

# Building a Single Classroom with Technology

*Full Paper*

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## **Abstract**

This research project explores how teaching staff can make creative use of technological systems to merge different cohorts of information technology (IT) students into a single classroom – facilitating better learning activities. A case study research method is used to explore how teaching staff members made better use of technology to help their students learn more fruitfully. Specifically, two subjects were purposefully selected for investigations, where the teaching staff members used technology innovatively in teaching and learning activities. In each case, use of technology to share resources and communicate is combined with a cultural shift in the approach to develop a single classroom with different cohorts of students. The results demonstrate new ways of using technology to enable different groups of students to communicate by enabling interaction of students from different cohorts not previously well-practised in teaching. The research results may drive future creative use of technology.

**Keywords** Case Study, Creative Use of Technology, Inter-group Interaction, Student Satisfaction, Improvement of Learning Outcomes.

## 1 INTRODUCTION

Technology - presented as different forms of information systems and supporting devices - is heavily used for many educational purposes in higher education in the 21<sup>st</sup> century. Collectively, this use of technology is known as educational technology (EdTech) or technology enhanced learning (TEL) and in universities, the rapid technology advancements facilitate an electronic education system model (Cloete 2001). In Central Queensland University (CQU), the educational technology used includes Moodle as a learning management system, an interactive system-wide learning (ISL) system, a Zoom video conference system that works with the ISL system, a student central system, etc. At CQU, students are of diverse backgrounds and ages, and are geographically situated across different campuses and via distance. CQU students can enrol on an on-campus, distance or multi-modal basis. All of these factors mean that running multiple campuses together with distance learning is challenging, as it deals with different student cohorts of varying sizes, making it difficult to manage all the diverse learners and teaching staff altogether. Given the geographical location complexities and student diversity, this research project explores how teaching staff members could make creative use of technological systems to merge different cohorts of information technology (IT) students into a single classroom to facilitate the learning activities.

This research looks to explore how teaching staff members could make use of technology to merge different cohorts of IT students into a single class with activities to facilitate learning. The aims were to explore whether: (1) technology helps encourage frequent classroom interactions between students and teaching staff; (2) it helps teaching staff to address student learning issues; and (3) through it, staff provide the students with adequate help and advice to improve their learning. An interpretive case study research method is adopted to explore how teaching staff members could make use of technology to merge different cohorts of IT students into a single class for activities to facilitate their learning. Specifically, two subjects were purposefully selected for investigations, as the teaching staff members are regarded as those who used technology innovatively in teaching and learning activities. In each case, technology is combined with new learning approaches to develop a single classroom with different cohorts of students. Research is then conducted to explore how two teaching staff members as subject coordinators (SCs) were able to make creative use of technological systems to merge different cohorts of information technology (IT) students into a single classroom to facilitate their learning activities. It was believed that such acts would help students learn more fruitfully. The results demonstrate that creative use of technology enables different groups of students to communicate and interact with students from other cohorts not previously well-practised in teaching. It is believed that creative use of effective technology could increase student satisfaction. The research results may drive future creative use of technology.

## 2 LITERATURE REVIEW

Research a lot of scholars commonly highlight an importance of adopting educational technology, as a pedagogic approach to improve teaching and learning (Amerih, Nazzal and Elsalloukh 2013; Crippen and Archambault 2012; DePietro 2013; Efe 2011; Ernst and Clark 2012; Gronlunda and Islam 2010; Henderson 2015; Jaffer 2010; Kehoe and Goudzwaard 2015; Laurillard 2007; Loveless 2003 2004 2011; Shelton 2014; Shin, Kim and Jung 2018; Talib, Yassin and Nasir 2017; Tarling and Ng'ambi 2016.)

