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A Student-Generated Video Careers Project: Understanding the Learning Processes in and out of the Classroom

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ABSTRACT

This article describes how in recent years, the multimedia recording capabilities of mobile devices have been used increasingly to create a more active, learner-centred educational experience. Despite the proven value of student-generated multimedia projects, there are still gaps in our understanding of how students learn during them. This article reports on a project in which first-year information technology students interviewed IT professionals in their workplace and video-recorded the interview to enable sharing with their peers. In order to understand the statistically significant increases found in students' learning, student diaries and reflections were analyzed qualitatively. Factors found to contribute to learning included: the iterative nature of student activities; the multiple, evolving representations of knowledge as students proceeded through the project; the importance of the workplace context in engaging students and enhancing learning; the affordance of mobile technology for capturing and sharing this context; and the collaborative and metacognitive processes fostered by the project.

KEYWORDS

Careers Education, Collaborative Learning, Information Technology Students, Learning Processes, Mobile Learning, Project-Based Learning, Student-Generated Multimedia, Video, Workplace Learning,

INTRODUCTION

Mobile devices – that is, portable digital devices – have been a key enabler in the shift to a more active, learner-centred approach to education in the twenty-first century. Herrington and Herrington (2007, p. 7) note their affordance "as tools for complex and sustained tasks and problem solving" and their support for authentic learning activities, including data gathering in the field and the creation of multimedia content by students. Contextualization of learning outside the artificial environment of the classroom joins with multimedia content creation in powerful ways, as Pachler, Bachmair and Cook (2010, p. 23) describe:

New relationships between context and production are emerging in that mobile devices not only enable the production of content but also of contexts. They position the user in new relationships with space, the physical world, and place, social space.

This paper acknowledges this relationship between context and content through research into an assignment that required students to undertake a project in the field and create a record of their field learning in video format using mobile devices. Thus context (the information technology (IT)

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industry workplace) and content (a short video of an interview with an IT professional) were closely intertwined. The learners were first-year, first-semester undergraduate students enrolled in either an IT (computer science) or IT/Business degree. The principle learning objective was for students to acquire knowledge about the careers to which their degrees were leading them, and to enable them to make more informed choices about their majors. It had been recognized by the university that many of our students knew little about IT jobs or the IT industry, perhaps because of the wide diversity of positions that IT graduates fill and lack of knowledge by the careers counsellors at school who had advised them (Robertson, Dyson, Norman, & Buckley, 2002). The real-world context in which the learning experience was embedded was thus the world that the students would come to inhabit upon graduation.

The course in which the learning took place was a foundational communications subject that had previously focused on written and oral communication skills. The introduction of the IT Careers Project recognized that literacy practices had changed and now, in this "post-typographic world," they included photography, video, sound and multimedia (Davies, 2003, p. 115). Thus a secondary learning objective was the acquisition of multimedia communication skills. To make the video the students used sophisticated video and sound recording equipment provided by the university or the recording functions of their own mobile devices, such as smart phones or home digital video cameras. They worked in small groups of 3-4 students, for the most part independently of their tutor, although they could attend an optional introductory video workshop and later in semester an editing workshop. Most chose not to participate in these but to work it out for themselves, sometimes by viewing videos they located on YouTube or links to online resources provided as part of the project.

The aim of this paper is to explore the learning that occurred during this project and understand the processes that contributed to this learning. Firstly, two surveys, one before and one after the activity, revealed that significant learning took place for both key learning objectives (acquisition of IT careers knowledge and development of multimedia communication skills), based on students' perceptions. As a result of this, a study was undertaken in which student team Diaries and end-of-semester Reflections were examined to discover explanations for these excellent learning outcomes. This qualitative part of the research indicated several factors that contributed to the outstanding learning outcomes, particularly the iterative nature of the activities which students undertook to produce their videos and their need to repeat many tasks more than once; the transformation of their increasing knowledge into different representational formats as they proceeded through the project; the strongly motivating role of the workplace context; the power of mobile devices to capture this context on video for other students to view and learn from; and collaborative and metacognitive processes favoured by the project-based nature of the task.

The paper commences with a presentation from the literature of the effectiveness of student-generated multimedia projects and theoretical interpretations that have been put forward to explain their efficacy. This is followed by a description of the IT Careers Project and the research methods used for analyzing the learning outcomes and the processes which contributed to learning. The results are presented: firstly the statistical analysis of the student survey results and then the thematic analysis of selected student Diaries, supported by selected comments from student Reflections.

The paper contributes to our understanding of student-generated multimedia learning. In particular, it goes beyond existing research of the observed learning processes of small, in-class projects and provides insights into how teams of students learn when studying independently of their teacher, outside the classroom. It further demonstrates the potential of this learning approach even in very large courses. It is hoped that this example of a successful, sustainable project may inspire other academics to adopt this form of pedagogical approach.

LEARNING IN STUDENT-GENERATED MULTIMEDIA PROJECTS

Web 2.0 and ubiquitous computing have supported a rise in user-generated content and participatory culture (Jenkins, Purushotma, Weigel, Clinton, & Robinson, 2009) within the networked society (Castells, 2000; Castells, Fernández-Ardèvol, Qiu, & Sey, 2007). Current technologies and cultures of digital multimedia amplify previously unheard voices by supporting individuals in publishing. Students occupy a digital landscape characterised by new media (Kress, 2003) and new literacies (Knobel & Lankshear, 2007; Kress, 2003).

For education, this socio-technical shift from expert- to user-generated content aligns with wider pedagogical shifts from teacher-centred approaches to those focused on the student. Projects where students, instead of the teacher, generate and share multimedia place the student at the centre of their own learning (Frawley, Dyson, Tyler, & Wakefield, 2015). Student-generated multimedia projects, in affording "learning by doing" (Dewey, 1938), have the pedagogical potential to support constructivist pedagogies. By inviting students to construct a meaningful product or artefact, we also ask them to build mental models and understandings (Papert, 1980). Secondly, in creating this digital content for others to view, we recognize the social nature of learning, as theorized in socio-constructivism (Bruner, 1986; Vygotsky, 1978). In short, student creation and participation in Web 2.0 technologies can play a significant role in student learning (Merchant, 2009).

