TECHNOLOGY-ENABLED ENVIRONMENTS FOR FLEXIBLE LEARNING: A CASE STUDY AT THE UNIVERSITY OF THE SOUTH PACIFIC

Abstract

The introduction of technology-enhanced learning and teaching environments has been a challenge for many educational institutions in terms of providing adequate, effective and efficient ICT tools to enrich the delivery of learning and teaching. Spread across 33 million square kilometers of Pacific Ocean, the University of the South Pacific (USP) encompasses 12 island nations, and thus, the transactional distance between students and teachers represents a multitude of challenges. To deal with these challenges, the University continuously strives to leverage ICT in education. In this paper, the authors describe the innovative approaches and ICT tools used by USP to deliver its courses across its 14 campuses so as to provide the best possible learning experiences to its over 29,000 students who maybe enrolled in any of the four modes of delivery: face-to-face, print, blended and online.

The paper will also focus on the strategies, challenges and successes of various ICT tools used to enhance student learning experiences so as to meet the growing demand for ICT-enabled learning and teaching at the USP.

Keywords

Information and communications technology (ICT), learning technologies, learning and teaching, Professional development

1.0 Introduction

Globally the way in which higher education (HE) is delivered by many universities is conceptually changing. This is due to the fact that the availability and the proliferation of ICT-enabled devices are rapidly growing and more easily accessible. "For better economic change and development (OECD 2005) has identified critical factors that determine a nation's economic growth, development and success within a globally competitive market. Outlined was the critical role ICT played in entrepreneurship, innovation and the development of social capital. The capacity of students and teachers to use (digital literacy) and apply ICT (pedagogy) will be key for economic growth and stability in the future. Similarly, the United Nations Education, Scientific and Cultural Organization (UNESCO) strongly emphasizes the relationship between ICT use, education reform, and economic growth. This is based on assumptions that systemic economic growth is the key to poverty reduction and increased prosperity and that ICT are engines for growth and tools for empowerment with profound implications (UNESCO, 2008)." The University of the South Pacific is the same as many other universities who are trying to strengthen its ICT learning and teaching environment to delivery high quality higher education to the Pacific region and to the rest of world.

The University of the South Pacific is the only university of its type in the world, and the introduction of an ICT enabled tools for learning and teaching was a unique and challenging experience. The University is jointly owned by the governments of twelve island countries: Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu and Samoa (Figure 1) and offers almost 200 educational program through flexible learning in four different modes: Face to Face, Print, Blended and Online via its fourteen campuses across the region. USP has been a worldwide pioneer in Flexible Learning area since the early 1970s.

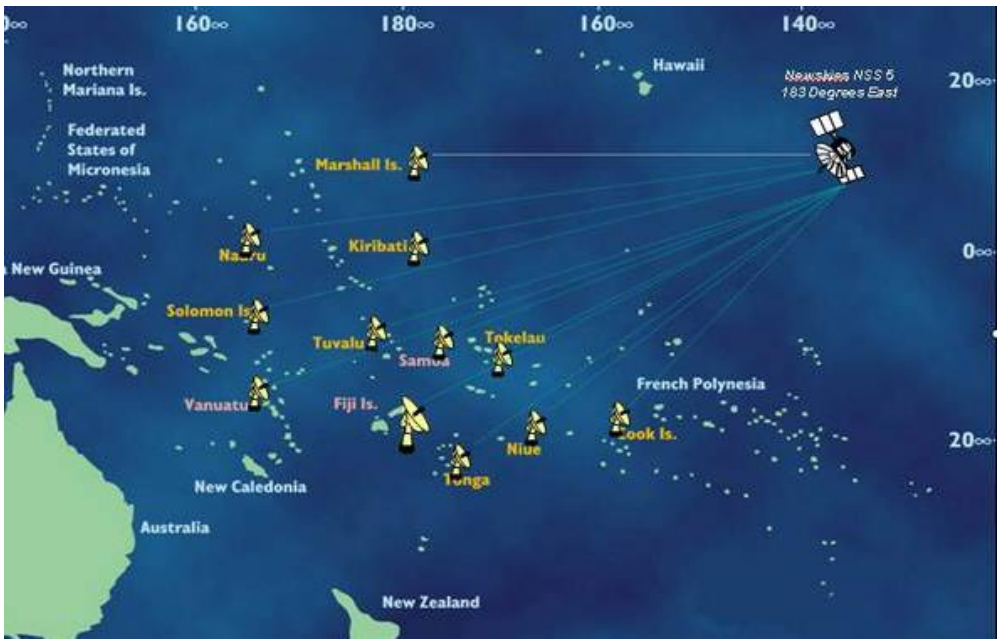


Figure 1: University of the South Pacific region

The University has two major backbone Network infrastructure systems; AARNET[1] (LAN) and USPNet (WAN) which are used to support and deliver its wide range of programmes. AARNET is the University's backbone connection to the internet which has a capacity of STM-4[2] and a satellite-based communications network (USPNet), which is used to reach approximately 29,000 students across the vast expanse of the Pacific Ocean. Students are provided with a blended range of printed and online materials, multimedia components, and audio and video tutorials through our video conferencing

[1] Australia's Academic and Research Network (AARNET), http://www.aarnet.edu.au/

[2] STM-4 (Synchronous Transport Module) STM-4 = 622.080 Mbit/s http://en.wikipedia.org/wiki/STM-4

system which is conducted at the main Suva Campus and received at the regional campuses by satellite transmission.