In information systems or technology education, students need to learn several types of critical skills such as inquiry, critical thinking, problem-solving, reasoning, etc. Loveless (2003; 2004; 2011) sees the important skills as those obtained at an appropriate educational level, for example experiences, problem-solving, communications, and supporting knowledge in areas associated with computer technology, maths and graphics. Crippen and Archambault (2012) posit that inquiry-based instruction is significantly used in the increasingly integrated learning content areas. They also add that engaging students to think like a scientist is indicative of the nature of inquiry warranted as a required pedagogy most needed for education. Meanwhile, Ernst and Clark (2012) explore how games, as their pedagogic approach, can develop competency for their students in a distance education environment. Due to the nature of these disciplines, the need to facilitate questioning and answering or interactive discussion activities in a classroom is critical to help students learn effectively. Through a need analysis in technology education, Talib, Yassin and Nasir (2017) highlight that students with active participation effectively learn problem-solving skills through intensive training. There must be pedagogical guidance that directs the integration of emerging technologies in teaching and learning (Tarling and Ng'ambi 2016). Amerih, Nazzal and Elsalloukh (2013) also maintain that it is possible to teach science to students who have only experienced traditional face-to-face classroom and labs by starting with print media, before moving onto audio broadcasting, and then proceeding to video conferencing.

Along with digital education comes the concept of a “network society”, which has changed many things (Feenberg and Jandrić, 2015). Technology advancements enable the teaching staff to use different emerging technologies to help students learn better. Gronlunda and Islam (2012) present a low-cost, large-scale interactive learning environment using video, mobile phones, SMS-based tools administered in a learning management system to enable student-centred mobile learning. To supplement e-learning system like Blackboard, DePietro (2013) assessed the benefits and risks of using new media tools, Twitter and Wikis, to help students communicate ideas, thoughts, feelings and information in class. Efe (2011) believes that experienced teachers with educational technology, who believe in its value, have more intentions to use technology and make their students use it and these experiences increase the chances of the teachers using educational technology.

With technology advancement like the prevalence of latest lightweight mobile devices, students today have more and more experience in doing their study online. In 2014, more than a third of students enrolled on campus reported doing half or more of their study online (Norton and Cakitaki 2016, p.25). Jaffer observes that Web 2.0 technologies transform the ‘read web’ to the ‘read-write’ web, and that the Internet transforms from a medium transmitting and consuming information, into a platform creating, sharing, remixing, repurposing and passing along contents (Jaffer 2010). Exploring how technology supports pedagogy, Henderson (2015) identifies ‘core technology’, like presentation software, which teachers use even when they may not feel it has a positive impact on student learning, and ‘marginal technology’, like blog, which is less often used or used when it fits into the pedagogic approach.

Through all of the research discussed above, a gap exists in understanding how teaching staff members could make effective use of technology to merge different cohorts of students into a single classroom for activities to facilitate their learning. Particularly, it will help to explore the grey areas about whether: (1) technology helps encourage frequent classroom related interactions between students and teaching staff; (2) it helps teaching staff to address students’ learning issues; and (3) through it, staff provide the students with adequate help and advice to improve their learning. Overall, we explored how teaching staff members could make better use of technology to help their students learn more fruitfully.

### 3 RESEARCH METHOD

This research adopts a qualitative case study research method. The case study is situated within an interpretive paradigm (DePietro 2013; Eisenhardt 1989; Creswell et al. 2007, Miskin, Bandara and Felt 2015, Onwuegbuzie and Leech 2007, Walsham 1995). It is a single case study with two embedded units for investigations (Yin 1994; Yin 2014). Case study research is selected, as it is appropriate in situations when (1) the main research questions are ‘how’ or ‘why’ questions; (2) a researcher has little or no control over behavioural events; and (3) the focus of study is a contemporary phenomenon (Yin 1994; Yin 2014; Walsham 1995; Creswell et al. 2007). It investigates how teaching members in two different teaching subjects can creatively use technology to facilitate a class with on-campus and distance students merged together at a single virtual classroom across the geographical venues. Case study research method is warranted as the most appropriate research method to investigate two scenarios whereby the boundary between a phenomenon and its context is not clear (Dobson 1999). Interpretive research, being an in-depth inquiry, has emerged as an important strand in Information Systems (IS), providing guidelines on how to conduct interpretive research and how to evaluate them (Walsham 1995; Eisenhardt 1989).

