Assessing Students' Experiences in a Virtual Learning Environment

Sivachandran Chandrasekaran, Julius Orwa and John Long
School of Engineering, Deakin University, Geelong
Corresponding Author Email: siva.chandrasekaran@deakin.edu.au

CONTEXT
Technology has played an important role in the provision of educational equity for learners in Australian communities. Engaging off-campus students through technology resources is vital for a virtual learning environment in engineering education. To ensure a positive experience for the students in off-campus (virtual) learning, the use of modern technology is crucial for collaborative and active learning.

PURPOSE
Design based education is a combination of project based and problem based approaches. Through small or big projects, students work in teams with combinations of off-campus and on-campus students. Integration of technology resources takes place within these groups through collaborative learning and active learning. Even though the facilities and technology support are provided for off-campus students, there is always a gap in fulfilling the off-campus students' learning expectations in a virtual learning environment. Technology plays an important role in providing student engagement in solving design problems, which is a need for the distance learner community in future. The purpose of this study is to evaluate students' experiences on the use of technology in learning and teaching, which is delivered in off-campus mode.

APPROACH
The cohorts of students involved in this online survey are from first year undergraduate engineering in Trimester 2, 2016. The online survey analysis of students' perceptions will help teaching staff to better understand and assess off-campus students' experiences, challenges and barriers in a virtual learning environment.

RESULTS
The distance learners' experiences are analysed from an online survey. This online survey analyses the students' experiences on use of technology and how it supports and enhances students learning in distance mode. It also analyses the student learning experiences on project/design-based learning approach in engineering. In this particular unit (Electrical Systems), students work in teams of 2-3 on lab work and other assignments. The analysed results also discuss the students' perceptions on teamwork, communication, interaction and assessment.

CONCLUSIONS
The aim of the engineering curriculum is to provide learning and teaching support equally for both on-campus and off-campus students. From the analysed survey results, this study reveals that the use of technology plays a vital role in students learning from availability and accessibility of materials to assessment methods, lab tutorials, and online seminars. In a project/design based learning curriculum, the distance learners have an equal opportunity to enhance the learning skills as the on-campus students experience in a study environment.

KEYWORDS
Cloud learning, Project/design based learning, Collaborative learning, Active learning.

Introduction

In maintaining the quality of delivering an education program, academic institutions have prioritised the significance of distance education and distance learners. Technology plays an important role in delivering a curriculum program to students studying in both on-campus and off-campus mode. The teaching environment, teaching support and teaching team have to be committed, equipped and adequately resourced to support integration of technology into engineering education. It is a challenging task for teachers to ensure that effective distance learning is offered to off-campus students through innovative technologies and technology spaces. The focus of this study is to analyse student perceptions on the distance learning experience in a particular unit. The cohort of students involved in this study is undertaking first year engineering study in distance mode.

Bradley intended that Engineers Australia's policy on accreditation of engineering programs offered in distance mode guidelines states, "Electronic and face-to-face opportunities must be provided for distance mode learners to interact, particularly to ensure that group and team based learning experiences are equitable for both on-campus and off-campus students" (Bradley, 2011; Engineers Australia, 2011). Chandrasekaran states that Deakin University has provided Cloud Deakin (Cloud learning environment) to incorporate a range of spaces and tools to enable interactive and engaging learning for on/off campus learners (Chandrasekaran, 2014). Chandrasekaran found that this cloud learning environment allows students to access unit content and course information including assessment items, and support materials; engage with lecturers and other students using Blackboard collaborate (virtual classrooms); listen to recorded lectures; join live streaming events and create student personal portfolio for highlighting their learning achievements (Chandrasekaran, 2014).

Deakin University is a regional university and is also Australia's largest provider of distance education. For almost three decades, Deakin has had more than 60% of its students enrolled in distance mode. The School of Engineering has been practising design-based learning in various units in every trimester. The purpose of this study is to assess students' experiences on use of technology in learning and teaching, which is delivered in off-campus mode (virtual learning environment). The study currently evaluates the distance learners' experiences in a particular unit (Electrical Systems) in the first year of an electrical and electronics engineering course.