While student-generated digital media aligns with contemporary pedagogies, empirical evidence is required to understand how this translates into practice. Evidence for several educational benefits has been identified. One study of student-generated video demonstrated that students were more engaged, displayed greater autonomy in their learning, adopted a strong sense of self-esteem and ownership, and developed both oral and IT literacy skills (Schuck & Kearney, 2006). The authentic voice of the students emerges as they express their creativity, sense of humour and individuality (Frydenberg, 2006). Students take part in knowledge discovery as they plan and produce meaningful multimedia artefacts for sharing with their peers (Rocha & Coutinho, 2011). In order to do this successfully, they must have a thorough understanding of the topic: to explain a concept one must know it (Frydenberg, 2006; McGarr, 2009; Hoban & Nielsen, 2010). Some authors go so far as to suggest that it is the very awareness of their peer audience that spurs students on to produce their best work in order to maintain the respect of their fellow students (Wheeler, Yeomans, & Wheeler, 2008).

However, obviously the multimedia itself and the practice of producing it are highly motivating, too, particularly for students living in a world where the convergence of recording functions in mobile devices, combined with user-generated content and file-sharing platforms to host it, are the norm (Dyson, 2012). Digital media projects recognize that students who have been exposed to technology for most of their lives require new pedagogical methods to engage them (Davies, 2003; Tapscott, 1998). Students are now "actively engaged in shaping their own forms of individualised generation of contexts for learning" (Pachler, Bachmair, & Cook, 2010, p. 23). Because these tasks are inherently motivating, students work hard and even poorer students often do well (Wikan, Mølster, Faugli, & Hope, 2010).

Context can be an important motivator in these projects, particularly where students are invited to go beyond the classroom and enter the real world. Cox (2016, p. 87), in a descriptive study of science, food science and engineering students' making videos of interviews with professionals, noted that "students gain a sense of the smell, noise and other sensory characteristics of the workplace. Such experiences are memorable and lend authenticity." These encounters promote graduate readiness through "a better understanding of what it means to be professional in their respective areas" and could "enhance the affective domain of student learning, providing an emotional boost and greater motivation to study" Cox, 2016, p. 93).

In order to understand why student-generated multimedia projects result in learning benefits, some researchers have adopted a different line of investigation, looking into the learning processes that students engage in. Some have focused on the social knowledge-building processes: since these

tasks are typically complex, they lend themselves to team work and team-based idea generation, negotiation of meaning, perspective taking and group problem-solving (Lee, McLoughlin, & Chan 2008). Metacognitive processes are also involved, that is, "strategies the learner uses to achieve specific learning goals, like planning and organising, allocating attention to relevant and irrelevant factors, looking for relationships and patterns, monitoring comprehension, identifying and testing procedures, evaluating outcomes, and reflecting on learning" (McLoughlin, Lee, & Chan, 2006, p. 35). Critical reflection, critical thinking and independent thinking were also identified in a study of geography students making videos of fieldwork they had undertaken (Mavroudi & Jöns, 2011).

Other research, drawing on the field of semiotics, focuses on the evolving representational forms in which students' knowledge is expressed at each stage of the learning process (Hoban, 2016). Studying trainee teachers in a classroom making "slowmations" (a type of simple, stop-go animation), researchers observed students moving through a predetermined sequence of five stages or activities which followed a digital storytelling procedure (Hoban, Loughran, & Nielsen, 2011; Hoban & Nielsen, 2010). Produced at each stage was a particular representation of the concept being studied: in "creating a representation, students make meaning as they reflect on the relationship between what they are making (the 'representation') and the concept or object they are trying to represent" (Hoban & Nielsen, 2010). Each representation has an affordance, or role, that makes students consider the topic in a particular way, depending on its mode of representation – whether notes, diagrams, photographs or the finished multimedia product. Meaning is "multiplied" or enhanced as it is transferred from one representational mode to another. The progression is not strictly linear as students often return to previous representations to check their knowledge before moving forward again to the next stage.

The research approach adopted in the current study aimed at discovering what learning processes students were adopting in this self-directed project, rather than imposing a predetermined learning strategy as Hoban, Loughran and Nielsen (2011) and Hoban and Nielsen (2010) had done. Because the learning process was largely determined by the student teams, the artefacts or representations of knowledge at each stage of learning were also open to discovery. This need for openness within the design of a student-generated digital media assignment is not superficial. Recent research into student-generated media has demonstrated the importance of student choice and agency with regards to the specifics of the assignment design (see McGahan, Ernst, & Dyson, 2016; Ernst, McGahan, & Harrison, 2016). In one study (Ernst, McGahan, & Harrison, 2016), the enforcing of a screencast assignment initially led to lower engagement and performance outcomes than the traditional written alternative; but once the educators and researchers introduced a choice of either traditional written or digital media assignment, both performance and engagement improved significantly. While the IT Careers Project did not offer a written alternative, choice was supported by allowing students to select their teams, the roles they would assume in their teams, which IT career professional to interview, how to conduct the interview and edit the video. Like Cox's (2016) students, this allowed for personalized learning.

A further point of difference from both Hoban, Loughran and Nielsen (2011), McLoughlin, Lee and Chan (2006) and Ernst, McGahan and Harrison (2016) was the field-based aspect of the IT Careers Project, which meant that learning processes were highly contextualized, and thus understanding the role of context, and the role of mobile technology in facilitating the transference of field-based learning to classroom learning, was an additional important line of inquiry. Since students were mobile and could not be observed directly, a different approach to capturing data needed to be adopted.

DESIGN AND IMPLEMENTATION OF THE IT CAREERS PROJECT

Initially, an assignment was trialled whereby students researched IT careers in teams comprising nine students. One student from each team went to the workplace to interview an IT professional and reported back their findings to their team, who prepared a written report for their tutor. The teams then gave a presentation to all the remaining students enrolled in the subject, some 300 at the time (Figure 1).

