E-learning and learner needs in information and communication technology education

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ABSTRACT

This paper explores the use of e-learning by information and communication technology students in blended learning. Blended learning in this research refers to a study environment where face-to-face learning and technology-mediated (or online) interaction with peers, teachers and resources happen and students are enrolled in both on-campus education and/or distance education mode. In particular, this research explores how technology is used in information and communication technology (ICT) education in a university that offers blended learning. The sample data were many undergraduate students in seven different campus locations and a cohort of distance education students. They were all involved in a core subject 'Software Development' in a bachelor of ICT program that had three group work assessments. The findings indicate that while technology could effectively help students to collaborate in their group work and assessment tasks, some technological features in the learning management system are greatly subject to constant enhancement due to the nature of the subject requirements and the needs to facilitate frequent technology-mediated interactions in some situations. A model of group work collaboration is developed to explain the needs of new design and development of features in e-learning tools.

Keywords: *information and communication technology education, e-learning, blended learning.*

INTRODUCTION

E-learning is a form of educational technology. Many higher education institutions these days have a web presence of their learning management systems (LMS). The popular LMS are such as Moodle, Web-CT, Blackboard and Sakai. To facilitate collaboration in learning and teaching, many LMS enable interaction and communications using web browers on the Internet. LMS generally allows asynchronous e-learning (Papachristos et al., 2010). In the earlier days, LMS enable asynchronous e-learning with communication being highly unidirectional. E-learning features were like sharing learning and teaching materials, collections

of online assignments for marking, forum discussions, group email services, assignment results management, learning lessons/ modules, and online quizzes. These days with web 2.0 technology, LMS are more advanced with synchronous e-learning features such as chat rooms, wikis, blogs and threaded discussion forums. The recent LMS include evaluation or feedback systems, plagiarism detection software, class announcements, inclusion of further external websites, individual group work calendar, etc. as additional useful tools.

Blended learning has been defined in different ways by various scholars. Bliuca et al. (2007) describe blended learning as learning activities that involve a systematic combination of face-to-face and technologically-mediated interactions between students, teachers and learning resources. Driscoll (2002) and Kerres and De Witt (2003) point out some different meanings of 'blended learning' as: (1) combining different Web-based technologies; (2) combining different pedagogical approaches; (3) combining any form of instructional technology with instructor-led training; and/or (4) combining instructional technology with actual job tasks to improve learning transfer. In this research paper, blended learning refers to the face-to-face and technology-mediated (or online) learning interaction with peers, teachers and resources in a learning and teaching environment where students are enrolled in both on-campus education and/or distance education mode.

This research examines how e-learning is used in information and communication technology (ICT) education in a university that offers blended learning. The data were collected from a sample of undergraduate students in seven different campus locations and an additional cohort of distance education students. They were all involved in a same core subject in a bachelor of ICT program that had three group work assessments. The findings indicate that while technology could effectively help students to collaborate in their group work and assessment tasks, some technological features in the learning management system are greatly subject to constant enhancement due to the nature of the subject requirements and the learner needs to facilitate more frequent peer interactions. A model of group work collaboration is developed to explain the needs of new design and development of features in e-learning tools.

This paper adopts the following structure. The next section is an overview of the research context about the kinds of students involved in the researched e-learning context. In general, it is about the nature of ICT discipline and the way knowledge is learned and gained. In more specific details, it is about the types of student learning activities and how students usually learn in ICT discipline. A 'Literature Review' section follows. From the literature review, some derived research questions were obtained. With them, the following section 'Research Method' addresses what and how to do to resolve the research problems. It also discusses the data were collected and analysed. A subsequent section 'Discussions and Findings' explains some insights and critical points discovered in this research. A model of group work collaboration is presented to explain the needs of some new features required in e-learning tools. The last section is the conclusion.

THE BLENDED LEARNING CONTEXT

Within the researched university context, the information and communication technology (ICT) discipline subjects cover important knowledge and skills. Such knowledge and skills are obtained by students after going through many different types of ICT subjects such as project management, systems analysis and design, programming languages, software development, website development, multi-media technology, data communication technology and final year information technology projects. The technical knowledge and skills often need to be learnt through learning-by-doing tasks.