As our case study units, we purposefully selected (Eisenhardt 1989; Creswell et al. 2007) two embedded units as two teaching subjects for case study investigations. The two teaching subjects were selected with a belief that the related teaching staff members used technology creatively in their teaching and learning activities, in combination with an existing blended learning<sup>1</sup> approach to blend synchronous face-to-face approaches with those using technology to deliver material asynchronously (Onwuegbuzie and Leech 2007), as two embedded units within a single case study with a purpose to shed light to the phenomenon within the context (Miskin, Bandara and Felt 2015). The two scenarios will be named Case 1 and Case 2 for the purpose of this paper. Using a single case study with two embedded units as Case 1 and Case 2, the case study enables the examination of the same issue of creative use of technology as how to integrate students from different on-campus student cohorts with distance students through two different scenarios. In both Case 1 and Case 2, all students were merged altogether into a single classroom, across the geographical venues. It also explains how, when and where the teaching staff member used technology advantageously to enable their students to engage in learning activities and achieve better learning outcomes.

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<sup>1</sup> Blended learning is a style of education used in both the two case study units, where distance students learn online, and on-campus students either receive traditional face-to-face teaching or learn online.

The two scenarios come from CQUniversity, which is a large regional Australian university, which operates with multiple campuses spread around different parts of Australia. For each campus, there is usually a lead lecturer/tutor who directly teaches on-campus students for the weekly lectures and tutorials in a subject. For bigger classes, there would possibly be a second or even a third tutor engaged to handle the additional tutorial class(s). At times when there were too many students to look after in the computer laboratories, more than one tutor would help handle different laboratory classes.

In addition to the on-campus students from multiple campuses, the university also has many distance students who are geographically spread around the country, including those who live in remote outback areas in Australia. For each of the two scenarios, it was about a designated subject where the coordinator taught on-campus students on the coordinator's own based campus. Each coordinator was also a lecturer and tutor for the distance students. In the two scenarios, each subject-coordinator gave clear directions to the fellow teaching members as lead lecturers and tutors on all different campuses about the content to be delivered for general subject matters, teaching activities, tasks in classes, assignments, examination information and all other student administration matters.

Interpretive case study research (Walsham 1995) was selected as the research method because it is appropriate when the focus is on human actions and interpretations surrounding the development and use of computer-based information systems (IS) in this research. In this research, it employs data collection techniques such as survey and documentation review. A survey was carried out in each subject of the two embedded units at the end of the teaching term involving all on-campus and distance students through a URL link of the related subject Moodle websites. The surveys with both open- and close-ended questions are based on the student responses. The surveys provided both statistical results and textual information on student feedback. Documentation refers to whatever technology-generated footprints available on the Moodle websites from the two scenarios, such as video-lecture recordings, emails, forum messages, Zoom video-conferencing meeting recordings, digital files/documents used in the online activities, and the stored data in learning management system about the above activities. Documentations enables the collections of data from all posted forum messages and responses to messages via General Forums, Q&A forums, News Forums and any designated Assignment Forums on the two subject Moodle websites. Most collected information was qualitative in nature. Interpretive research makes inquiries into the research phenomenon within a context (Yin 1994; Walsham 1995). This research was designed to inform how teaching staff members can use different technology in different creative ways to its fullest advantage to engage more students in fruitful learning activities in a single classroom. Data collected from both Case Study embedded units 1 and 2 as Case 1 and Case 2 were carefully examined and evaluated. Their useful details are presented in the sub-sections below.

### 3.1 Case 1 Description

Case 1 is a foundation year technology subject "Ethics and Social Issues" offered in Term 2 2018 with 142 students enrolled across 6 campuses as well as in distance mode as in Table 1 below.

Location	Brisbane	Cairns	Distance	Melbourne	Rockhampton	Sydney	Townsville	Total
Number	19	9	32	23	19	32	8	142

Table 1. *Ethics and Social Issues: On-Campus and Distance Student Enrolments*

Around 22.5% (n=32) of the cohort were distance students without face-to-face contacts with the subject-coordinator as their lecturer and tutor. The subject-coordinator also taught face-to-face students on Brisbane campus. On each of the six campuses, there was a lead lecturer/tutor that delivered face-to-face classes to students. The subject-coordinator looked after both Brisbane campus students and distance students. The subject covers ethical theory, ethical issues with the use of technology, stakeholder benefits or losses surrounding technology development, and social ethical issues related to privacy, censorship, employment, cybercrime, information overload and so on.

### 3.2 Case 2 Description

Case 2 is a first-year first-term technology subject "Systems Analysis" offered in Term 1 2017 with 178 students enrolled across 6 campuses (Sydney, Melbourne, Brisbane, Rockhampton, Cairns and Townsville) as well as in distance mode as in Table 2 below.