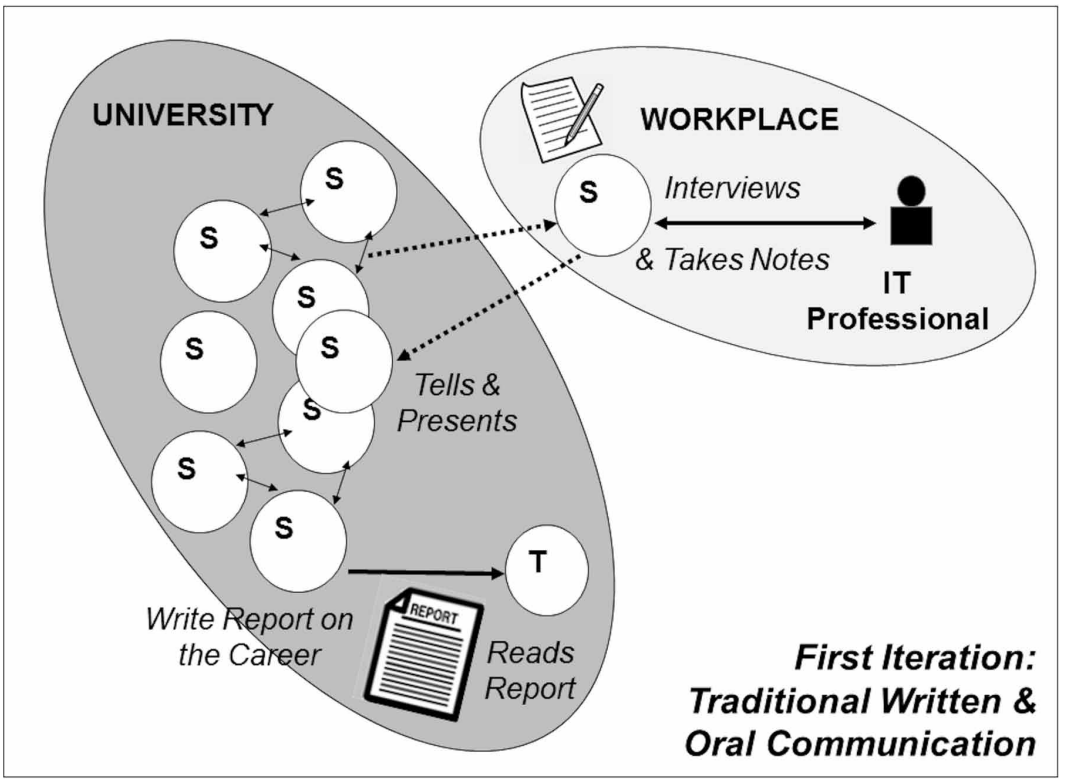
The assignment was seen as valuable but there were several issues:

- Only one in nine students enjoyed the benefit of meeting a professional working in IT and visiting their workplace. Thus learning was only situated in an authentic context (Lave & Wenger, 1991) for that student.
- The teams were too large and "loafing" occurred, with most work being done by the student who had conducted the interview.
- Organizing the mass presentation for sharing the results with 300 students was logistically difficult.
- There was no explicit linking of the careers being researched to the majors and study paths that students should follow in order to prepare for a particular career in IT.

A redesign of the assignment focused on addressing these issues (Figure 2):

- It was decided that all students should have the experience of meeting the professional and seeing what the IT workplace was like.
- Teams were reduced to three or four students each.
- To facilitate sharing of the interview results, mobile technology was introduced: students were given the brief to video-record their interviews, show an edited recording to their tutorial class of 30 students as part of a formal presentation towards the end of semester, and then further edit and compress the video to create a 5-8 minute vodcast (short video of smaller file-size) for upload to the learning management system (LMS), where all students enrolled in the subject as well as the tutors could access it. The assignment shifted from a traditional fieldwork activity, in which

Figure 1. First Iteration of the IT Careers Project (Key: T – tutor; S – student)



oral and written communication skills were developed, to mobile-supported fieldwork, in which students built their oral, written and multimedia communication skills to create a sharable and engaging digital product. As externalized representations of student understanding (Sharples, 2003), the videos and vodcasts could promote learning conversations amongst the students as well as between tutor and students. The vodcasts were to form part of a growing repository of IT career resources.

- Finally, in order for students to understand how the careers they had investigated related to the different IT majors offered by the university, the tutors gave students a short presentation about the content of the majors in the last week of semester and students then mapped all the careers they and their peers had investigated to the majors. That concluded the IT Careers Project for the students.

Students undertook the assignment over a 10 week period, beginning in the fourth week of semester and finishing in the final teaching week. The redesigned assignment was first implemented in the second semester of the Australian academic year when enrolments following the mid-year intake are typically smaller for this subject (96 students in this case), thus making the project more manageable in its first iteration. Some small changes were then made before offering it on a continuing basis in the course. To gain some idea of the scale, enrolments typically range from 320-430 in the larger semester to 95-130 in the smaller semester.

RESEARCH METHODS PHASE 1: QUANTITATIVE ANALYSIS OF STUDENTS' LEARNING

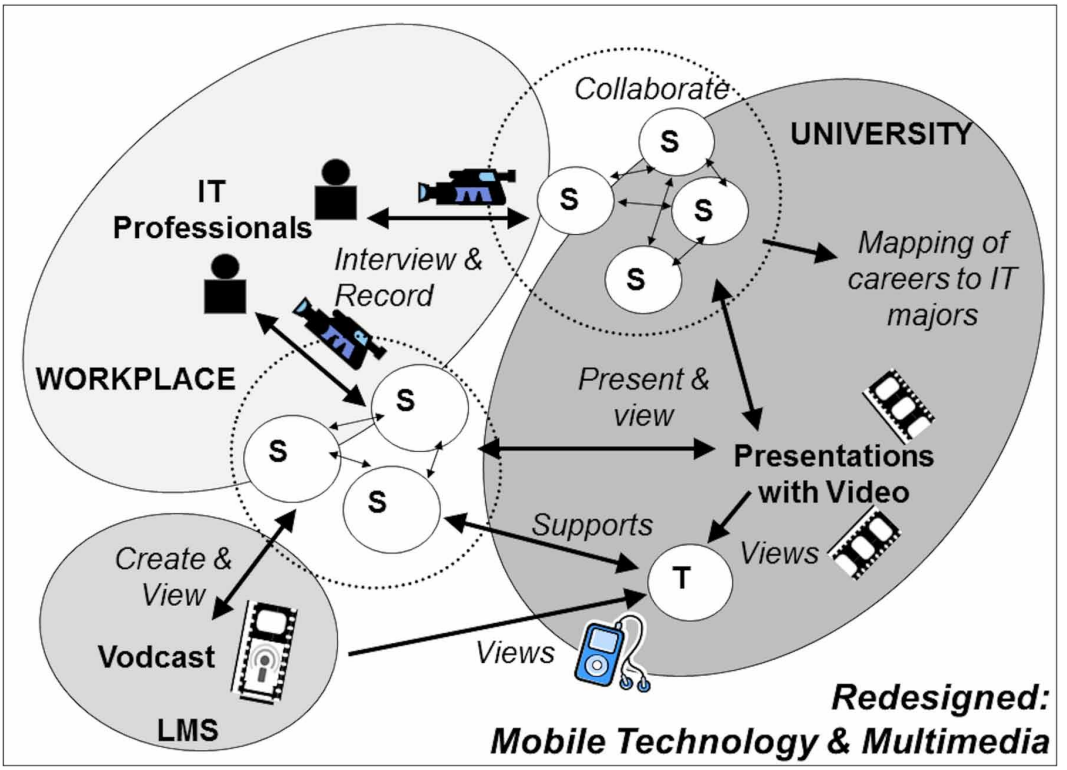
To evaluate students' learning in the assignment the second semester it was offered, students were surveyed anonymously about their knowledge of IT careers, the major which they intended to follow to achieve their chosen career, and their multimedia skills. The survey consisted of three statements about careers and two questions about multimedia skills which students rated using 5-point Likert scales:

1. I know what career I would like to follow at the end of this degree.
2. I am well informed about different IT career options.
3. I know what area of study or IT major I want to undertake in this degree.
4. How do you rate your knowledge and skill of making video recordings?
5. How do you rate your knowledge and skill of video and/or audio editing?

The same survey was presented at the beginning of semester (n = 316; response rate = 92%) as at the end of semester (n = 275; response rate = 80% for all items except that one student failed to answer Q 3, thus n = 274 for that item). This provided a measure of changes in their self-perceptions over the course. As no other teaching about IT careers had been provided, the evaluation is a valid measure of their perceived changes in knowledge, i.e., learning, while undertaking the various activities associated with the project (workplace interview, video production, listening to their peers present their careers findings, watching other videos and vodcasts, and mapping careers to majors).

The results were firstly analysed descriptively using an Excel spreadsheet and then statistically using SPSS software. For the statistical analysis, the means for each question were compared (end versus beginning of semester) using a 1-tailed independent samples *t* test. Since the samples are large, the assumptions of the *t* test regarding continuity and normality of distribution hold (Hinton, 2004).

Figure 2. Redesigned IT careers project (Key: T – tutor; S – student; LMS – learning management system)



RESULTS OF THE QUANTITATIVE ANALYSIS: ACHIEVEMENT OF LEARNING OUTCOMES

The descriptive statistics are presented as graphs in Figures 3, 4, 5, 6 and 7 comparing the survey results at the beginning of semester with those at the end of the semester. For all questions, there was a noticeable improvement in students' perceptions of their mastery of the knowledge or skills addressed by the questions. For example, in Q. 1, students who agreed or strongly agreed that they knew what career they would like to follow at the end of their degree increased from just over half (51%) of students before the project began to 61% once it had concluded. The number of students who disagreed or strongly disagreed with this statement halved from 16% to 8%. For Q. 2, students who agreed or strongly agreed that they were aware of career options in IT increased enormously from 43% to 81% over the course of the semester, with a decline in those stating they disagreed or strongly disagreed from 18% to 4%. On Q. 3, students who agreed or strongly agreed that they knew what IT major they wished to pursue increased from 55% to 67%, while the number who disagreed or strongly disagreed fell from 19% to 6%. The results for Q. 4 showed that students who believed their video-recording knowledge and skills were good or excellent grew from 46% at the beginning of semester to 56% at the end, while the number of those who assessed themselves as poor or very poor more than halved from 14% to 6%. The final question likewise showed marked increases in students' self-assessed learning: there was an increase from 39% to 51% of students who believed themselves to have good or excellent video and/or audio editing knowledge and skills, with a large drop from 24% to 9% of those who believed they were poor or very poor by the end of semester.

The results of the *t* test comparing students' perception of their knowledge before and after undertaking the IT Careers Project are presented in Table 1. It can be seen that, for all items rated by

Figure 3. Awareness of chosen career (Q. 1)

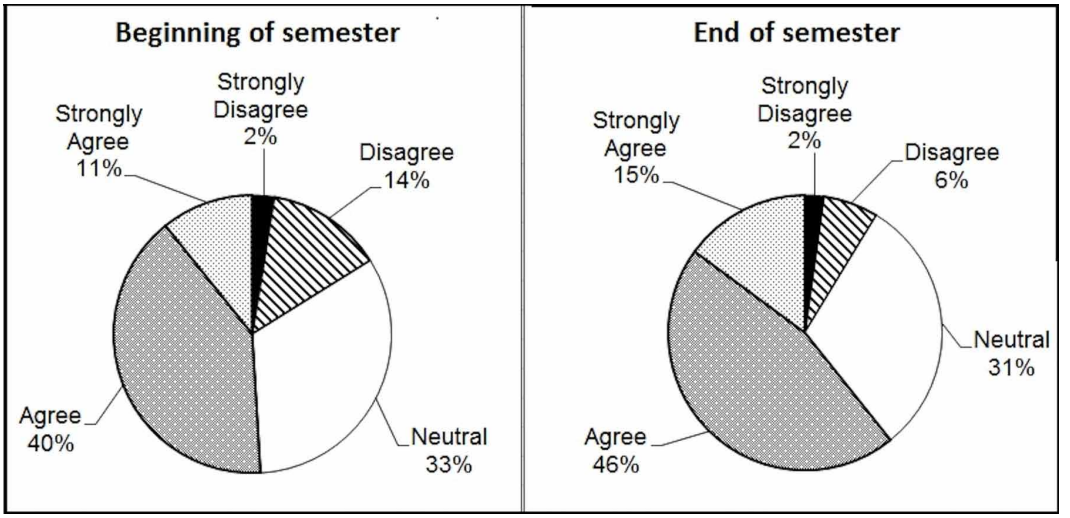
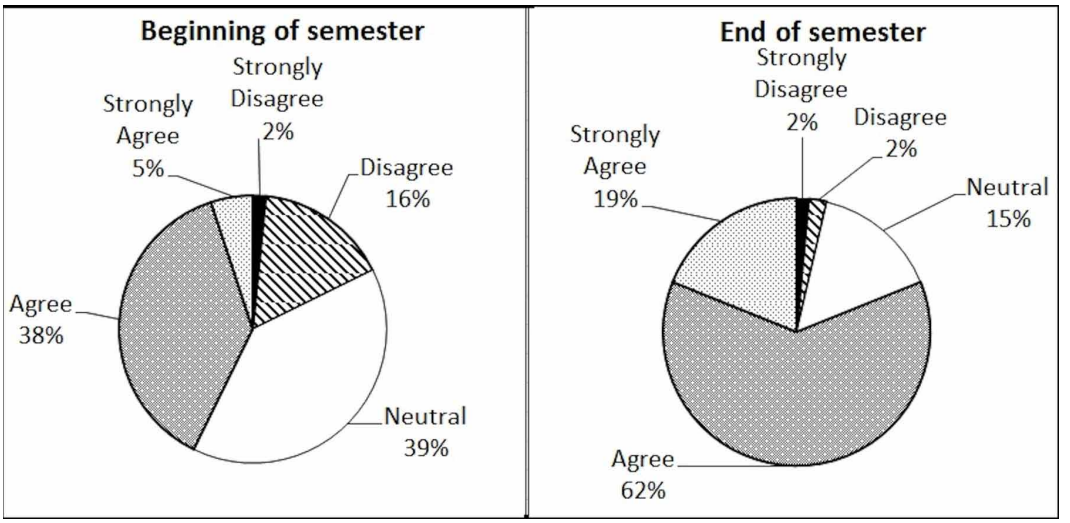