There are some on-campus students who attend lectures and tutorials at our three regional campuses. There are international students attending lectures and tutorials in four or sometimes five international campuses in some Australian capital cities. There are also distance education students who are either Australian residents who reside in different states and cities or students who live in any other part of the world. An advantage for the distance education students is that they can study in a mixture of modes such as some subjects in distance education mode or some subjects in on-campus mode in a program.

Face to face teaching and learning happen in our regional campuses and international campuses whereas distance education students relies on online materials and basic learning-and-teaching communication activities are provided on a learning management system developed on the 'Moodle' platform. In all teaching modes, all students access the same learning and teaching materials (e.g. lecture slides, handouts, notes, readings, online study guide, study modules) online. All different campuses have the required subject software installed for the teachers and the students to use. All distance education students have to install the required subject software and practice the software tasks at home. Although they undertake the practical tasks for assignment without supervision, they can email, phone or contact the subject coordinator directly for assistance if needed.

The students importantly need to gain functioning knowledge other than declarative knowledge in the subjects. As Ramsden (2003) recommends, subject contents and conduct computer tutorials were planned with tasks that enable students to effectively use software to perform the requirements in assessment activities.

LITERATURE REVIEW

McLoughlin and Lee (2007) and Suthers (2005) discuss the potential use of the technology in learning. Clark and Mayer (2007) regards electronic learning or e-learning as self-led instruction delivered via computer through the technological means over CD-Rom, Internet or Intranet with purposively designed multi-media delivery contents, samples and methods relevant to teaching objectives. McLoughlin and Lee (2007) discuss the use of technology for participatory learning in the Web 2.0 era. Web 2.0 and e-learning 2.0 technology (Cucu et al, 2010) enables students to be an active component of educational process. The

principles of Web 2.0 allow effective sharing of resources and experience in learning, peer interaction, prompt feedbacks and clarification of doubts in the same subject. All students and teaching staff can communicate and interact online through subject news, via subject emails, in chat room and in discussion forums. All learning tasks can be discussed in face to face or through online interaction and communications involving all students and staff. Blended learning which combines online and face-to-face approaches works best for different cohorts of students with different or changeable needs (Dziuban et al., 2004). Australian National Training Authority (2002) notes that distance education is encouraged especially in support of the use of e-learning in distance education.

Face-to-face learning and teaching provides a better learning environment for teachers to guide the learning of students. Guided discovery is more effective than pure discovery of an individual student in promoting learning and transfer of knowledge to new problems (Mayer, 2004). Guided learning allows students to make guided discovery of the subject contents. On this note, on-campus students who attend face to face lectures and tutorials have an advantage to enjoy immediate attention, care, personal assistance and useful guidelines useful of the lecturers and tutors. As the disciplinary learning activities and assessment tasks are highly problem-based and technical, these activities and tasks often work best as guided discovery learning. Social interactions of staff and student in both online and face-to-face situations work best to facilitate guided discovery. In particular, distance education students need to interact with peers and teachers to enable some forms of guided discovery. In addition, distance education learners need interaction to overcome the feeling of isolation (O'Neil et al., 2004) other than for the purpose of guided discovery. Beldarrain (2006) recommends that distance education subjects should include interaction as the foundation of effective distance education practices. Authors like Winzenried (2009), Soon and Sarrahzadeh (2010a, 2010b) suggests the distance education students to interact virtually in online chat room, Skype, emails and discussion forums for assistance in assessment items, clarification of doubts, group work, etc.

For the successful virtual collaboration, social relations are as important as the project content and team expertise (Karpova et al., 2009). Since students interact in the class and in group projects, cooperative learning is adopted in learning and teaching (Ledlow, 1999; Jacobson, Davis & Licklider, 1998; Panitz, 2000; Johnson et al., 2000). In structuring the learning designs in ICT discipline, Bigss (1996) and Biggs and Tang (2007) recommend to the teachers to constructively align the outcomes (such as student knowledge, technical competence, skills, learning experience, etc.) with the subject contents (such as lecture, quizzes, laboratory tasks, tutorial questions, learning activities in forums), the subject assessment tasks and its required technical software outcomes.

Although there have been various types of research done on e-learning and blended learning, research that explores how e-learning is used to fulfill blended learning needs in information and communication technology (ICT) education in a university is limited. This research explores how e-learning is used in information

and communication technology (ICT) education in a university offering blended learning.