Distance Learning and Distance Learners

In distance learning, it is always a challenge for an academic to provide appropriate course content and activities that maintain a quality of delivery equal to that for on-campus students. Distance learners are capable of undertaking coursework through online education, which allows them to balance work and study. The distance-learning mode has provided various curriculum opportunities for students learning away from campus environment. It provides a virtual study environment that enables students to acquire technical/social knowledge and also reveals the quality of learning and teaching towards career opportunities. Also Steven states that although the role of technology will never replace the academics in any curriculum, it provides ways to enhance and fulfil the quality of delivering the education in distance learning (Stevens, 1994). The study conducted by Mills and Zhuge mentioned that the use of online communication technologies overcome the teamwork problems identified by the students (Zhuge & Mills, 2010). Michael et al. (Simonson, Schlosser, & Orellana, 2011) claim that researchers focused on enhancing learning experiences for distance learners by using technology-oriented learner centred approach.

Technology has played a vital role in the history of distance education from the early stages of correspondence education to electronic mails, which brought the education to isolated individuals in remote places. Author Grevelle Rumble reminds that the fourth generation of education in early 1980s was developed by the growth of new revolution of technology

through powerful PCs, which opened the way for online education and virtual classrooms to be possible (Rumble, 2001).

At Deakin University, the learning and teaching delivery is a combination of cloud and located learning activities. Cloud learning (online learning) enables students to evidence their achievement in distance learning. Catford states that the units contain integrated short, accessible, highly visual, media-rich, interactive learning experiences rebuilt for the mobile screen, and integrating learning resources created by Deakin to provide worldly and premium experiences for distance learners (Catford, 2012). Dianna intended that in cloud learning, students have an opportunity to become generators of content, collaborators in solving real world problems, and are able to evidence their achievements in professional and personal digital portfolios (Dianna, 2005). The following facilities such as collaborative learning, technology integrated design centric practice and virtual learning resources are offered and continuously support the distance learners' learning at Deakin University study environment.

Collaborative Learning in Distance Education

The technology-oriented experiences for the students take place in a digital environment where students are able to connect with peer learners, teaching staff, and mentors, and have the ability to create evidence of their achievements in the curriculum. Crease and Valentine state that off-campus learning experience looks to harness new technologies to provide highly visual, media rich, interactive learning experiences to engineering students at various locations and times, which suit the students' availability (Crease, 2011; Valentine, 2002). Mühlfelder & Chandrasekaran also claim that providing this experience requires the use of new delivery platforms with educational technology resources that are media rich and engaging (Mühlfelder & Chandrasekaran, 2015). It also requires an innovative strategy in assessment and assessment pieces that are able to provide meaningful feedback to the students.

The students learn the importance of teamwork through collaborative learning. The distance learners are away from each other and away from classroom environment. Technology is used as a stream to connect those students, which creates an online collaborative environment such as Cloud Deakin (virtual learning environment). It provides opportunities for students to share their individual experiences and exchange ideas amongst themselves. The students, as collaborative learners, develop social skills through the virtual learning environment. Thus use of technology helps the students to balance life, work and study.

Technology Integrating Design Centred Practice

Technology integrated design-centred curricula are designed to motivate students and teach engineering in a way that is student-centred and project driven. Boling states that the design-centred curriculum integrates off-campus and on-campus student learning, which allows students to learn through design activities in the distance-learning mode (blackboard discussion forums, peer-peer interaction) and through interactive classrooms (Boling, 2012). Design centred curriculum is set to have a positive effect on student content knowledge and the development of skills such as collaboration, critical thinking, creativity, innovation, and problem solving, which increase their motivation and engagement by new technology integration.

The project/design based learning approach is practiced at various levels of engineering at Deakin. Littlefair claims that the students have an opportunity to enhance the capability of learning from theory to practice with the curriculum infrastructure CADET "Centre for Advanced Design in Engineering Training". CADET emphasizes engineering design and development through virtual and physical modelling, simulation and prototyping – skills at the heart of the 21st century engineering challenges (Littlefair, 2012). The project-oriented design based learning approach (PODBL) is a learning and teaching model where students

learn through projects around design-focused activities that involve studio based learning environment at Deakin.