Figure 4. Knowledge of career options (Q. 2)



students, the mean rating at the end of the semester is significantly higher than at the beginning of semester, at least at the 0.005 level of significance. For items 2-4, the significance is in fact higher, at the 0.001 level.

Thus, according to students' self-evaluation of their knowledge about IT careers and their multimedia recording and editing knowledge or skills, the project was extremely successful. The two main learning objectives of the project were realized, based on students' self-reporting.

Figure 5. Knowledge of IT majors (Q. 3)

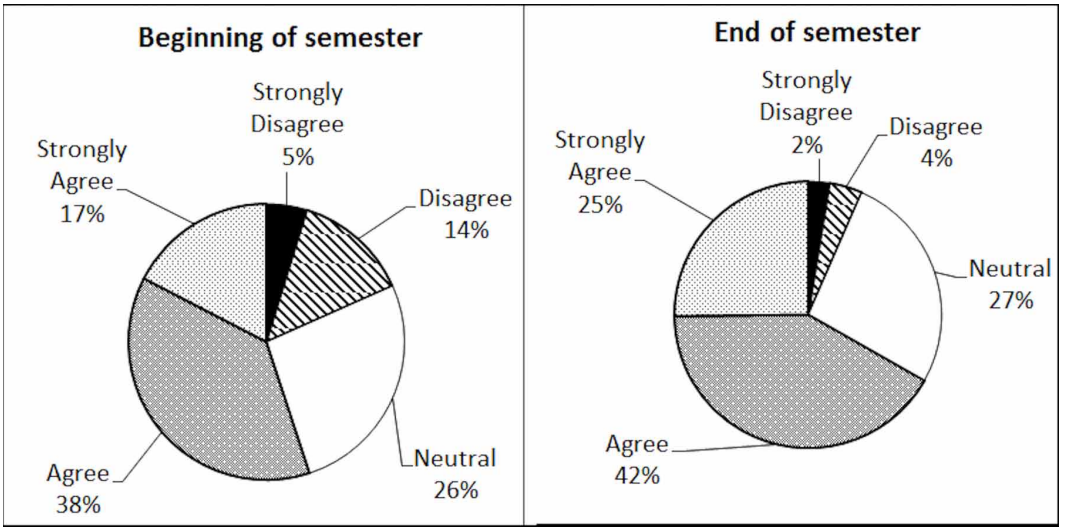
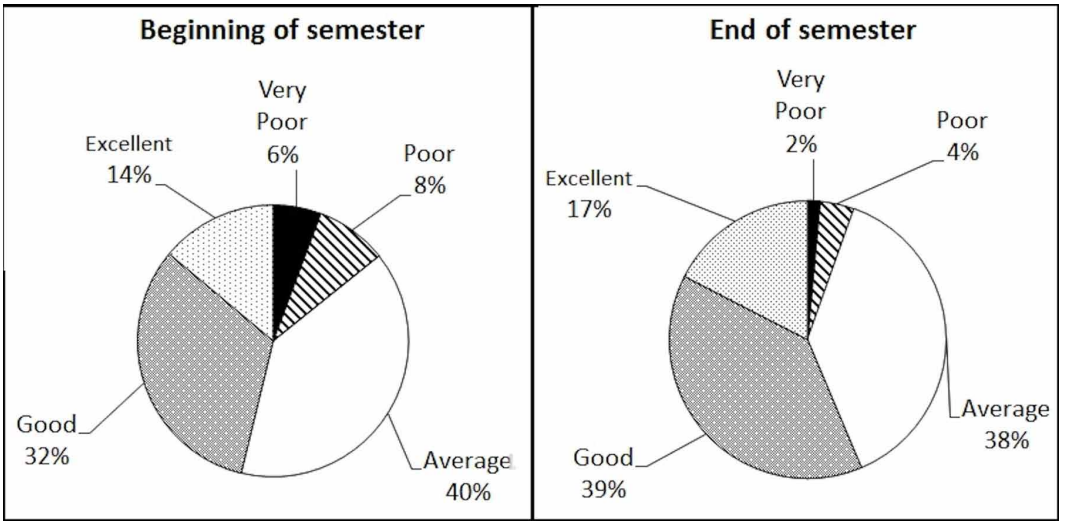


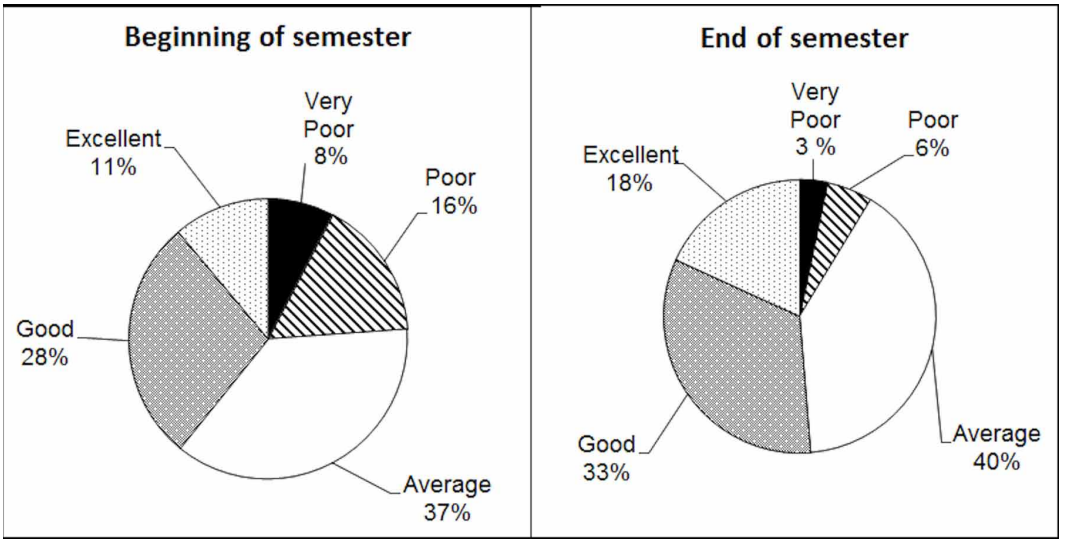
Figure 6. Video-Recording knowledge and skill (Q.4)