RESEARCH METHOD

This research aimed to understand how e-learning is used to fulfill blended learning needs in a university's information and communication technology (ICT) education, focused on the phenomenon of blended learning needs. As indicated above, this topic has not been widely studied and therefore it is appropriate to use a qualitative, interpretivist approach to explore the issues involved. The research adopts a qualitative case study approach. A positivist approach which intends to measure but not providing an in-depth understanding is not warranted in this research.

The sample data were from a total of 108 undergraduate students in seven different campus locations and a group of distance education students. They were all involved a core subject in a Bachelor of ICT program that had three group work assessments. The subject was about using their prerequisite knowledge in a System Analysis and Design subject and the contents in Software Development subject that they learn during the semester to produce various modeling diagrams, an information system development project timeline and a prototype for the proposed information system solution. The students had to use the Internet to access their online material on LMS. As there are three group work assessments, all students practiced cooperation learning where they helped their group members in their common group work tasks. The assignments provided practice-based activities based on a predetermined case study. Students had to present their database design modeling diagrams and create a prototype of their proposed solution to the organizational information system problem in the case study. They use Gantt chart in assessments associated with the software Microsoft Project. Modeling software like Microsoft Visio or Visible Analyst is used.

As all seven campuses are far apart, the researcher observed the performance of all campus students based on the close communications and feedbacks from their different lecturers and tutors via phone calls and emails. Due to a designated location of the researcher, the researcher was able to observe a particular on-campus group directly throughout the running of the subject. Emails and phone call communications were other ways for the researchers to explore also the students with learning needs and subject questions. An online questionnaire (please refer to Appendix A) was made available to all students at the end of the semester inviting student feedbacks on how e-learning fulfills their blended learning needs in their ICT education. Various distance education student groups communicated with their lecturer in chat rooms where the researcher also had the opportunities to access the chat room messages and their group emails. All collected data were compiled and analysed after the teaching semester ended. A project work book was a requirement for all the three assessments. The researcher was also able to obtain and analyse the project work books of all groups about their learning needs in the subject, the barriers and difficulties they experience in

their learning activities and assessment tasks. They could freely report how e-learning help them in the subject learning.

The online survey tool collected and analysed the statistical data. It provided a report of all answers for each close-ended and open-ended survey questions. All email messages were placed in a central folder for analysis. Chat room messages were analysed for learner needs and their e-learning use. Project work books were used to explore students' feedback on their learning and group project experience. Learner needs were explored based on the four written formats and notes that the researchers had for phone call communications.

DISCUSSIONS AND FINDINGS

On a whole, students felt that information was presented and communicated to all of them throughout in the semester of their studies. In the learning process, they believed they were motivated in their learning and had an opportunity to gain satisfactory knowledge and skills. A vast majority of students agreed that they were encouraged to engage and participate with other members in collaborative learning. Most students found satisfactory feedback delivered to them from teachers and peers in an appropriate and timely manner. They noticed they gained group work experience using knowledge in the subject.

Based on the analysed student experiences, common answers from the students were presented into Table 1. The table shows the student responses on their experience on how different aspects of the subject and its practice were of most value to them.

The negative experiences however were distance education students felt they were disadvantaged with the current low performing online collaborative tools used (i.e.GoogleDocs) for group interaction. They recommended that a group leader should be compulsory and nominated by all team members from the beginning to the end of the semester. From some groups with idle members, members commented that in a study environment, any group member that did not contribute or provide feedback and complete all their work should be penalised, not the entire group. Some students suggested that a work plan of the project should be established by the group for each assignment and become a component of the marking criteria. A distance education student commented that for the use of communication tools, the teachers should provide a clear explanation and give guidance to the students.

Table 1: Student Learning Experience.

Subject Aspects	Experience
Project management	▪ I learned time management in my project.
Group work	▪ Group work was fun and really good; ▪ Collaborative and team effort in producing the documents in each of the assessment are values to me; ▪ Hands on participation and development of the group project were good experiences; ▪ I know how to communicate with group members. learn a lot information about how to handle group ▪ I learned from the assignments and team work; ▪ I learn how to work as a group, not as an individual, which leads to task being completed in adequate time
Answering student queries	▪ I appreciated having such a great lecturer that made learning enjoyable; ▪ The course website was made available prior to commencement of term.
Software development concepts	▪ I learned to develop an information systems based on user and system requirements ▪ Learned software system development principles in team work ▪ I learned to use modelling diagrams like data flow diagrams ▪ Database design ▪ Documentation

As for the e-learning use, the students explained that they all used the subject Moodle website. In addition, they also use the list of the following tools for their group assignments in their projects:

(1.) Group communications: Email, Skype, msn chat, facebook chat, Yahoo Messenger and teleconference;
(2.) Group collaboration and document sharing: GoogleDocs and DropBox;
(3.) Group modeling diagrams: Visual Analyst, Visio, Erwin
(4.) Project management/Timeline chart: MS Project;
(5.) Group report preparation: MS Access, MS Word, MS Excel; and
(6.) Others: various programs downloaded from the net.