Virtual Learning Resources and Tools

The virtual learning environment (Cloud Deakin) harnesses new and emerging technologies to provide highly visual, media-rich, interactive learning experiences especially for off-campus students. Stuart Palmer claims in his research study that virtual learning environment enables distance education students to be comfortable with learning resources and be confident in adapting and acquiring new engineering skills (Palmer, 2003). The virtual learning resources provide students a space to access the academic environment through digital devices. Stuart Palmer also claims that moreover it is a space for distance learners to engage, interact and to manage peer-to-peer and work integrated learning (Palmer, 2001). Cloud Deakin is the University's virtual learning platform environment, which provides media rich, highly visual and interactive learning experiences to the students. It allows both on/off campus students to connect with teaching staff, mentors, peers and employers that enhances the students' positive learning experiences. Cloud Deakin incorporates a range of spaces and tools such as

- Cloud Deakin e-Portfolio tool for organising and reflecting learning skills
- A homepage leading to unit sites (audio and video resources)
- Access to units, course information, weekly lectures, assessment materials
- Access to virtual classrooms - Bb collaborate session (e-live session) to interact with teachers, tutors and peers (Long, 2014)
- Space to watch weekly recorded lectures – Echo system
- Tools for discussion forum, online quizzes
- Ability to submit assignments, receive timely feedbacks.

Design/Methodology

The students' who have participated in this paper-based survey undertake a first year engineering unit that introduces students to the fundamentals of electrical systems. The unit begins by introducing the concepts of electric charge, electric fields and electric potential. Capacitance, resistance, inductance are covered, followed by a study of alternating current and resistor-capacitor, resistor-inductor, resistor-inductor-capacitor circuits. It also covers semiconductor devices, the characteristics and application of diodes, rectifiers, bipolar-junction transistors and op-amps are considered. This unit has four assessment tasks, namely examination (50%), practical reports (25%), online test and problem-solving assignment (12.5% each) for a total of 25%. To be eligible to obtain a pass in this unit, students must achieve an overall mark of at least 50% in the unit, at least 40% in the examination, and a minimum of 40% on the practical reports. The purpose of this study is to analyse off-campus learners' experiences on teaching and how technology helps to enhance students' learning away from a located learning environment. The survey questions are listed in Appendix A.

Questions one to five enquired about students' experience on the impact of using technology in learning, experience with online technologies/activities, resources' help to achieve unit learning outcomes, how use of technology affects students' ability to achieve graduate learning outcomes (GLO) and factors influencing student engagement in the particular unit studied through virtual environment. The reason for those questions is to analyse current cohort with future cohort of students' study through new learning and teaching approach.

Teaching - Weekly Activities

Table 1 below outlines the unit weekly activities. Since the unit provides a first year introduction to Electrical Systems, its content spans the full range of topics in electrical systems (DC Circuits, AC circuits and Devices). After introducing the basic quantities and

units used in electrical systems in Week 1, DC circuit topics including Ohm's law, Energy, Power and their applications in Series Circuits, Parallel circuits and Series-Parallel circuits are covered in weeks 2 to 4. Topics in AC circuits, including AC generation, RC circuits, RL circuits, RLC circuits and Transformers are covered in weeks 5 to 8. Weeks 9 to 11 are devoted to Devices and include topics such as Diodes, transistors and operational amplifiers.

Table 1: Weekly Activities

Weekly Topics		**Teaching Process**		**Deliverable**	**Practicals**	
Week	Topic	On Campus	Off Campus	On/off campus	On	Off
1	DC Circuits	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials			
2	DC Circuits	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials		✓	
3	DC Circuits	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials			
4	DC Circuits	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials	Assignment 1 – online test	✓	
5	AC Circuits	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials			
6	AC Circuits	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials		✓	
7	AC Circuits	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials			
8	AC Circuits	2 hr Lecture, 1 hr Seminar, lecture materials	Intensive Week (residential week)	Assignment 2 – Problem solving		✓
9	Devices	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials			
10	Devices	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials		✓	
11	Devices	2 hr Lecture, 1 hr Seminar, lecture materials	Recorded lectures, 2 hr Bb collaborate, lecture materials	Assignment 3 – Practical report		