RESEARCH METHODS PHASE 2: QUALITATIVE ANALYSIS OF STUDENTS' LEARNING PROCESSES

Following the findings from the student surveys, research was conducted the subsequent year to discover why the IT Careers Project had been so effective in teaching the students about careers. As the students completed their work by themselves and away from the classroom (unlike Hoban and Nielsen (2010), Rocha and Continho (2011) and Schuck and Kearney (2006)), their learning processes could not be directly observed and another method had to be adopted. The new cohort of students was asked to report on their learning by means of a weekly team Diary and end-of-semester team Reflection. The hardcopy Diary and Reflection was submitted by each team of students at the

Figure 7. Video/Audio editing knowledge and skill (Q. 5)



end of semester and a random selection was then entered into a spreadsheet, totaling 45 Diaries in all (almost half the Diaries submitted for the subject that semester).

In the Diary, students recorded their activities during the project, how they organized their work and how they overcame any obstacles. A further random selection of 16 Diaries was made from the initial 45 and a thematic analysis was conducted of students' entries over the 10 weeks of the project: the information was sorted into themes based on student activities, with the resulting artefacts or representations also recorded, or inferred if necessary, from the stated activities. The thematic analysis was conducted by a research assistant and one of the authors, with cross-checking to minimize subjectivity and improve reliability of themes identified. This analysis revealed the key activities undertaken by students, the artefacts they produced, and the way in which their knowledge was represented and transformed as the project progresses.

Table 1. Students' self-reported learning

Statement/Question	*Survey*	*Mean Score (out of 5)*	*Analysis using 1-tailed t test*		
			t (df)	*p*	*Sig.*
1. IT career to be followed	Post	3.65	2.865 (589)	0.002	$p < 0.005$
	Pre	3.43			
2. IT career options	Post	3.95	10.007 (589)	0.000	$p < 0.001$
	Pre	3.29			
3. IT major	Post	3.83	3.995 (588)	0.000	$p < 0.001$
	Pre	3.49			
4. Video recording skills	Post	3.67	3.419 (589)	0.0005	$p < 0.001$
	Pre	3.40			
5. Video and/or audio editing skills	Post	3.58	4.600 (589)	0.000	$p < 0.001$
	Pre	3.19			

Following this analysis, the 45 Reflections were examined for insight into how mobile learning contributed to students' learning, specifically the impact of the workplace context and the contribution of mobile technology in capturing students' knowledge of the careers studied and sharing this knowledge with other students. Information on these aspects was gathered mainly from students' comments in response to the Reflection questions, "What were your key learnings about IT Careers? How did the Careers Project contribute to your learning about IT careers?" and "What were your most interesting experiences during the Careers project?"

In addition, comments on collaborative knowledge-building processes and metacognitive processes typical of project-based learning were noted from the 45 Reflections, in particular in the answers to the questions, "What skills did you acquire during the Careers Project? How did the Careers Project contribute to your development of these skills?" and "What were the main problems you encountered during the Careers Project, how did you deal with these and how could you have handled things differently?"

The data was categorized and is summarized in Tables 2 and 3. Due to the nature of the qualitative research, where student teams were allowed a high degree of freedom in what they chose to record, and no follow-up clarification by the researchers was possible, no quantification of the data was deemed to be appropriate. In this context count-data of thematic data were felt to be inappropriate and potentially misleading. Instead, where it was clear from the weekly diaries and end-of-semester reflections that most or only a few students expressed a certain idea, we have mentioned this. We have quoted freely from the student's Diaries and Reflections since these represent the main source of evidence to support the concepts regarding the students' learning processes; this format allows the data to speak for itself and the students' voices to be heard.

RESULTS OF THE QUALITATIVE ANALYSIS: STUDENTS' LEARNING PROCESSES

The results of the thematic analysis of students' team Diaries are given in Table 2. The main activities appear in the order in which most teams recorded their commencement of the associated tasks (for example, all but one team stated that they undertook team organization activities right from the beginning). However, main activities often overlap, with teams inevitably commencing preparation for their video before the interview, and the filming of video footage taking place at the interview. Also, a minority of teams chose to undertake the final editing of their video directly into the vodcast format and show this at their class presentation, instead of a draft version of their video, thereby compressing two main activities into one.

Not all students recorded all activities or tasks listed. For example, only 8 out of 16 teams explicitly noted that they had performed background research. Though all teams organised their teams, a range of approaches was used: 4 teams stated that they had set up a Facebook page and 1 team used Google Docs to manage team discussions and contributions. Only 4 teams recorded having used brainstorming as a creative thinking technique.

Some of the students' activities are of a pragmatic nature, particularly Team Organization and Project Planning. Though developing skills in these areas was not the main aim of the assignment, they are highly valuable and, indeed, necessary skills for any IT graduate to possess. Thus, the opportunity for students to practice and learn these skills, often by trial and error, was a valuable part of the project. Students' comments in their Diaries sometimes show their awareness of this, as was the case with one team: "[Week 4] People don't get along well. - Still figure out how to make it better. … [Week 5] Try to strengthen the relationship (first time, so need more time to work in a team). - Go out for drinks. [Week 7] Conflict of time between members - negotiate between members - Compare timetable then finally have a good time."