Moodle[3] is the official Learning Management System for the USP after it went through a process where a rigorous evaluation criteria was applied against some notable LMS's including A-Tutor, Sakai and WebCT (bought by Blackboard) and a home grown system called Edison based on Plone systems." The main reasons that the University considered Moodle to be the best candidate were based on its pedagogical fitness for the University's course delivery purposes, the extensive adoption of the platform by educational institutions around the world, and the overall usability, reliability and functionality of the platform.

2.0 Literature review

Emerging ICT tools and technologies have certainly demonstrated to be a force to be reckoned with which has transformed the learning and teaching landscape. In this modern times of learning and teaching ICTs higher education is the most powerful tool for the creation of that knowledge and hence a knowledge-based society. ICTs have brought about drastic changes in the facilitation of education and revolutionised the way teaching and learning are conducted. ICTs allow open source learning rather than manual source learning, thus encouraging students to learn new ideas. These innovative tools also bring about active learning and encourage collaborative, creative, integrative and evaluative aspects in the education sector (Mbatha, 2014). Likewise, in his earlier study, Jorge (2002) hypothesizes that ICTs provide a great development opportunity by contributing to information dissemination, providing an array of communication capabilities and increasing access to technology and knowledge, among other things. Studies on the adoption of ICTs across the globe in higher education recommends that a robust ICT infrastructure be made available to enable all stakeholders involved in the learning and teaching process to use e-learning systems effectively. However, it is important to note that for a visible and effective revolution to take place in higher education, changes will have to occur that will disrupt the status quo.

The integration of ICT in higher education is 'inevitable' (James & Hopkinson, 2009). ICT has changed the way businesses and industries are conducted and influenced the way people work, interact and function in society (Bhattacharya & Sharma, 2007; UNESCO, 2002). ICT has become common place at home, at work, and in educational institutions (Kirkup & Kirkwood, 2005). The use of ICT, including the Internet at home and work has increased exponentially (McGorry, 2002). In order for any tertiary institution to engage with educational technology, it is vital that it enables the academic discipline areas to reconceptualise its pedagogical models and practices and at the same time engage in research to compete with the international demands of growing educational technology.

Online education is not bound by location or the same time constraints; thus previously unserved individuals have taken advantage of educational experiences. As technology and courses have improved, more students have begun to take online courses alongside regular face to face classes. Some online classes even allow students to experience similar interactive class activities, and sometimes previously impossible activities with the help of tools such as wikis, blogs, social media, mobile devices, open source tools, open education, anytime/anywhere education, social bookmarking, sharing sites, wireless connections, Google, instant messaging, Internet telephony, social networks, free software, digital cameras and recorders, cloud computing, cheap storage, groupware, broadband, and virtual worlds as disruptive ICT in education.

At the USP, online courses are expected to grow exponentially. As of 2015, USP's bandwidth consumption tripled in size during the last seven years, while the number of online, ICT-based courses

[3] Moodle's design is in line with best practices in eLearning http://en.wikipedia.org/wiki/Moodle and http://docs.moodle.org/en/Philosophy

available to students is projected to grow almost 200% per annum, from 78 in 2007, to over 600 by the end of 2018, which will represent 75% of all courses offered by the USP.

At the USP for example, the 12 member countries vary widely socio-economically, particularly in terms of the availability of technical expertise and capacity, ICT infrastructure, policy development, learner support, management competence, workflow and systematic processes. Thus, the deployment of an LMS takes place across one institution but in a dozen very different contexts.

Given the range of possible approaches to LMS deployment, from theoretical or problem-driven, factor based or management-dependent, this paper reports on another institutional experience where a range of specific factors, including those cited, came to define the LMS implementation process.

3.0 Web based conferencing system

In an educational setting, the communications capabilities that are enabled by information technology allow for new pedagogical models, which can have profound implications for how today's students learn and prepare themselves for a workplace that itself uses these technologies in groundbreaking ways (Barnhart, A.C. and A.G. Stanfield, 2011). One good example of such ICT tools is web conferencing systems, which can be used to cultivate the skills needed to create and execute compelling academic and professional presentations online. Academics now have the full options of incorporating web conferencing into their courses which research has shown to increase comprehension and retention of material.

Web-conferencing systems offer a wide array of modalities for facilitating collaboration and contextual learning with tools such as Chat and notes areas can be used to communicate written text, Voice over IP enables audio-based discussion, and screen-sharing and whiteboard tools allow visual information to be exchanged. Kress et al. (2001, p. 2).

