuses in Central Queensland University (CQUniversity). It was also offered to the external flexible learning students (through distance education; or simply Flex students,). The regional campuses that offered SDA were Mackay, Bundaberg and Rockhampton spread within the region of Central Queensland. The international campuses were Brisbane, Sydney, Melbourne, and Gold Coast. As Rockhampton was a main campus, it accepted both domestic and international students. Mackay and Bundaberg campuses had only domestic students. Face-to-face teaching and learning happened in our regional and international campuses, whereas Flex students relied on online learning-and-teaching (L&T) materials and completed activities provided on 'Moodle' (a learning management system).

There were teaching staff interacting with domestic and/or international students in lectures and tutorials on all campuses. But, for the Flex students, they interacted with the course coordinator. O'Neil, Singh and O'Donoghue (2004) explain, distance education learners require a great deal of interaction to overcome the

feeling of isolation. Beldarrain (2006) recommends that distance education courses should include interaction as the foundation of effective distance education practices. The course coordinators help Flex students virtually in online chat room, Skype, emails and discussion forums providing them with assistance in assessment items, clarification of doubts, group work advice, etc. When laboratory activities like the hands-on modelling software use were taught in different regional and international campuses, the tutors monitored all the tutorial activities. Flex students installed the purchased required course software, learnt and used them by themselves. Unlike the on-campus students who were supervised under their immediate teaching staff, Flex students practiced the software tasks at home and undertook the practical tasks for course assignment on their own. The Flex students would however email, phone or contact the course coordinators directly for assistance, whenever needed.

Unlike many other ICT courses, SDA has different characteristics. The course was about building an essential foundational understanding of basic knowledge associated with developing computer application systems or software development. Central to learning was students' grasp of critical systems development methodologies and modeling tools that would help them to graphically represent the user requirements of a computer application system. Students also used decision table, Gantt chart, Pert chart, cost and benefit analysis as project management tools to reflect their project techniques/skills learnt. In real-life ICT projects, software development team members work closely together. So, SDA had two group assignments. They were important to the student learners, as most of the software development projects were complex and needed to be developed with combined knowledge and skills of two or more team members. It is important to build group work skills in the students (Kelly, 2008). However, in SDA, due to the clearly different student cohorts, the course learning outcomes, and the assessment objectives, SDA assessments were made as group work projects. Students were formed into groups and they produced group reports for submissions. SDA also involved two other individual assessments as an online quiz and a final exam. For group work, group communication and collaborative work tools like forums, chat rooms and wikis were added to the course Moodle sites for all groups i.e. on-campus or Flex mode.

RELATED WORK

This paper has a thrust on pedagogy which is by and large known as an art or science to teach. However, pedagogy has been widely defined in various sources differently with the implications of teaching the learners with the children minds. More recently, a term andragogy was also made related to teaching the learners with the adult minds. As ICT learners came from all backgrounds for mixed mode studies. Literature on pedagogy and andragogy is hence explored to give a clearer understanding needed in formulating pedagogy for ICT mix mode studies.

To develop an appropriate pedagogy for ICT education especially for a course like SDA, the related literature in three areas are explored in three sub-sections below: 1. Pedagogy and andragogy; 2. Constructive alignment; and 3. Authentic assessment.

Pedagogy and Andragogy

Pedagogy is derived from two Greek words, paid [sic], meaning "child," and agogus [sic], meaning "leader" (Mohring, 1990). Ozuah (2005) explains that pedagogy means the art and science of teaching children and pedagogy is fundamentally a teacher-centered model. Pedagogy refers to situations where an adult teacher accompanies and assists a child learner so that he/she may become an adult (Yonge, 1985). Pedagogy embodies teacher-focused education (Mohring, 1990). Clargy (2006) adds that pedagogy always involves an adult assist a child to become an adult and there is an element of involuntariness to help the child mature. Knowles (1977) introduces andragogy as the art and science of helping adults to learn and explains it is widely used over the world as an alternative to pedagogy. Andragogy refers to situations where an adult teacher accompanies and assists an adult learner to an enriched adulthood (Yonge, 1985), premised on several crucial assumptions about the nature and characteristics of adult learners (Ozuzh 2005). Andragogy is more about a teacher adult guiding a learner adult in learning making the learner adult self-directed in learning. Merriam (2001) explains that andragogy as self-directed learning important to the present-day understanding of adult learning.