The conceptual content is delivered on-line in a manner similar to that by Long (Long, 2015) used to teach first-year physics. A series of recorded video presentations on the various

topics and subtopics are embedded in the unit website. Students are instructed to watch the videos and read the text material before class time. In place of traditional lectures, the instructors mainly conduct problem-solving sessions. In the on-campus seminars, students spend time practicing problem solving in small groups where they are assisted by the instructor as needed. Off-campus students attend weekly online tutorials (Bb collaborate sessions) where they spend time with the lecturer going over concepts and solving problems. While the on-campus students attend the laboratory for 3-hour practicals on a bi-weekly basis, off-campus students come in and complete their practicals on a specified day during the residential week (Week 8).

Figure 1: SEE 103 Lab Spaces at CADET

The practicals are conducted in a modern and spacious laboratory equipped with computers, circuit boards, power supplies, digital multimeters, display units and all the accessories required for the students to conduct experiments and successfully collect data. Figure 1 above shows the Electrical Systems laboratory. The left image is a wide view of the laboratory showing the spacious and comfortable layout and the right view is a close up showing some of the equipment in the laboratory (Horan, 2014). The deliverables are the same for both on-campus and off-campus students and are due in Weeks 4, 8 and 11 as shown on Table 1.

Students' Perceptions

Results

The survey questions were given to 20 students who are studying the electrical systems unit in distance mode, 12 participants responded to the survey. The survey results are analysed and described below about students learning experiences on the use of technology, efficiency of online technologies and activities, learning resources and factors influencing engagement in distance learning. The survey results from this particular unit are appropriate for the current practice at Deakin virtual environment.

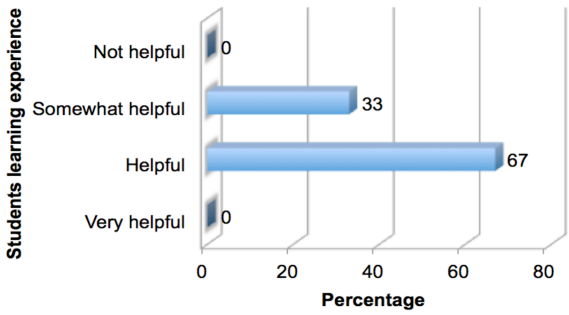

Figure 2: Students learning experience – use of technology

The analysed results will help the teaching team to incorporate changes and recommendations needed for future cohorts. The students' experiences in using technology such as Cloud Deakin virtual environment to learn and collaborate with peers is shown in figure 2. The off campus students say that the use of technology is helpful (67%) and somewhat helpful (33%) in studying the particular unit at Deakin. When students are asked about how efficient online technologies helped their learning in distance mode, all students (100%) mentioned that online technologies are very easy to use with very efficient (33%) and efficient quality of access (67%). Students also stated that online technologies/activities provided an efficient interaction between staff and students (table 2). The blackboard collaboration and interaction between the students was efficient to an extent for off-campus students, where the staff required to concentrate while teaching/facilitating in a virtual environment.

Table 2: Students' perception using online technologies/activities

Student Perceptions	Very efficient	Efficient	Somewhat efficient	Not efficient
Quality of access	33	67	0	0
Ease of use	33	33	34	0
Sufficient interactivity with staff/students	0	100	0	0
Use of and usefulness of blackboard collaboration for inter- and intra-team communication	0	67	33	0