Considering that there are so many web conferencing tools available to us to leverage learning and teaching in Higher Education the USP also decide to make a leap towards improving its online courses with the use of BigBlueButton which is an open source web conferencing system main designed with the educational pedagogies.

a. BigBlueButton

An open source web conferencing system developed primarily for on-line learning and distance education. It is based on GNU/Linux operating system and integrates well with various learning and content management systems specially Moodle. BigBlueButton enables real-time sharing of audio, video, presentation (with whiteboard markup), polling, emote icons (including raise hand), chat, and the presenter's desktop. It is localized into over 35 languages and supports JAWS screen reader.

b. The trial

As the USP moves more and more courses and programmes online it becomes imperative that adequate learning support and tools were made available to student for a successful experience in this new yet demanding mode of learning. With the USP passion for using open source software as much as possible the team at CFL turned to bigbluebutton and used this tool in few courses as trial.

BI442: Biodiversity and Conservation a postgraduate level course was choose and this course was offered in Semester 1 of 2016. The course had 29 students 11 were based in Lautoka and 18 in Laucala. Classes were held every Wednesday from 5.00 pm – 8.00 pm.

c. Survey Results

A survey was conducted towards the end of the semester via the *Questionnaire tool* in Moodle and students were encouraged to participate. 4 reminders were sent via the Moodle private message. Only 9 students out of the 29 answered the survey (31%). The survey consisted of 11 main and would normally take up to 5 minutes to complete. Of the 9 students that answered the questionnaire 5 students (56%) were from the Lautoka campus and 4 from Laucala (44%).

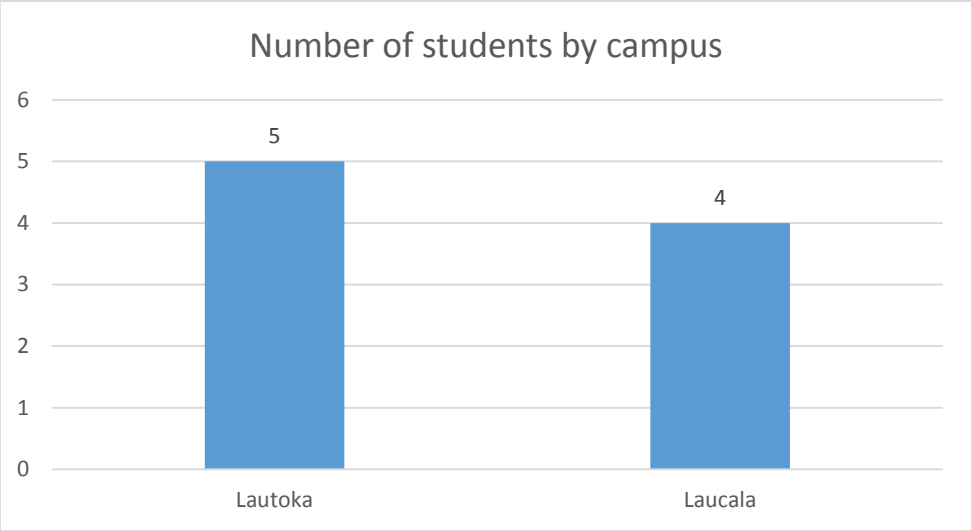


Figure 1 Number of students that answered the questionnaire by campus

d. Usability and Reliability of BBB

Results for questions 1 and 2 of the survey showed that students were generally happy with using the mic and chat. However, one clear error that occurred in every session was when BBB went from WEB RTC to Flash. While this occurred Lautoka campus was disconnected till the flash based BBB was loaded. This explains why 4 students agreed to Q2. Of these 4 students, 3 were from Lautoka campus. The 2 Students that disagreed were from Laucala.

It should be noted that this issue is caused by network configuration rather than BBB itself.