In the subject, students reported (except 7.14%) that it was not their first experience with doing group work in a subject. The learning and teaching materials are effective and adequate in this course. The members in their group communicated and interacted frequently in group work. Members in their group helped one another with their skills and knowledge in the group work. They regarded the members in their group as adequately skilled in using the equipment/technology for their group to collaborate in group work. Most of them believed that the group work experience in the subject would prepare them for their future employments in the real world while 21.43 % of them disagreed. As the subject encouraged all members to turn a term to be a leader in each week of the project, most members agreed they were given an opportunity to lead their groups in the projects. Generally, most groups felt that all members strive towards group work success. Most groups enjoyed the group assessment tasks in this

subject. They felt their members were responsive to other members' feedbacks. More than 85% of students felt that their group members were cooperative, help voluntarily and strive towards group work success. The teacher, or teaching team, provided enough guidance on how to complete assessment tasks well.

Using the results of the investigations in the study above, Figure 1 as a model of group work collaboration for ICT students is developed.

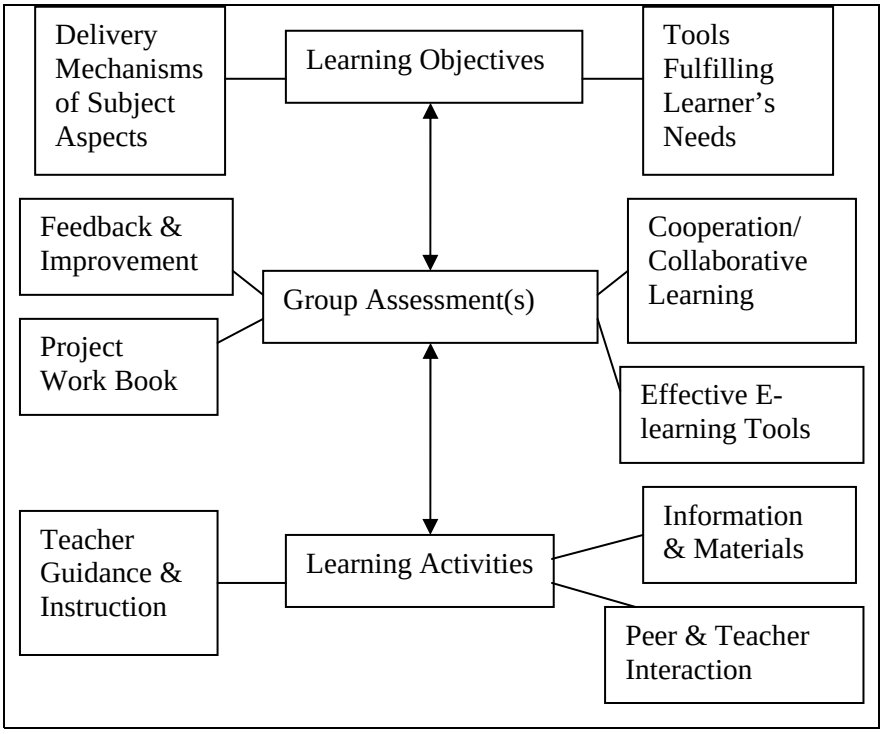

Figure 1: A Model of Group Work Collaboration

Using the subject's and student's experience in this research, Figure 1 essentially explains many critical elements that have to take place in the learning environment for the ICT students to group work collaboratively in the ICT subject Software Development.

Learning objectives can be achieved and best shown in the results of the assessment items. Learning objectives need to be supported by delivery mechanisms of subject aspects to help students learn concepts in learning activities and reflect their understanding in the group assessments. To do so, e-learning tools or some forms of teaching pedagogy used have to fulfil the learner needs. The arrow between learning objective and group assessments is bi-directional as learning objectives must be realized in student performance of the

group assessments and group assessments are set to achieve the learning objectives.