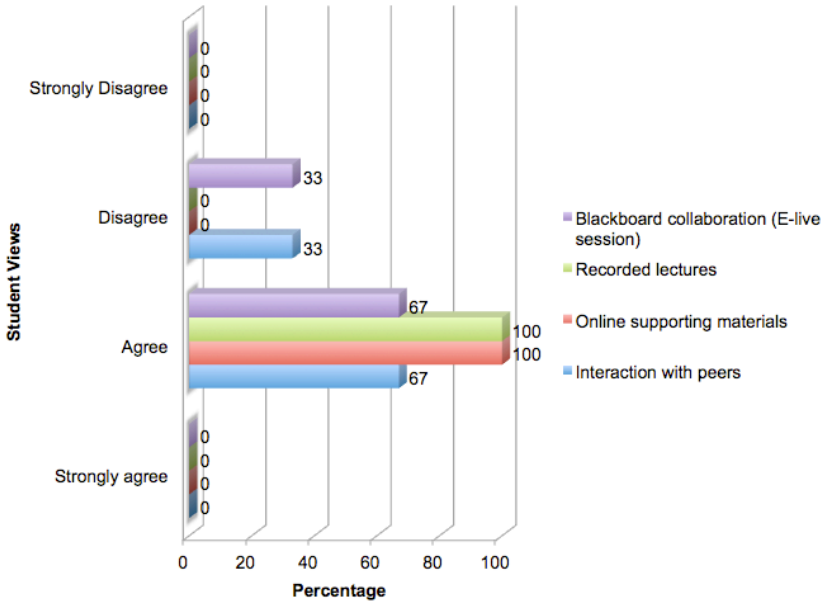

Figure 3: Students learning experience – learning resources

Figure 3 discusses the students' experiences with learning resources available in Cloud Deakin. It is clearly shown that most of the students (100%) agree that recorded lectures and online supporting materials helped to enhance their learning in the virtual environment. About 67% of students agree that the blackboard collaboration and interaction with peers provided a beneficial learning environment in distance mode whereas 33% of students disagree that interaction with peers and blackboard collaboration did not provide enough support. This is partly due to the unfortunate situation of some students living in different time zones from

that of the moderator or other students. Students learning in distance mode have to take time zone differences into account and plan accordingly to be able to attend the sessions and to interact with peers and moderator.

Students are informed of the learning outcomes that they need to achieve in each unit. The graduate learning outcomes are self-directed learning, communication, digital literacy, problem solving, teamwork, critical thinking, discipline specific knowledge and engineering application. When students are asked about how their learning ability in virtual environment helped them to achieve graduate-learning outcomes (table 3), about 67%(very much) of students mentioned that the use of online technologies provides comfortable environment to spend more time, having positive impact on individual learning and interaction with other students. 33% (somewhat) of students mentioned that an online technology does not really help in distance learning. For better learning and teaching, distance learners need to be self-directed learners who can balance life/work and professional activities.

Table 3: Students perceptions – ability to achieve graduate learning outcomes

Student Perceptions	Not really	A little	Some what	Very much
It is comfortable for me to spend more study time in distance learning mode	0	0	33	67
Have had a positive impact on the way I approach my individual learning in the course	0	0	33	67
Have had a positive impact on the way I interacted with other students	0	0	67	33
Have had a positive impact on the way I interacted with Information & Communication Technologies	0	0	67	33
Have made it easier for me to work more effectively on project/assignment tasks	0	0	33	67