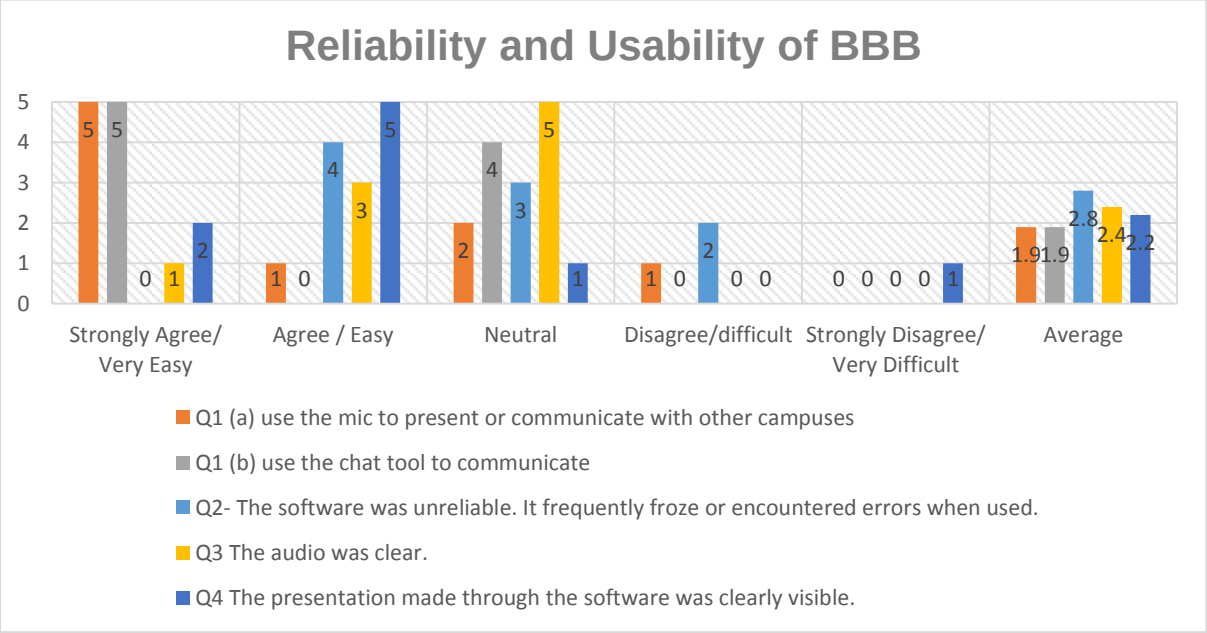


Figure 2 Q1-Q4 results with the average displayed in the far right

e. Interaction

Students from both campuses had to interact via BBB with each other and the Lecturer. A few of the sessions required group discussions and a nominated speaker from each group would present their group's discussion points. From the questionnaire results students were mostly happy with the interaction with only one student strongly disagreeing to Q6. Most students chose neutral (11) and this is maybe due to the fact that only certain people were chosen to present via BBB.

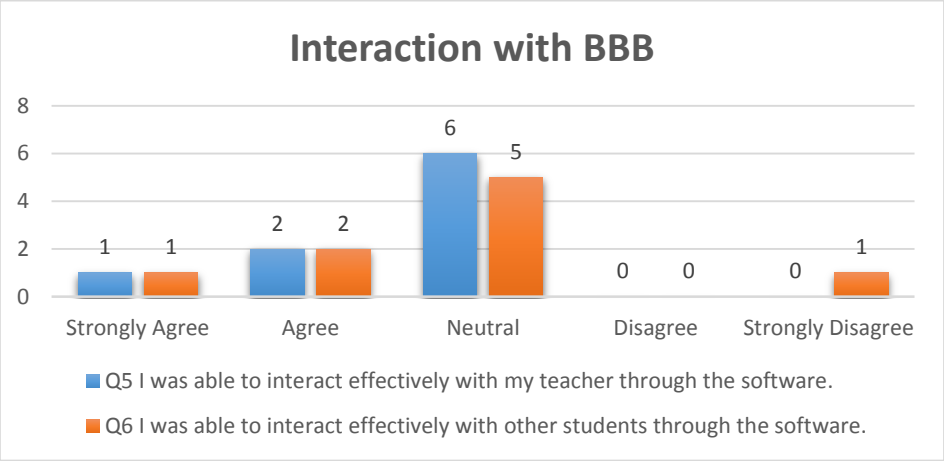


Figure 3 Q5-Q6 results for interaction with BBB

f. Recorded Lectures

BBB allows for recording of a session however it is only accessible in Moodle. Students were not able to download this recording. As an alternative, Camtasia was used to capture the lecture on the laptop (screen and audio) during the session. The recording was then edited and broken down into parts. These were uploaded for students to download. The results in the questionnaire clearly show that students preferred to download their lecture and view it on their personal computer (PC). Only one (1) student indicated that he/she "mostly view the lecture on Moodle rather than downloading it".

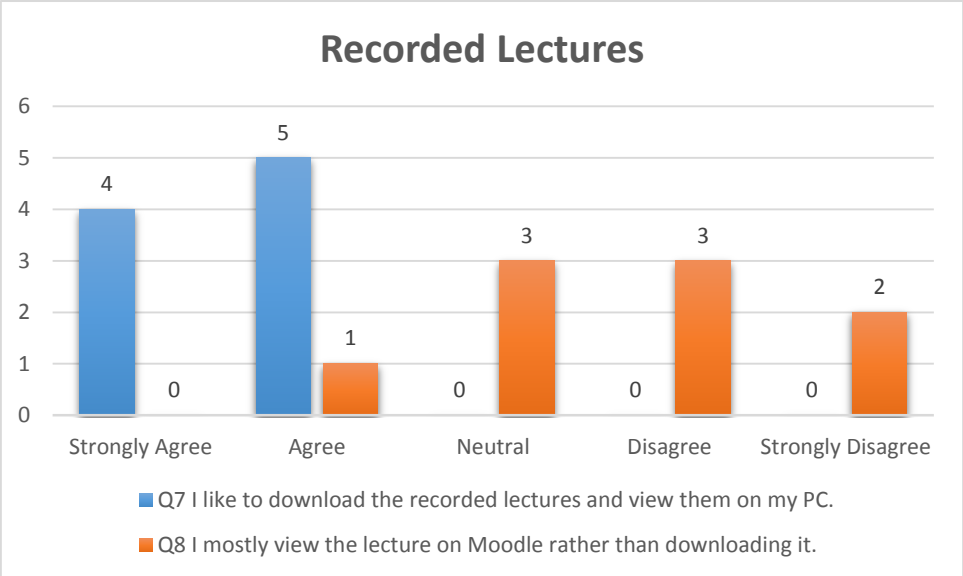


Figure 4 Q7-Q8 students view of recorded lectures

One student commented on the recorded lecture as follows:

> *"Would appreciate if the lectures are uploaded the next day....delays in lecture uploading cause a delay in studying at a personal level since we are full time workers at Lautoka and time management is very important to us."*

g. Support

Students were asked about the support given in Q9. There were mixed responses with 4 students agreeing and 2 students disagreeing. The rest were neutral.

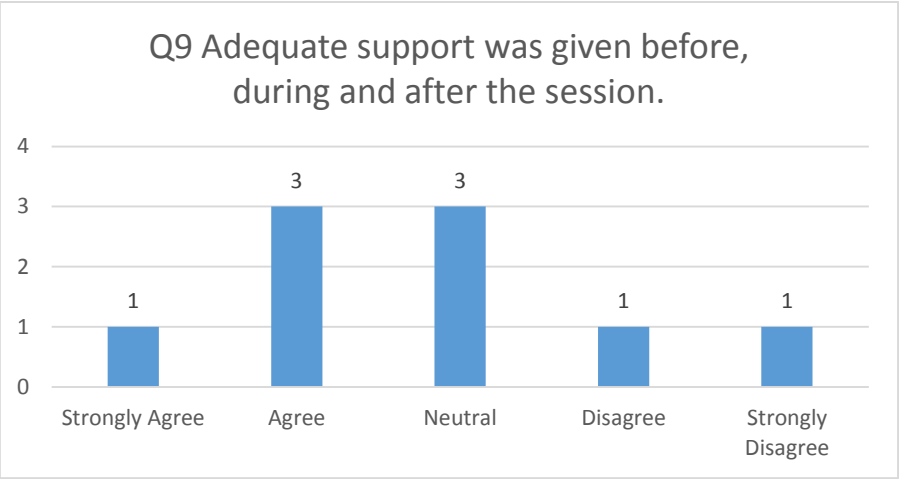


Figure 5 Q9 students' views on adequate support

Student responses that reflected on the support are as follows:

> *"I really think the set up needs to be ready before class. Once the class begins, there should not be any technical issues. For us in Lautoka campus, we had to wait for the technicians to do the set up and we are usually left behind in the lecture time. At times the audio plays up and we hardly hear a thing."*

> *"We frequently experienced the PC freezing mid-way and sometimes at the start of lectures. I didn't find this too much of a problem since live recordings were made available to us via Moodle. It did however frustrate most of us that we had to waste travel expenses and time to attend the lecture when we could have just missed it and then downloaded the recording ourselves. Otherwise our course coordinator was extremely helpful and considerate towards the Lautoka cohort and we are very appreciative of this :)"*

h. Overall Experience

Students (7) were generally happy with the overall experience with only 2 students being neutral.

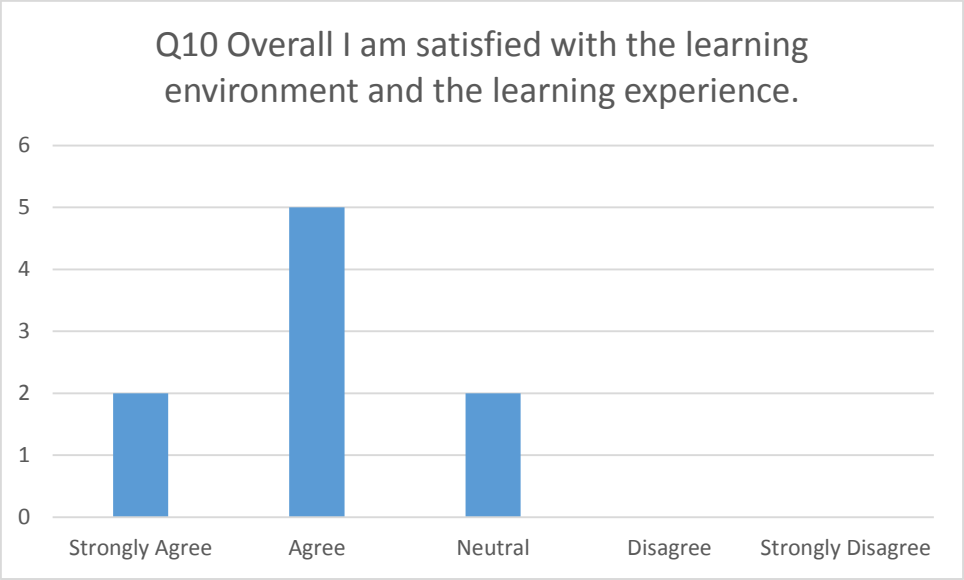


Figure 6 Overall satisfaction

Two (2) students entered comments reflecting on the overall experience as follows:

> *"Overall I think it is a great way of teaching the unit."*
>
> *"Overall the lectures through online learning was very efficient. However, a video (like Skype) type lecture would be more effective. I hope for more units to be offered like BI442 to Lautoka campus so that students like me who are working students have an ease of access to Lectures."*

4.0 Early Warning System

In Higher education institutions (HEIs) student demographics have radically shifted, and student enrollment numbers have dramatically increased and educators therefore face several challenges as they are now being asked to teach learners effectively across a much broader spectrum of ability, learning and study skills, prior learning and educational goals. (Leah P. Macfadyen, Shane Dawson, 2010).