Location	Brisbane	Cairns	Distance	Melbourne	Rockhampton	Sydney	Townsville	Total
Number	38	7	51	17	20	41	4	178

Table 2. *Systems Analysis: On-Campus and Distance Student Enrolments*

Around 28.65% (n= 178) of the cohort were distance students without face-to-face contacts with the subject-coordinator as their lecturer and tutor. On all six campuses, the lecturers/tutors took care of their students. The subject-coordinator looked after both Townsville campus students and distance students. 'Systems Analysis' is a subject that teaches students important knowledge and skills of the systems analysts. The critical subject concepts include information system development, information systems development methodologies, technology project management, information system requirements gathering, and modelling diagrams.

As in the interpretive tradition, the researchers ensured careful work took place for the conceptualisation and execution of case study (Walsham 1995). The researchers carefully evaluated and interpreted the investigations together. They carefully checked through the data and peer-reviewed tables or reports developed. The researchers also prudently checked the other researcher's work to rectify all possible errors and to ensure the correct human interpretations and meanings.

## 4 RESULTS AND DISCUSSIONS

This section presents the results of Case 1 and Case 2 (as Case Study embedded units 1 and 2) of the investigation. It discusses how the SCs used technology creatively to facilitate flexible interactive learning helping students achieve positive learning outcomes. 4.1 and 4.2 differently present innovative use of specific technology in Case 1 and Case 2. 4.3 covers both Case 1 and Case 2.

### 4.1 Case Study – Embedded Unit 1

Case 1 effectively employed advanced technology that could record weekly class sessions meanwhile enabling distance students to join each class through video conference technology. It successfully brought students from multiple campuses and in distance mode into a single classroom. The main purpose was to allow discussions amongst students forming camaraderie between different student groups. Staff and students could see one another over the images on computer screens of connected campus sites, as well as individual distance students who joined in. There were frequent discussions and brainstorming happened in each class session.

To achieve the above, the subject Moodle website provided important useful lecture/workshop materials as well as useful resources as activities that would help in tasks of both the two assignments. Due to the nature of the subject, students are taught mainly through a 3-hour workshop structure. All students were informed and made aware of how the workshops work right from the start of the teaching term. Students were expected to go through all the provided weekly lecture, tutorial and activity materials in advance to prepare themselves well before attending each class session. This meant they could effectively contribute to all workshop discussions that would help them learn. The class session was run with a combination of lecture material interspersed with workshop questions that students must facilitate as a group. Traditionally, students at a distance cannot participate in these sessions. Instead, they are invited to participate in the workshop forum with weekly questions, but participation in this forum is low. Through the weekly class sessions through video conference and recording, students met in a single cohort classroom. They became engaged and participative in discussions and class activities.

The video conference class session for connecting distance students was set up to run concurrently for the workshop on one of the face-to-face campuses. Students could dial in during the live 3-hour workshop and be encouraged to participate in the workshop in a workshop question model. To develop camaraderie, all students who joined online were asked to show their name on their screens and make their video available if possible, so the other students would know what they looked like. In addition, the workshop session was recorded and published to the subject website each week for review by both on-campus and distance students.

From the second session onward, distance students were more diverse and on different locations, but this still allowed for collaboration between these students and the face-to-face students. Additionally, the distance students used a chat feature provided by the video conferencing system more often to form a group in the virtual space, discussing points amongst themselves to reach a unified conclusion that could be voiced by one of the students dialling in from afar.

The result of this intervention was a positive involvement of the distance students in the session. During the first session, where some distance students dialled in from any campuses, they became part of the overall cohort on the face-to-face campus. Students in the face-to-face workshop learnt the names of the distance students and vice-versa. Each group of students would build on the comments of the other group and agree or disagree with their point of view. Based on the informal feedback given from the distance students, they felt much more a part of the session. They also felt that allowing them as distance

students to join the on-campus students was a positive approach, as it motivated and engaged them well making them feel that they really participated in the same physical classroom.