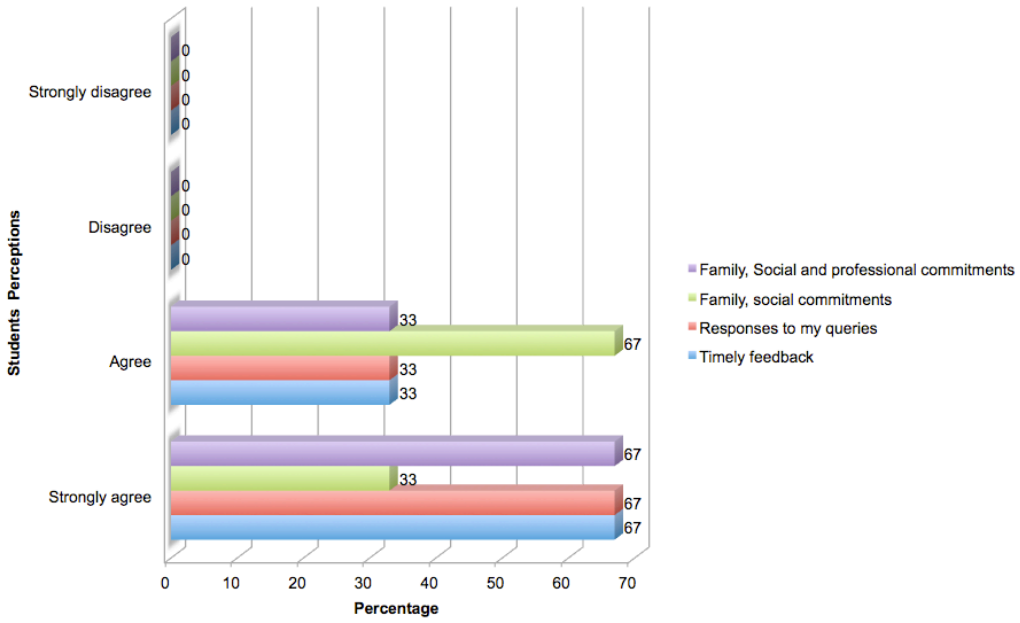

Figure 4: Students Perceptions – factors influencing engagement

When students were asked about the factors which influence their engagement in distance learning environment, about 67% of students strongly agree, 33% of students agree that timely feedback given by the facilitator/peers, responses to queries, family, social and professional commitments are the factors which highly influence their engagement during studies (Figure 4). Overall students' responses show that distance learners are satisfactorily knowledgeable in using the online technologies, which helps to enhance their learning capabilities in distance mode. Students expect a positive experience in off-campus learning and academics are prepared to maintain that foremost service of teaching and learning to distance learners. Decades ago, distance learning has started from the state of mail delivery education to one-one-device communication. The necessity for learners is always changing according to the medium of higher education taught. Students and academics are responsible for coming up with creative and innovative ways of enhancing learning that creates pathways to graduate career opportunities.

Discussion

An engineering curriculum has the responsibility of educating students in their engineering disciplines. Students have responsibility for acquiring quality learning. In each learning process, a student learns at his own pace and in his own learning style to achieve educational objectives. Through a chosen learning career path, students obtain a great opportunity to gain self-knowledge that helps them attain their full potential. The role of students in the project/design based learning approach is as follows:

- Ability to observe and react in a professional environment (self-directed learning).
- Identify and solve problems with interactive knowledge (outcome based learning).
- Getting involved with the practical application of knowledge (laboratories with breakout rooms).
- Being creative and innovative in solving design problems (analytical thinking).
- Be aware of industry graduate expectations and be career focused.
- Seek support and guidance from staff members (face to face interaction through DBL studios).
- Contribute engineering knowledge to the needs of society (industry based projects).
- Adapt to new values, customs, and learning styles in a working environment (career focused learning).

Based on the above responsibilities of students in a project/design based learning approach at Deakin, the delivery of cloud (online) and located (on-campus) learning is balanced by the appropriate use of technology and also by balancing the life/work and study commitments. From the above analyses it is clearly stated by students that family, social and professional commitments influence their engagement in studies in distance learning environment. Moreover, every student's responsibilities are to achieve the learning outcomes and follow the assessment criteria in their studies.

The project/design based learning approach is proposed at Deakin study environment to enhance on-line/on-campus students learning towards career focused, more hands on, outcome oriented, more self-directed and collaborative goals. Information gained from this study will be instrumental in restructuring the course to adapt to the proposed learning approach. The students' perceptions gained from this study will help us to restructure the unit to align with the proposed new learning and teaching approach.

Conclusion

Overall, the paper summaries the students' perceptions on the use of technology in a virtual learning environment at Deakin and how technology helps to enhance off-campus students learning outcomes. It summarises technology based education problems, issues faced by distance learners and their solutions. Integrating new methods of digital technologies in an

engineering pedagogy such as project/design based learning approach enhances off-campus students' learning ability and enables them to acquire skills to satisfy future industry career requirements. This research study ensures that virtual learning resources, tools for distance learners will help students to achieve 21st Century engineering skills. The design centered curriculum with innovative educational technologies is able to make engineering more attractive to students by enhancing or transforming teaching and learning through the use of technology in a virtual learning environment.

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Appendix A (Survey Questions...)

1. Based on your experience, what is the impact on your learning of the use of technology (Cloud Deakin) in distance education?
2. What is your experience with the following in using online technologies/activities in distance education?
3. The following learning resources have been helpful to me in achieving my unit learning outcomes?
4. In terms of your own experiences, how does the use of technologies affect your ability to achieve your graduate learning outcomes?
5. The following factors are important in influencing my engagement with this unit (SEE103)?