Group assessment(s) explains that in ICT subjects where group assessments are involved, the assessments are to be designed to allow feedback and improvement. As group assessment involve a group of members, cooperation or collaboration learning where learners help, feedback, advise and collaborate towards a group work success is critical. Since a group is involved, a group project work book is to be maintained to record all group member assigned task completions in each week and the barriers encountered. To achieve so, group members' effective use of e-learning tools must take place.

Learning activities are to be set up in alignment with group assessment(s) and the learning objectives. To allow students with adequate knowledge and skills to carry out the group assessment tasks, teachers must provide clear instructions and guidance. The required sufficient information and subject resource materials must be made available to all students. During the process of learning activities in physical or virtual classroom, learners who conduct the learning activities must frequently interact with their peers and teachers, as peer oriented learning happen in cooperation and collaborative learning. As part of the duties of the teacher to provide guidance and instructions, the teacher should set up a learning environment where the teachers and students can comfortably engage in frequent interaction.

As ICT industry is heavily involved in team work in group ICT projects, the model also extends to and will be applied in other ICT subjects involving group work collaboration.

CONCLUSION

Due to the nature of ICT disciplinary subjects being highly 'learning-by-doing', the learning objectives, assessments and learning activities must be well-aligned. In other words, subject contents, learning activities, assessment tasks, teaching methods used are to be constructively aligned within the clear major/strand objectives and program objectives.

As group work is significant workplace requirement in the ICT industry, the alignment of learning objectives, group assessments and learning activities are to be aligned considering cooperation/ collaborative learning allowing frequent interaction amongst peers and teachers. The investigations conducted in this study report a model of group work collaboration suggesting various critical elements to be considered by ICT educator and e-learning designers in developing the e-learning tools by aligning the learning outcomes, subject activities and tasks.

Innovative learning and teaching is made possible these days through the use of modern learning management system powered by advanced web technology. While modern learning management system suffice to deliver the learning materials and the basics in subject delivery, e-learning tools have to consider the

group work collaboration needs of student and staff users to encourage cooperation/collaborative learning. For example, effective communications and interact amongst teachers and peer learners are important to enable the feedback to a group member as a learner to enable one's understanding and allow this member to assist other member learners.

This research also shows an importance in ICT learning and teaching community by embracing the use of advanced technology to bridge the gap for use of e-learning, using software tools for group work tasks involved group assessments in face to face and distance education to enrich the learners' experience.

REFERNCES

Australian National Training Authority. (2002). Assessment and online teaching, Australian Flexible Learning Quick Guide Series: Flexible Learning Advisory Group, ANTA.

Beldarrain, Y. (2006). Distance education trends: integrating new technologies to foster student interaction and collaboration. Distance education, 27(2), 139-153.

Biggs, J. (1996). Enhancing teaching through constructive alignment Higher Education, 32(3), 347-364.

Biggs, J., & Tang, C. (2007). Teaching for quality learning at university (Third ed.). New York, USA: McGraw Hill and Society for Research into Higher Education and Open University Press.

Bliuca, A.-M., Goodyear, P., & Ellisc, R. A. (2007). Research focus and methodological choices in studies into students' experiences of blended learning in higher education The Internet and Higher Education, 10(4), 231-244.

Clark, R. C., & Mayer, R. E. (2007). E-learning and the science of instruction: proven guidelines for consumers: John Wiley and Sons.

Cucu, C., Cristescu, M.-P., & Cristescu, C.-I. (2010). Contributions to Using IT in Education: An Educational Video Player. Informatica Economica, 14(2), 108-119.

Driscoll, M. (2002). Blended learning: let's get beyond the hype. Retrieved from http://www-3.ibm.com/software/mindspan/distlrng.nsf/89297bbbe911d2788525674c00675635/20630ec43b8dbb4985256b810060561e/$FILE/Blended%20Learning%20Feb%202002.pdf

Dziuban, C. D., Hartman, J. L., & Moskal, P. D. (2004). Blended Learning. Research Bulletin, 2004(7), 1-12.

Jacobson, D., Davis, J., & Licklider, B. (1998). Ten myths of cooperative learning in engineering education. Paper presented at the IEEE Frontiers in Education, Tempe, AZ, November 4-7, 1998.