Finally, the recording also helped to encourage an integrated cohort approach. The SC noted that the familiarity of language in student emails increased due to seeing him or her on the screen each week (i.e. students would write “How’s it going?” and “Are you still marking like you said on the video?”). It was noticed that a few distance students at the exam even introduced themselves as if they were old friends based on a fact that the student had seen the SC on the video conference system every week. Students also appeared to enjoy the videos more over time, with the weekly posting of recordings brought along more and more students to attend the live class sessions.

## **4.2 Case Study - Embedded Unit 2**

In Case 2, as many students experienced difficulties in understanding complex concepts and challenging modelling diagrams as the nature of subject contents, they often approached the SC directly to seek help. They particularly did so when the immediate lead lecturer/tutor could not address their questions or was unavailable to assist. Distance students who preferred synchronous instant communication would phone the SC for help. To deal with the needs of too many of these students and to provide timely help for them, the SC decided on the use of digital consultations. The move to digital consultations was also due to numerous past distance students sending emails to the SC about clarification of any complex concepts or their perceived hard assignment tasks. Each time when the SC replied to them, the SC always found it hard to explain things on emails. The SC used to make phone calls, but audio did not allow show and tell. Further, there was a need to cut down the times spent on different dreadfully lengthy email replies, and the increasing need for the students to show their work problem online to the SC before an effective reply could happen. Hence, a digital consultation was planned and formulated for the term.

Each digital consultation was prearranged, and students needed to be available online to start it. On the subject Moodle website, a link for digital consultation, or video meeting room, was set up in the Assignment Resources section. The link to digital consultation was set up to allow any student member to enter the video meeting room anytime 24 hours/7days throughout the term time without all students knowing so. The students could click the link using a desktop or Mac PC, laptops, smart phone or iPhone, and tablets or iPads.

Digital consultations were based on the use of Zoom (a video conference tool). It was versatile to allow the attendees to show and tell whatever they want to present. People could share and exchange desk top screens, which greatly helped the participants to see what was shown and explained as problems before any discussion on solutions. The participants also shared in each digital consultation classroom what they drew on a paper a figure, table, chart or modelling diagram. The SC could write or draw on the office whiteboard to explain complex concepts or diagrams with diagramming rules underpinning them. Occasionally, if any participant did not have a webcam, the person could participate by only asking questions and receiving verbal answers. In an occasion, there was a student whose iPad video stopped working half-way through an online consultation meeting. All participants suddenly could not see the person. The person continued in the meeting by talking only.

The digital consultations between the SC and the students initially started with predetermined weekly days and times to help distance students in general subject enquiries, tutorial activities or assignment-related tasks. As the students were given different types of software to assist them in developing different assignment tasks, they also asked software or software task-related questions. Using desktop screen sharing, they could show whatever issues with the software directly on their screens. Later, the SC encouraged distance students and any on-campus students who sought help via emails or phone to also participate during the designated pre-arranged consultation times for distance students. For the distance students with different commitments, they could also arrange with the SC additional online consultation times besides the standard pre-arranged time slots. In the initial teaching weeks, it was the early evening time on a fixed weekday, mainly for distance student to join. In the later teaching weeks, students from all other campuses who genuinely needed help came along to seek help from the SC. Students on the same campus as the SC did not join, except one who was sick and missed a weekly class.

For the digital consultations, as the students were not required to show their names when they came on board. Normally, only the SC knew the names of the students better in each digital consultation. However, students who frequented the digital consultations recognized the familiar faces and knew other student names soon. Students could remember names well, especially when they picked up each time the SC called the names of other students during the discussions. They also remembered names when two students asked the same doubtful question or talked to one another afterwards. Through interactive discussions, distance students enjoyed this subject. They also felt that they had known their

subject mates, and no longer a loner learner. Many distance students with familiar faces attended the digital consultations weekly. There were usually more students participated in the few weeks before an assignment due date. More and more students joined whether on-campus or distance when it drew closer to the final assignment due dates as it had the most challenging tasks.

There was a unique case, whereby an aviation technology student who enrolled in this IT subject in distance mode sought help, due to difficulties in understanding IT terminologies, concepts and modelling diagrams in object-oriented systems analysis. Some students joined the digital consultations in different occasions to check whether work developed was on the right track. For example, they checked whether the learned concepts in some task answers presented to the SC through screen sharing were correct, their drawn diagrams appropriately reflect the task scenario, there was careful check to remove errors, the types of rectifications were acceptable, etc. In the two weekly digital consultations close to the end-of-term examination, there were no students (distance or on-campus) that took part in digital consultations. That was possibly due to by then, they have no questions, doubts or problems requiring clarification, advice and help. Through Case 2, it has reinforced the view that all students can be a single cohort with the right level of support.