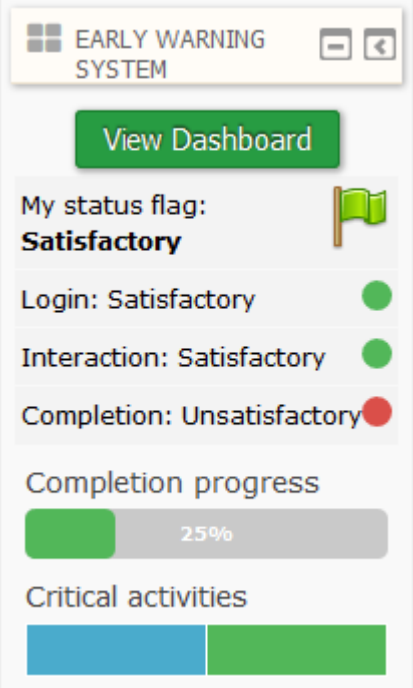
Despite the popularity of early warning systems, research on their implementation is sparse. In the last few years, researchers have begun to investigate various data mining methods to help instructors and administrators to improve e-learning systems (Romero & Ventura, 2006). These methods uncover new, interesting and useful knowledge based on students' usage data and some of the mains e-learning problems or subjects to which data mining techniques have been applied are dealing with the assessment of student's learning performance, provide course adaptation and learning recommendations based on the students' learning behaviour, dealing with the evaluation of learning material and educational web-based courses, provide feedback to both teachers and students of e-learning courses, and detection of atypical student's learning behaviour. (Castro, Vellido, Nebot, & Mugica, 2007). A well implemented early warning system can help educators address these challenges as EWS can be used to identify off-track students and to design and assess interventions to keep them on track to graduate on time as per there programme prescription.

The Early Warning System (EWS) project first started at USP back in 2014 when the Faculty of Science, Technology and Environment (FSTE) together with Centre of Flexible Learning (CFL) began an experimental project to monitor student interaction within the learning management system, Moodle.

In late 2015, the development of the EWS project was refocused and mainstreamed due to its importants to the USP. For the EWS project team this meant continuity, robustness, full-time support and availability to all users. While the development (software design and development) is done by the Learning Systems Team, other parts of the EWS project are still handled by the faculty staff involved in the EWS project.

a. About EWS

Early Warning System (EWS) is a student interaction monitoring tool.



This tool allows students to view their participation and interaction in selected activities of a course. EWS creates a Student Dashboard which presents a summary of a student's interaction in Moodle.

The EWS tool offers the following features for students:

A progress bar indicating the critical activities/resources and their completion status.

Completion percentage of the monitored activities in the course.
Overall status flag, based on set criteria and student interaction.
Graphical display of the weekly login trend of the student.

Graphical display of the interactions of the monitored activities of the class against a student's interaction.

Upcoming and overdue activities are easily identifiable.

In addition to the features mentioned above, the EWS tool allows

teaching staff to get an overview report of the overall class interaction and participation. The interaction data presented by EWS is based on the student interaction in Moodle. It does not factor in other learning activities students engage in outside of Moodle. Therefore, EWS should be used only as an indicative tool for visualising student interaction and not as a tool for measuring student performance.

b. Status Flag

The status flag represents your overall interaction in the course. It is based on the percentage computed from your login index, interaction index and activity completion in the course.

During the initial set up of the EWS tool for the course, the lecturer assigns weightings to the login, interaction and completion indices based on the nature and expectations for the course.

There are three types of status flags.

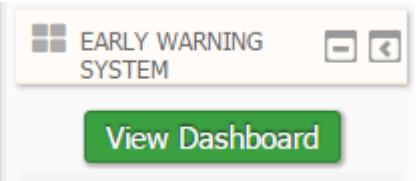
Flag	Status	Remark
	Satisfactory	Green flag - between 60% to 100%.Your overall interaction and completion meets the expectation of the course.
	Average	Orange flag - between 40% - 59%. Your overall interaction and completion is quite low.
	Unsatisfactory	Red flag - between 0% to 39%. Your overall interaction and completion is below the expectation of the course.

The login index, interaction index and the activity completion are denoted by either a green, orange or red circle.