Table 2. Key project activities and outputs

Main Activities	*Tasks*	*Artefacts or Outputs*
Team Organization	Form team Exchange contact details Email or message team members Assign roles and allocate work Set up Facebook page, Google Docs, etc. Build relationships Establish rules for team operation	Contact list of members Emails, messages Agreed roles Online collaborative space Team rules
Project Planning	Brainstorming Plan project Discuss/choose career/IT professional Contact/email IT professional Make appointment	Ideas for proceeding with project Project plan Choice of career/ IT professional Contact details Appointment
Background Research	Research an IT career Research the IT professional, and his/her organization Incorporate into interview questions, video or presentation	Research notes or downloads
Interview	Plan interview; interview techniques; roles of team Draft and refine interview questions Practise interview Conduct interview Inspect workplace	Interview plan Interview questions (draft, final) Interview answers Observations of workplace
Video Production	Book/choose video equipment Learn how to make a video, test equipment or practise View past examples of vodcasts Design video (length, look, etc.) Record interview Develop script Locate editing software Initial editing/cutting of video footage Edit audio track Incorporate video into presentation	Equipment booking Design of video Rough interview footage Script Draft video
Presentation	Plan presentation Create presentation slides Script presentation Assign roles Rehearse presentation Present slides and video to class Watch other groups' present and comment	Presentation outline/plan Presentation slides (draft, final) Rehearsal Oral and multimedia presentation
Vodcast Production	Locate editing or file conversion software Editing of video and audio Compress/shorten video to make vodcast Upload vodcast to LMS View other teams' vodcasts	Final edited vodcast

Iteration of Learning Activities

One of the most obvious features of the project was the large number of tasks that student teams needed to undertake in order to complete the project successfully. In addition, many of the Diaries showed how teams had to revisit tasks more than once, with students creating drafts before the final artefact was arrived at. This was very noticeable with the development of interview questions, for example with one team having a delay in being allocated their interviewee: "[Week 6] Each team

Figure 8. Student team practising with a university video kit

member individually wrote a few questions for generic IT professional as we wait for [the university] to assign the group a professional. … [Week 7] assigned an IT professional to our group, we then wrote further questions pertaining to his specific field, being Software Development and 3D Effects. [Week 8] The group meet on campus to choose a final list of questions from a bank of questions we individually formulated." This reiterative nature of some of the tasks can reasonably be interpreted as contributing to the outstanding learning outcomes from the project.

Most teams encountered technical difficulties, often due to poor planning, for example not testing or practising with the video equipment before arriving in the IT professional's workplace for the interview, or not participating in the video workshop that was offered to all students on a voluntary basis. Only one team recorded sending a team member to the workshop; this team member then reported back to his team on what he had learnt. This meant that a lot more work had to be done during the editing phase. Few students seemed to have had video experience but were prepared to work it out, for example: "[Week 8] The microphone given wasn't working so we had to use the default camera mic. - We learned that we should have checked the equipment before using it. [Break Week] Edited a bit of the video interview, but not yet finished. The raw format from the camcorder wasn't compatible with the video editing software. - Found a program and learned how to convert it to a recognisable format e.g. avi. [Week 9] Finished off the editing of the video. [Week 11] Rewatched video to see if there are anymore improvements to be made. - Checked to see if there is anything wrong. [Week 12] Tried to fix the audio of the video. Audio was difficult to fix". However, these students found the video-making the most engaging aspect of the assignment. Informal conversations with other students during semester confirmed that many found the chance to use the professional video and audio recording equipment provided an exciting and motivating opportunity (see Figure 3), even though some chose to use their own smartphones and video cameras for reasons of convenience.

Some teams turned their technical problems to advantage, like the team who had to go back to the workplace to conduct and record the interview a second time: "With the second interview, we used multiple angles and it can be considered new skills have been learnt." This team actually went to the IT professional's workplace three times in total as, the week after the initial interview, they went to take "photos, and additional videos for the vodcast and meet other staffs." This supports the view that repeated attempts and more time on task probably contributed to learning, that is, there was a practice effect. Certainly, changes in students' perception of their knowledge and skills of video recording and editing over the course of the project were highly significant (Table 1).

Table 3. Representations of careers and multimedia knowledge

Main Activities	*Major Representations*
Project Planning	Choice of career and IT professional
Background Research	Research notes or downloads
Interview	Interview questions and answers Workplace observations
Video Production	Video footage
Presentation	Presentation slides Oral and multimedia presentation
Vodcast Production	Vodcast

Evolving Representations of Student Knowledge

In addition to the practice that students received through their oft repeated attempts at tasks – the successive drafting of their interview questions and presentation slides, and their planning and design of various aspects of the project – there is also evidence of an evolution in the way that their knowledge about the IT career was presented. Extracting some of the main representations from the multitude of artefacts shown in Table 2, and concentrating on the six main activities that contributed directly to their learning about IT careers and development of multimedia skills, one can see a variety of representation formats, or modes, and an increasingly sophisticated expression of the students' knowledge as they progress from their initial choice of career and interviewee, to the interview (oral and audio) and workplace visit (visual), to the video production (video), class presentation (oral, multimedia), and finally to the production of the vodcast (Table 3). It was not obvious from most of the Diaries, but was very clear from viewing the students' uploaded vodcasts, that these were highly crafted representations, with "intros," "outros," titles, captions, background music, humour, and special effects. This diversity of representational modes and the multiplication of meaning contained within this evolving representation of careers knowledge may well contribute to the students' achievement of enhanced learning outcomes, as proposed by Hoban, Loughran and Nielsen (2011) and Hoban (2016).

Context and Content in Mobile Learning

Students' group reflections on "What were your key learnings about IT Careers? How did the Careers Project contribute to your learning about IT careers?" often showed that they appreciated the context of the learning activity. The project allowed them to learn aspects of a career that would probably not be part of any textbook or website job description, such as dress codes, behaviour in the workplace, communication styles, workplace culture, the work environment, and how job structures varied between small and large firms. As one team wrote, "Learnt about daily life – couldn't be googled! – More direct way of learning – great experience."

Of the 45 student reflections examined, 43 stated that it was a highly motivating way of learning when responding to the question, "What were your most interesting experiences during the Careers project?" A major factor was the workplace learning context: for example, the "most interesting experience during this project was to go to an IT professionals workplace and gain a first hand experience of their work environment and see what they do on a day-to-day basis" (Figure 4).

Talking to the IT professional provided information about the career (Figure 5) and also inspiration and motivation: "The opportunity to interview with an IT professional was definitely considered the most interesting part of our careers project. The interview allowed us to experience what it was like to be a network administrator for a day, as well as providing us with some interesting facts and opinions about the occupation. This was further exciting for our team as some of our members are genuinely

Figure 9. Network administrator on the job showing the workplace environment

interested in becoming a network administrator, and only increased their goal of becoming one." Another student noted, "The interview was the highlight of this whole experience. To see someone talk so enthusiastically about IT was very uplifting and made me happy to be doing IT." The project thus gave students "a vision for their careers" (Cox, 2016, p. 93).