Critically, it is stressed that whether it is the 'andragogy' or 'pedagogy' used, the two teaching models are still about 'the art and science of teaching' though the main difference is whether the learners are 'adults' or 'children'. In both teaching models, there are however no clear detailed guidelines on what and how to teach the learners with differences in the age or gender and whether the two models work separately or in parallel in higher education. In higher education, pedagogy as a teacher-focused model is appropriate, if learners were students who would depend heavily on and need substantial guidance from their teachers. However, students could possibly be independent and self-directed since higher education are usually grown-up adults, so teachers are mainly the provider of directions and key advice. It is argued that for the purpose of this research situated within a 'mixed mode studies' context, although students are usually grown-up adults, they are allow to learn like 'adults' or 'children'. So both the models supporting 'self-directed learning' and 'teacher-focused learning' in higher education are adopted for the purpose of this purpose.

Constructive Alignment

By combining the constructivist theories of learning and the instructional design literature, Biggs (1996) introduces the concept of 'Constructive Alignment'. He explains that constructive alignment is a marriage between curriculum objectives, L&T activities, teaching methods and assessments. In particular, Biggs examines the use of constructive alignment in outcomes-based teaching and learning in higher education. Biggs and Tang (2007) emphasize an effective alignment between the learning objectives, learning tasks/activities and assessments for outcome-based teaching to help the learners perform in their learning. For this research after course achievement (as outcome-based teaching), a constructive alignment that considers the needs of the diverse cohorts, the learning

objectives, learning activities, assessment methods in the learning environment is deemed essential. 'Constructive Alignment' will be used to provide the paramount principles and guidelines in ICT course design for the mixed mode studies based on SDA.

Authentic Assessment

The above two sub-sections looked into the importance to articulate a pedagogy combining the teacher-focused model and the self-directed learning model, as well as using constructive alignment to improve the outcome-based learning. Often learning outcomes are not assessed in the class assessments. Sometimes, the class activities may not provide the students with required knowledge to achieve the learning outcomes or may not help the students perform in the assessments. Authentic assessment is examined to ensure the assessment item like a university assessment is designed and developed to constructively aligned with the learning objectives and learning activities.

Wiggins (1990) explains that an assessment is authentic when we directly examine the student performance on worthy intellectual tasks about their acquired knowledge. He further explains that the tasks represent the priorities and challenges found in the learning activities. Alters (2002) add that authentic assessments focus on what students understand as their subject knowledge and demonstrate what their understandings are through their assessment performances. It is argued in this paper that constructive alignment can facilitate authentic learning in students through interactive learning activities. For such learning activities, the students gain knowledge and their knowledge will be tested in the assessments. The assessments examine whether they achieve the learning outcomes. Constructive alignments, authentic assessment and authentic learning are intertwined (Leahy, 2013, Wanga et al, 2013). When authentic assessments become available, authentic learning can happen (Allchin, 2012). Authentic learning occurs through tasks, activities, and assessments that result in significant and meaningful achievement rather than trivial or useless achievement (Knobloch, 2003). It is argued that when learning objectives, learning tasks/activities and assessments are well in alignment, authentic learning can happen together in the presence of authentic assessments.

METHODOLOGY

This research adopts qualitative case study research method. For the case study, two SDA course offerings in Term 2, 2010 and Term 2, 2011 were chosen due to the researcher was a course coordinator. This research was granted a university ethics approval as well as the consents from all course members. In this research, the data collection techniques observation, documentations and survey were used. Observation is about viewing and reviewing all course learning activities as communication messages, changes to the materials contents, and member interactions on the course Moodle websites. Documentation refers to exploring all developed work like recorded contents resulting from group work, group assignment reports, etc. Survey refers to an online end of term survey on the course Moodle website. The participants in this research included both the

students and staff in COIT11226 Systems Development A (SDA) in terms 2 of two consecutive years i.e. 2010 and 2011. There were 8 staff members and 126 students involved in the course in Term 2 2010 and 9 staff members and 143 students involved in the course in Term 2 2011

A constructive alignment approach was also adopted in this case study research to find out what would be an appropriate pedagogy for teaching the information and communication technology (ICT) course students, specifically SDA students in mixed mode studies. Using qualitative case study, it helps to understand the social discourse of the members in the course. The qualitative approach also helps derive a thorough understanding of the learning objectives, the learning activities and assessment that will best help to develop the most appropriate pedagogy.

The course coordinator took over the teaching delivery of SDA in 2010. Before the take-over, some colleagues commented that the past SDA assignment specifications were highly unclear to the students. The project case study was far too brief with little useful information provided. A few tasks were not based on knowledge taught in the course though were related to the learning outcomes. The students were asked to write a group report for submission, but were not clear guidelines on the report tasks for the group project report For example, the students were asked to produce an analysis report but the tasks as report elements were not clear to them. Students could not tell how their learning activities were related to the assignment report tasks. The course assignment specifications needed to be constructively aligned and changed to a large extent by making the entire assessment agreeing with the learning activities and learning outcomes.