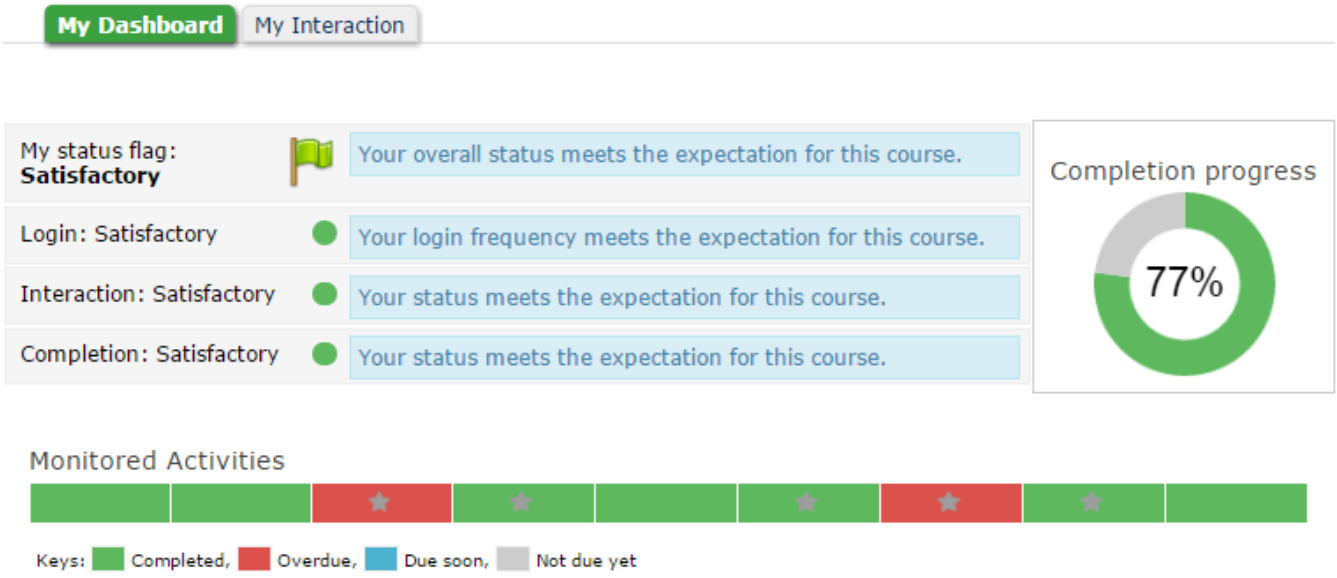
Circle	Status
	**Green** circle means **Satisfactory** interaction
	**Orange** circle means **Average** interaction
	**Red** circle means **Unsatisfactory** interaction

c. Student Dashboard

To view the student dashboard, locate the EWS block in your course page and click on View Dashboard button.



The Student Dashboard shows the same set of information that is shown in the EWS block on the course page, but with some extra details. Given below is a screenshot of the Student Dashboard page.



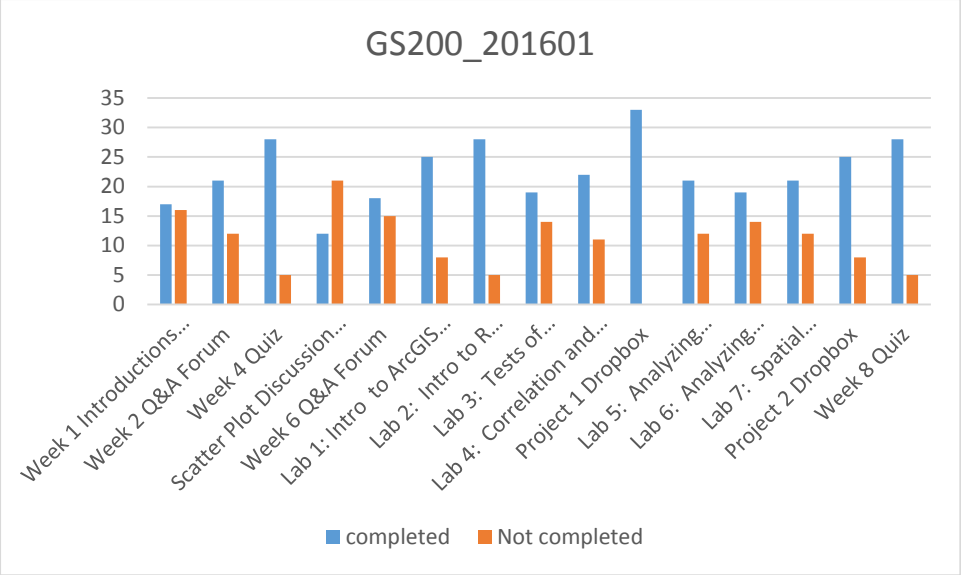
The Monitored activities bar shows all the activities that are enabled for monitoring in the course. This includes both critical and non-critical activities. To view the details of the activities, move your mouse pointer over (or tap) the coloured blocks, and the details of the activity will display in a pop up.

d. EWS Trial

GS200_201601 and ISF21_201601 were two of the courses where the course coordinators were very keen in participating and trialling EWS to gauge its potential in improving the course completion, student grades and attrition rate. GS200: Quantitative Methods is a second year undergraduate course and ISF21: Foundation Information Systems is a pre-degree level course and both courses were offered in Semester 1 2016. GS200 had 33 students while ISF21 had 426. Below are some of the basic analysis that has been carried out as we are still in the very early stages of implementation and trials of this new tool. There are various other analysis types and techniques being discussed around all the of data that is being generated and gathered by the EWS system.