Johnson, D. W., Johnson, R. T., & Stanne, M. B. (2000). Cooperative Learning Methods: A Meta-Analysis. Journal. Retrieved from

Karpova, E., Correia, A., & Baran, P. (2009). Learn to use and use to learn: technology in virtual collaboration experience. Internet and Higher Education, 2009(12), 45-52.

Kerres, M., & De Witt, C. (2003). A Didactical Framework for the Design of Blended Learning Arrangements. Learning, Media and Technology (Journal of Educational Media), 28(2), 101-113.

Ledlow, S. (1999). Cooperative Learning in Higher Education. Journal. Retrieved from http://clte.asu.edu/active/clinhighed.pdf

Mayer, R. E. (2004). Should There Be a Three-Strikes Rule Against Pure Discovery Learning?: The Case for Guided Methods of Instruction. American Psychologist, 59(1), 14-19.

McLoughlin, C., & Lee, M. J. W. (2007). Social software and participatory learning: Pedagogical choices with technology affordances in the Web 2.0 era. Paper presented at the Ascilite Conference 2007, Singapore.

Ramsden, P. (2003). Assessing for understanding. In P. Ramsden (Ed.), Learning to Teach in Higher Education (2nd ed., pp. 176-206). New York Routledge Falmer.

O'Neil, K., Singh, G., & O'Donoghue, J. (2004). Implementing eLearning programs for higher education: a review of literature. Journal of Information Technology Education, 3(1), 313-323.

Panitz, T. (2000). Cooperative learning: 67 benefits of collaborative learning. Listerv Posting, available online? Journal. Retrieved from http://www.gphillymath.org/ListServes/coop_learning.pdf

Papachristos, D., Alafodimos, N., Arvanitis, K., Vassilakis, K., Kalogiannakis, M., Kikilias, P., et al. (2010). An Educational Model for Asynchronous E-Learning. A case study in Higher Technology Education. International Journal of Advanced Corporate Learning, 3(1), 32-36.

Soon, L. & Sarrafzadeh, M. (2010). Student Experiences: Collaboration for Group Assignment in Distance Education. Proceedings of the International Conference on Education Technology and Computer (ICETC 2010), ppv2.421-v2.426

Soon, L. & Sarrafzadeh, M. (2010). Collaboration for Group Assignment in Distance Education: M-learning Opportunities and Challenges, Proceedings of the IADIS Mobile Learning 2010 Conference (ML 2010), pp328-332

Suthers, D. D. (2005). Technology Affordances for Inter-subjective Learning: A Thematic Agenda for CSCL. Paper presented at the Conference on computer support for collaborative learning: learning 2005: the next 10 years!, Taipei, Taiwan.

Winzenried, A. (2009). Trainee Teacher Librarians collaborating at distance: some practical applications for your library future. Paper presented at the ASLA XXI Biennial Conference 2009, Perth, Australia.

Appendix A

1. Knowledge/Motivation

This course provides me with an opportunity to gain satisfactory knowledge and skills. It also engages and motivates me in my learning.

2/3. Communication/Presentation/Availability

Information in this course is presented and communicated to me in my study.

I was encouraged to engage and participate with course members in collaborative learning.

4. Assessment/Feedback

Satisfactory feedback was delivered to me in an appropriate and timely manner in this course.

5. Overall

I have gained group work experience using knowledge in this course.

Based on your experiences, what aspects of this course and its practice were of most value to you, as a student?

Based on your experiences, what aspects of this course and its practice require improvement?

Group Work Communication & Interaction

Members in your group communicate and interact frequently in group work.

Members in my group help one another with their skills and knowledge in the group work.

Members in your group are adequately skilled in using the equipment/technology for your group collaboration in group work.

Group Work Experience

This is NOT my first experience with doing group work in a course .

I believe that the group work experience in this course will prepare me for my future employment in the real world.

I am given an opportunity to lead my group in this course.

All members strive towards group work success.

My group use some technological tools in our group work.

Please list the technological tools that you have used in enabling your group work (e.g. GoogleDocs, Emails, Skypes).

Group Work Assessment Feedback

I enjoy the group assessment tasks in this course.

In group work, I was responsive to my members'' feedbacks.

My group members were cooperative, help voluntarily and strive towards group work success.

The teacher, or teaching team, provided enough guidance on how to complete assessment tasks well

Course Organisation

The learning and teaching materials are effective and adequate in this course

Quality of Course

I would recommend this course to other students

Thank you for participating in the course evaluation!