DISCUSSIONS AND FINDINGS

For the course offering in Term 2 2011, the constructive course changes or improvements were initially based on the course coordinator's past teaching experience from other universities and a collegial consultation with another peer course coordinator who taught in the same course. The assessment later had the tasks expanded and clearly laid out as a list of expected group project report contents to carefully align with its course learning activities and learning objectives. For example, the tutorial activities and the online quizzes covered the fundamental course concepts needed in the two assignment reports. In many learning activities, especially those involve the use of MS Project or UML diagram software in computer laboratories, students have to practically grasp the knowledge and skills in laboratory tasks through a learning-by-doing process.

Some course announcement emails were sent to the students to ensure that the students in all groups clearly read and understood the assignment specifications, project case study and related subject materials. They were encouraged to use the group work tools to communicate and collaborate in completing the assignment tasks. All relevant teaching staff were also informed to supervise the students on their group work tasks. They were told to report student learning difficulties or success outcomes to the course coordinator (as course member feedback). During the term, student or staff email feedback (as course member feedback) was collected. Some notes were taken about staff comments on the course through

their phone calls. Based on the feedback from staff and students (as course member feedback), changes and improvements were made in the next course offering in Term 2, 2011. The changes enabled students to progress and achieve better towards the learning outcomes. As a result, the student achievements were greatly improved. The course was also offered in Term 3, 2010 and Term 3, 2011. The successor of the course benefited from the enhancements. While student performance showed improvements in the two consecutive terms 2, the teaching evaluations of terms 3 also improved in comparisons to terms 3 in the past years. It supports that there was a sharing of insight and experience to improve teaching together amongst colleagues in this course in general.

Yorke (2003) remarks that the act of assessing allows the assessors to learn about the extent to which students have developed expertise and can tailor their teaching accordingly. It is believed that the use of feedback collected from the students and teaching staff (as course member feedback) in a course offering can help a course coordinator make improvements for the next offering. If the practice is always adopted, the course would continuously improve. In the learning environment that involved the group work assessments, there was group work tools used for virtual collaboration on the Moodle course website. The successful virtual collaboration, social relations are as important as the project content and team expertise (Karpova, Correia and Baran, 2009). The tools enable the teachers and course coordinator to provide performance feedback to the students and also allow the course coordinator to collect course performance feedback. However, not all the students were self-directed and performed pure discovery as individuals. For students who had their doubts in an assignment and need help or clarifications, the lecturers and tutors assisted them (as a form of performance feedback). The course coordinator also provided advice and clarified doubts in course forum student message as a form of guided discovery. Moodle was new in the university in Term 1 2010. So, it was new to all course members in the first SDA course offering in Term 2 2010. Although the group work tools were not so well adopted by all student groups in the first course offering, the tools were better utilized by students with better staff guidance and assistance in the next course offering. It supported Mayor's idea that guided discovery is more effective than pure discovery of an individual student in promoting learning and transfer of knowledge to new problems (2004).

Authentic Learning and Assessment

The course 'SDA' teaching and learning strategies were implemented to support teacher-focused learners to a large extent with the available help and advice of tutors, lecturers and all teaching staff as subject mentors, advisors, and facilitators. But, it also supported self-directed student learners who need less help and advice of the teaching staff or the course coordinator. To facilitate authentic learning with authentic assessments, the course coordinator worked closely together with a peer colleague to constructively alignment the learning objectives, assessments and learning activities in SDA for the first offering. Taking the advice, critique and feedback of the teaching staff who taught in the course at the end of the first offering, a better prescribed text was later selected to better align with the learning objectives for the next offering. It was a more conducive authentic learning

environment where students enjoyed their authentic assessments (with performance feedback). It was believed that it benefited the students and improved student performances.

SDA adopted the following guidelines for course improvements:

1. Actively engaged students in authentic learning
2. Course member feedback was used to improve student learning.
3. Students and teachers have effective partnership in learning and assessment (as performance feedback).
4. Students were inducted to the learning objectives, assessment, and learning activities/ tasks.
5. When self-directed learning failed, teacher-focused learning will need to continue to function.
6. Students receive performance feedback in their assessments to improve their achievements.