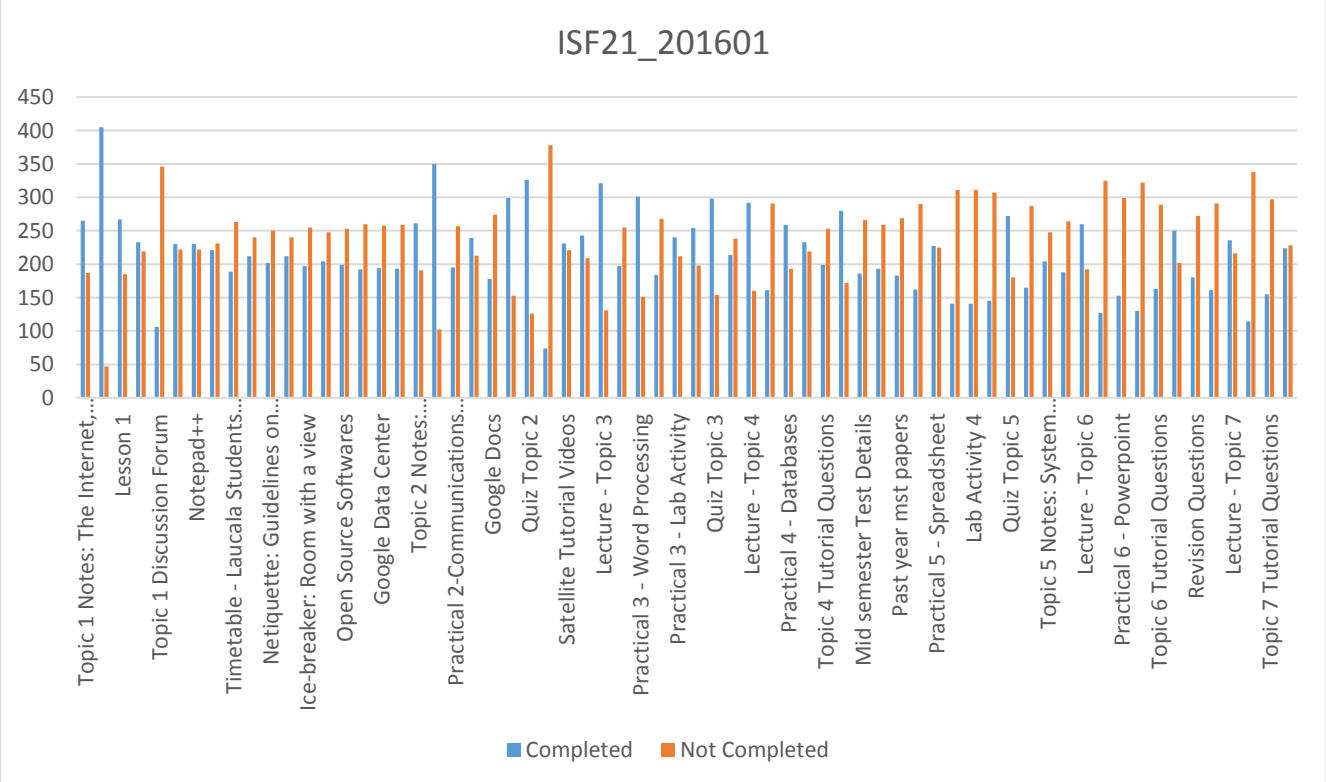
GS200

Overall status	Total students
Satisfactory (60 - 100)	23
Average (40 - 59)	3
Unsatisfactory (> 40)	7



ISF21

Overall status	Total students
Satisfactory (60 - 100)	241
Average (40 - 59)	72
Unsatisfactory (> 40)	140



5.0 Conclusion

Over the past decade or so education sector, particularly higher education institutions have rapidly adopted digital technologies to transform the learning and teaching landscapes. The pace of this adoption combined together with the rapid development of technologies, offers newer opportunities to higher education institutions to leverage the use of ICT in learning and teaching. USP is no different, as it continuously strives to leverage ICT in education providing adequate, effective and efficient ICT tools to enrich the delivery of learning and teaching across its 14 campuses, providing best possible meaningful learning experiences to its over 29,000 students enrolled in any of the four modes of delivery: face-to-face, print, blended and online.

In that respect, two such technologies have been recently trialed out and integrated at USP; Web based conferencing system (BigBlueButton) and Early warning system (Student interaction monitoring tool). This paper discussed how these two technologies were introduced and implemented at USP. Initial surveys that were presented in this paper indicate that the two technologies had very positive impact on student learning experiences. Future research work should focus on the efficacy of these two technologies on the student achievements and enhancement of student experiences.

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