### 4.3 The Case Study

The SCs in both Case 1 and Case 2 strategically used many types of forum on subject Moodle website for interactive discussions throughout the teaching term, such as Q&A forum, News forum, General forum. In Case 2, Assignment 1 Forum and Assignment 2 Forum were also used. In both Case 1 and Case 2, Q&A Forums were useful for the students to post forum messages as questions for staff to answer. General Forums were used for general discussions of the subject. News Forums were mainly for the teaching staff members to send subject-related notifications and subject-related news. The Assignment 1 Forum and Assignment 2 Forum were directly related to the two assignments in the subject for Case 2, more for the students to direct their assignment-related questions to all subject members for discussions seeking potential answers. Forums are the main tools that facilitated a lot of interactions amongst all staff and student members. In addition, all teaching staff members could send direct personal emails to their students through the Compose Email in Moodle or from staff email.

Case	Student satisfaction and experiences
Case 1 Video conference workshops	...explanations were made clearly on each chapter and especially ... always encourage us to participate in class. ... very passionate about the subject which from a student's perspective, really helps to engage interest... I can now not only see the benefits of the unit, I actually enjoyed it. Keep up the good work. It is easy and fun to do assignment. I enjoyed the weekly classes online, it kept me interested. This is the most wonderful Unit of my course.
Case 2 Digital consultations	... provide interactive discussions to clear doubts, explain key concepts, advise timely and help develop student skills in assessment tasks. ... questions were answered quickly by ..., which helped us to work on our assignment. ... found ... very helpful and responsive when asking a question. ... new skills and knowledge that you can apply not just in the subject, but everyday life. The best aspect was the assignments were well explained. SC explains any problems and concepts very well. This unit was very enjoyable.

Table 3. *Satisfactions Demonstrated in Students Survey Feedback*

Table 3 showed that all students who joined the video conference workshops and digital consultations were satisfied with their learning experiences and useful answers to their questions/doubts. The creative use of technology truly improved students' learning and work outcomes. The SCs saw that effective technology that helps to solve student problems and improve their study results often helps more than the traditional type of technological tools like email and forum. After the subject result release, some students sent thank-you emails to the SCs to thank them for all the efforts and times spent on esp. video conference workshops and digital consultations, to help them learn difficult things in the subjects well. They largely saw the new use of technology as a very useful means to engage them and as a great help point for students in the subjects.

The results demonstrate both video conference workshops and digital consultations in Case 1 and Case 2 were creative use of technology to enable students in different study groups to interact with a larger mass involving all diverse students attending class on-campus and online in a same virtual classroom.

The creation of a single larger mass using technology helps encourage frequent classroom-related interactions between students and teaching staff. It further enables inter-group or interpersonal interaction not previously thought of and well-practised in CQU staff teaching. It truly helps teaching staff to address students' learning issues. Staff were able to provide the students with adequate help and advice to improve their learning. The finding indicates that through virtually a 'single' group, students increase their satisfaction and camaraderie through inter-group interaction, particularly when distance students willingly shared their real-life experience in discussions and discussed in-depth challenging questions. These results highlight how and why technology can be successfully used for creating a single virtual group, due to all student members including the staff members were using technology. The single virtual group could happen due to all participants, being academic staff and students in undergraduate technology degrees, possessed the abilities to use technology to join the virtually single classroom. Overall, teaching staff members made creative use technology to help the students learn more fruitfully.

## 5 FINDINGS AND IMPLICATIONS

The findings demonstrate that it is possible to build a single classroom with diverse students with creative use of technology. However, to truly facilitate this, a cultural shift is required to enable students to think that they are a single cohort. In particular, the invitation of students from all campuses to view the video conference lectures/workshops or participate in the digital consultations is important, so that students know that these sessions are for more than just distance students. The use of recordings and readily available digital sessions importantly support a blurring of geographic locations and asynchronous learning. It reinforces in students that they belong to the larger mass who participate in these sessions. They become involved even if distance or time would traditionally make this difficult.