Using the guideline discussed above, Figure 1 is a pedagogy developed to explain how it helps students to work effectively in the mixed mode studies. The pedagogy presents a philosophy with the 6 guidelines above underpinning learning and teaching for the information and communication technology (ICT) students in mixed mode studies.
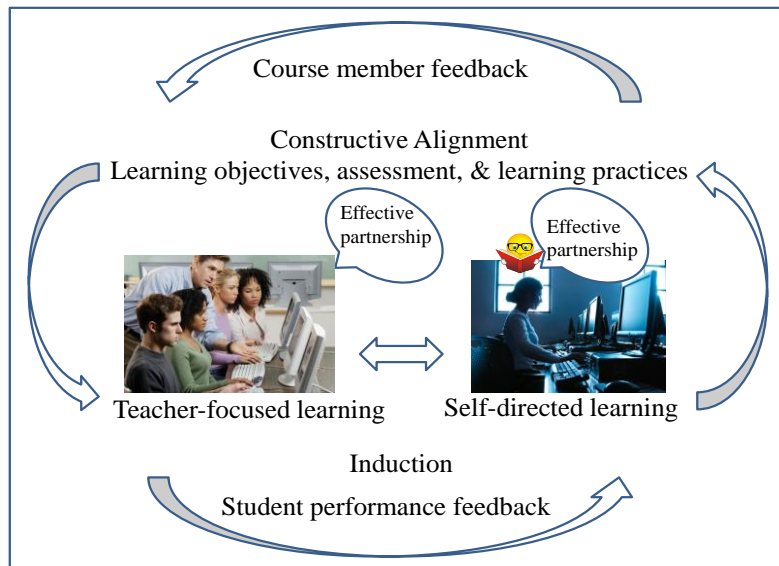

Figure 1: A pedagogy for teaching the ICT students in mixed mode studies

As in the box that represents a mixed mode studies environment, *constructive alignment* must be put in place to align the learning objectives, assessment, and learning activities/tasks. The word '*Induction*' at the bottom of the box shows that the Students need to be inducted to know their learning objectives, assessment,

and learning activities/tasks at the beginning of the course. On the left-hand-side graphic, it shows that *teacher-focused learning* is best applied in ICT courses, as the ICT learning activities and assessment tasks are highly problem-based and technical, these activities and tasks are often best learnt through guided discovery learning. Hence, regional and international campus students who attend face-to-face lectures and tutorials on-campus should be given assistance and useful guidelines from their lecturers and tutors in learning. As in the right-hand-side graphic inside the box, Flex mode ICT students are expected to be self-directed learners and usually engage in *self-directed learning*. Nevertheless, it needs to be an *effective partnership* between the teaching staff and students in the course to enable some effective learning and teaching. As in the two call-out bubbles, social interaction of staff and student in both online and face to face environments regulate an important learning and teaching.

Importantly, self-directed learning sometimes fails and the students will need guidance and help from teaching staff. It should be made flexible for a self-directed student with pure discovery to switch to teacher focused learning for guided discovery or vice versa. A bi-directional arrow between the two graphics indicates the flexible switch between self-directed learning and teacher-focused learning. The four left, right top and bottom arrows show that from time to time, the course members must be active in providing feedback to continuously improve the course, though sometimes not for the immediate course offering, but in the next course offering. There are two types of feedback important to course improvements. The first type of feedback is *performance feedback* as what the students will need from the teaching staff about whether their assessments reflect their tasks undertaken met the learning objectives. The second type is *course member feedback* needed from both the teaching team and all student members about the course. The feedback will help the course coordinator to make improvements of the course in future course offerings. The teaching staff particularly the course coordinator is responsible to collect such feedback to continuously improve the course in the future offering(s).

CONCLUSION

This paper has discussed how the ICT course pedagogy for teaching students in mixed mode studies was formulated. Teaching students in mixed mode studies will need a carefully crafted appropriate pedagogy to effectively facilitate learning and teaching in a mixed mode study context. The research has identified students in mixed mode studies as those who have a mixture of characteristics. Some students are able to self-direct their studies. Some rely on staff members in teacher-focused teaching that would provide them with the experience of guided discovery. The paper has also addressed the importance of ensuring a constructive alignment amongst learning objectives, learning activities/tasks and assessment as a basis to formulate the pedagogy appropriate for higher education ICT courses. It also emphasized the intertwined relationships between constructive alignment, authentic learning and authentic assessment. A useful pedagogy was developed and presented, which is believed to be useful for the related members in a wider

ICT education community, especially the ICT teaching staff members teaching a similar ICT course as in the case study.

The research is currently based on a single case study. As the research is based on only a case study conducted for Australian higher education ICT course, the proposed new pedagogy may need to be adjusted for the overseas higher education ICT courses where the student characteristics in the mixed mode study are different. It is a limitation for this research to be based on only a single case study. To refine the proposed pedagogy in this paper, more case studies that involve students in many different higher institutions are needed. More future research involving many universities in different countries is also needed to further strengthen the research findings.

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