Capturing Context and Content through Mobile Devices

One question that must be asked is whether students learnt from watching the videos shown in the class presentations and the vodcasts viewable from the LMS, or was the learning chiefly related to their own experience in the field? In other words, did the affordance of the mobile devices (video cameras or mobile phones) for capturing and sharing information about the career contribute to the learning outcomes? Though for most students the visit to the IT professional's workplace was a compelling experience, a number of students' reflections noted that they also learnt from their peers and this allowed them to learn about more than just the one career they had investigated themselves. For example, one team wrote that, "We were unaware of many of the IT jobs that had been studied. It always looked like a great workplace environment and almost all of the jobs had opportunity for advancement". Another team stated that "Because we watched the videos of other groups, we learnt about far more IT jobs"; while another group confessed that their most interesting experience in the project was "Watching other people's vodcasts and learning from them."

Thus, the significant increases in students' learning of careers and career options, as reported earlier, did not just derive from the single encounter with one IT professional. The video content captured the context of the workplace-based interview and conveyed this to other students. Without this support from mobile technology we can surmise that the learning achievements would have been much less.

Figure 10. Business analyst (left) talking with student interviewer (right) and discussing typical documentation required for the job

Collaborative and Metacognitive Learning Processes

There is an ample body of literature detailing the power of collaborative learning dating back at least to the 1980s (Webb, 2013), and teamwork was certainly a prominent feature of the assignment, as it is in many complex student-generated multimedia projects. The Reflections showed that on one level groupwork increased the engagement of the students with the project: "Overall the project was fun and enjoyable, working in a class team is always great fun. Work and a balance of laughter!", wrote one group. In addition, collaboration was perceived as contributing to a successful outcome: "Without teamwork the presentation and the vodcast would not have been completed. We were able to share our ideas as a team from the beginning to end."

Many teams divided up the work according to the skills of individual team members. Some, however, failed to take advantage of the peer learning that collaboration can bring. For example, most members of one team seem to have *not* learnt video-editing skills because they assigned this task to one sole student: "At the beginning of the project none of us knew anything about video editing and because the time was not much; we have decided that one person [student's name] should have worked on that part only, in order to acquire the skills in time; so [student's name] has acquired some skills in video editing. … if we had had more time we would have liked to do the video editing together." However, this team did learn from examining other teams' work: "looking at the videos on [the LMS] we have understood that the sound in the video is very important, because in some videos the questions and answers were not easy to be understood. -Looking at the presentations of our classmates has helped us avoiding some weaknesses in our job."

Nevertheless, others were successful in availing themselves of the opportunity to learn from their own group members. One team reflected that "Since different members had different skills, we got to learn new things from each other during the project which made it much more interesting than it

would have otherwise been"; while another noted that "As each team member was involved in each stage one way or another, we felt we had all gained skills which we had earlier not refined." Video editing was by far the most commonly mentioned skill that peer learning contributed to: "…one issue we had to grapple with was that of video editing. With nobody in the team who was familiar with video editing, we had to work collaboratively in completing the video stage by stage."

Metacognitive processes often worked hand in hand with the collaborative processes, both contributing to learning: "We had built up a lot of team work skills including constructively criticizing each other's work in order for each member to make improvements on their work and learn from their mistakes. We also learned to resolve faults and conflicts by doing team votes and deciding as a team which would be the best solution to the problem. Our team communication was another skill we learned as we kept our team informed of any issues that arose, as well as discussing and solving problems together instead of doing individually. … We accepted the fact that we had to be responsible to the team, thus we each gave ourselves a deadline in which we aimed to complete a particular task and that we had to stick to our schedule."

Specific metacognitive processes mentioned in the Reflections included project management, time management, organizing, planning ahead, dividing the project into phases, documentation, prioritizing, problem solving, learning from mistakes, evaluating solutions, constructive criticism, being versatile, having a "logical mind set" and being "logistically prepared". This is supported by Thomas (2000, p. 38), who notes that project-based learning is "an effective method for teaching students complex processes and procedures such as planning, communicating, problem solving, and decision making".

CONCLUSION

The IT Careers Project has been extremely successful in giving IT students the opportunity to become better informed about careers in their field of future employment while developing the multimedia communication skills they need increasingly today. In fact, students' self-reported learning on these two key learning objectives has been shown to be statistically significant. The project has moreover been an excellent vehicle for students to develop soft skills, such as teamwork and the ability to plan and manage a project. The varied skills listed by one team comprised, "Definitely team skills, interview skills, interview set up skills, video editing skills and overall time management skills. The careers project involved all these aspects not just one aspect as such it helped us obtain these skills altogether, as it was different to normal paper and pen assignment - it was practical experience."

Despite the difficulty of assessing mobile learning undertaken by students in the field, independently of their teacher, a method was adopted using students' Diaries and Reflections to understand the learning processes and why such good learning outcomes had been achieved. This revealed several contributing factors. Firstly, a practice and "time spent" effect, through reiteration of tasks and the large amount of effort and time dedicated to achieving the desired goals. This was particularly noticeable in students' development of multimedia skills. Secondly, there was a progression in the way students' knowledge of the career was represented, and these representations showed an increasing sophistication in terms of the multimedia format (Hoban, Loughran, & Nielsen, 2011; Hoban, 2016). Thirdly, the context of learning and meeting the IT professional were extremely motivating to most students, and this was enhanced by the ability of the video taken with a mobile device to communicate the workplace context to other students in the classroom and via the LMS in a much more powerful way than is usually possible with more traditional media such as text. In addition, collaborative learning (including peer learning) was shown to contribute to the students' learning, with metacognitive processes advancing the conduct of the project.

With complex, multimedia, team-based, mobile-learning projects such as this – set in a real-life context outside the classroom – there are no doubt many factors which enhance students' engagement and challenge them to achieve good learning outcomes. Future research should shed more light on our

understanding of the complexities of how students learn in these circumstances. In the meanwhile, however, our students can continue to benefit from an approach to learning which reflects the reality of their world – a world in which almost every student comes to university armed with a mobile device and a world no longer predicated on print, but saturated with multimedia.

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