The results support the work in the literature, such as the Amerih's, Nazzal's and Elsalloukh's assertion that teaching can build on face-to-face instruction with an additional digital experience (2013), and the assertion of Talib, Yassin and Nasir that students given the opportunity will seek out a way to actively participate in their learning (2017). It also builds on Feenberg's and Jandrić concept of a network society (2015), and Gronlunda's and Islam's suggestion that the network society can be used through the implementation of a variety of different technologies such as video and text to enable a student-centred learning approach (2010). Finally, it supports Efe's comment that technology students and teachers can effectively use technology to push forward a better digital education approach (2011).

From this work, a set of guidelines were derived and developed into a set of guidelines to support the use of technology that facilitates a single cohort of students. As in Figure 1, the guidelines provide in the four boxes four bullet-point items making up a checklist that educators should use. The checklist is useful when an educator is trying to implement a class with students from multiple campuses in different enrolment modes with a combination of face-to-face and distance students.

Geography	Timing	Synchronicity	Culture
<ul style="list-style-type: none"> <li>• Use Digital Technology Such as Video Conference or Digital Consultation to Remove Geographical Barriers</li> </ul>	<ul style="list-style-type: none"> <li>• Schedule Frequent Sessions for Student Learning</li> </ul>	<ul style="list-style-type: none"> <li>• Support Asynchronous Learning Through Recordings and Forums/E-mail/Wiki Technology</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a Culture of a Single Cohort Where Face-to-face Students Feel They Welcome These Technologies</li> </ul>

*Figure 1: Guidelines for Developing a Single Cohort Classroom*

These guidelines importantly highlight four key steps for educators to carefully follow so that the class could turn into a single cohort within a single virtual classroom. As proposed in Figure 1, there must be adequate considerations for the four important key factors in the model as *geography*, *timing*, *synchronicity*, and *culture* for working out an achievement of a single virtual campus cohort.

*Geography* here alerts the educators to make arrangement for the required technology based on clear understanding of the established geographic positions of the students and the teaching member. *Timing* is about effectively planning for the time schedules of digital sessions after thorough considerations of the convenient and available common time of the participants. *Synchronicity* is about checking and assurance for the synchronicity of all members who can successfully participate in the activities within a same session at a same timing wherever they are before conducting a planned digital session. *Culture* draws the attention of educators to all participating members online who are to adopt a same developed culture in order to effectively and positively interact with one another within a same virtual classroom. Finally, it importantly highlights the cultural change needed, clearly reflecting that digital resources like



video conference workshop and digital consultation are no longer just for distance students, but all members. Make it clear to students right from the start to develop a single cohort in a single classroom.

## 6 CONCLUSION

This research has presented a case study with two embedded units as Case 1 and Case 2, discussing how technology can be used innovatively in combination with other traditional/ blended learning approaches to create a single virtual classroom with both on-campus and distance students. The findings indicate that creative use of technology can merge different cohorts of students into a single classroom with activities to facilitate their learning. This move helps encourage frequent classroom-related interactions between students and teaching staff. It helps teaching staff to address student learning issues. Further, staff can provide the students with adequate help and advice to improve their learning.

Using technology creatively can enable inter-group or interpersonal interaction not previously well-practised in traditional teaching. This research has developed a Model for Developing a Single Cohort Classroom which is believed providing useful guidelines to education to help use technology innovatively to build a single classroom with a single cohort of students whether from multiple campuses or distance students. Building a single classroom with all cohorts will be an advantageous move for many Australian universities today when they set up campuses at more than one different Australia locations or international venues (Moll and Hoque 2011; Norton and Cakitak 2016; Smith 2009). The research is expected to drive future similar research work to explore the limitation of the existing work.

Currently, this research is only based on a single case study with two embedded units. To strengthen the validity of the research results and for better generalization, more future work is needed to include different case studies from other technology subjects in different universities. Instead of only exploring the students in information systems or technology disciplines, it can also explore the subjects in the wider disciplinary areas. Nevertheless, through this research, it is proposed to have the single virtual classroom extended to a wider educational context like TAFE, training institutions, etc., where diverse group members in geographically diverse areas can gather together in a same single virtual classroom.

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