Evaluating new learning technology in Asia - Singapore as a case study

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Abstract— In the contemporary landscape of fast-paced and highly competitive societies, the computer has become an indispensable tool in both the workplace and education. The ability and knowledge to use computer software, gadgets and innovative equipment, empowers individuals to be at the cutting-edge in performing tasks and in finding solutions to problems. Today's technology is constantly working to create better solutions to overcome the limitations of traditional audio visual (AV) connectivity. Wireless learning technology is also predicted to increase overall productivity and creativity in application and to be cost effective in implementation, maintenance and delivery. This makes it a more viable solution than traditional wired technology. Successful Wireless Learning Technologies (WLTs) are set to replace the traditional methods of information sharing and set the trend for future information presentation and collaborative multiuser sharing. Educating students for the future workplace requires innovative uptake of the latest technologies. Successful Wireless Learning Technology is one of these innovations, providing convenience in using wireless technologies and offering wireless smart presentations and collaboration solutions for the education field. This scoping paper aims to make a preliminary evaluation of wireless learning technologies for multi-platform compatibility over a multitude of personal devices and operating systems. The paper begins by outlining the uses of a variety mobile and wirelss technologies, paying particular attention to the Singapore context. It then presents a comparison of WLTs in terms of instalability, usability, performance, usefulness and manufacturer support. This information is a preliminary background to a research proposal to investigate one WLT solution, the ProVEOS system. The paper concludes with recommendations for the adoption of digital learning technologies to promote collaboration between students and greater interaction of students with academic staff, thus enhancing the learning and teaching experience.

Keywords- wireless learning technology, education, student experience.

I. INTRODUCTION

Progress in wireless learning technology (WLT) has influenced developments in all sectors of the economy. The higher education sector, including, importantly, the learning and teaching arena, has enormous potential to engage wireless learning technologies. This engagement includes mobile technologies to facilitate student engagement and enhance the interaction of students with academic staff.

The Singapore context

According to the World Economic Forum's recently released Global Competitiveness (GC) Report [1], Singapore is now the second most competitive economy in the world. It has surpassed Sweden to fill the second position in these rankings, making it the only Asian economy on the top-five list. It is an ideal market in which to establish a foot hold in businesses with a global intent [2].

Singapore taxation is one of the lowest and least complex in the world. Singapore, unlike many countries, does not impose capital gains, dividends or wealth tax. Corporate taxation is levelled at 8.5% for profits up to S$300,000 and limited to a flat 17% for earnings above that amount. Personal income tax rates for residents start at 0% and do not exceed 20% [3].

Additionally, Singapore is the financial hub for the South East Asian region due primarily to the efficiency and stability of its financial system. It is located at a geographical crossroads and has used its location to develop transportation and communication networks of international standards. These are, in turn, supported by advanced IT infrastructure. These factors make Singapore an attractive place for business start-ups. In fact, Singapore's financial system and infrastructure, combined with its strategic geographic location as a major hub in a network of shipping routes, has enabled the country to attract a multitude of Foreign Direct Investments (FDI) to set up their regional or global HQs.

In order to understand the potential of the Singapore market for business prosperity, start ups must analyse the geographic, demographic and psychographic factors of the country. Singapore compares well with other countries in the Asia-Pacific region at the beginning of the Asian Century.

Singapore is a very stable country ruled by a one major political party – the People's Action Party. It has a sound economic situation, as shown by a per capita GDP of US$62,100 in 2010 - the 5th highest in the world. According to 2010 figures, Singapore has a real growth rate of 14.5% and an inflation rate of 2.8%. The population of Singapore is 5.1 million which comprises of Chinese (74.2%), Malay (13.4%), Indians (9.2%), Eurasians and Peranakans(3.2%). (Retrieved form Official Tourism Board Singapore website YourSingapore.com www.yoursingapore.com). The median age of Singaporeans is 40.1 years and 86.2% of people are above 15 years old. The expatriate population includes citizens from countries as diverse as the Philippines, Indonesia, India, Bangladesh, China, North America, Australia, and European countries. As a result, Singaporeans have become more westernized and liberal in their mind-set and business conduct [2].

Singapore is also a global education hub. It has highly established, globally competitive, national universities and also draws in international universities in twinning arrangements or in establishing offshore branch campuses in the nation state. At the cross roads of east and west, north and south, strategically located between India and China, and at the heart of S-E Asia, Singapore attracts internatonal students from around the region and the world.

Within this context, as both a business hub and education hub, start up companies in Singapore include those developing wireless learning technologies. It is within this broader context that the authors of this paper have formed a research team to study WLT within the context of their own offshore campus of James Cook University – JCU Singapore. We intend to undertake a case study of one WLT, the ProVEOS system. This paper is a preliminary contribution towards this larger research.

II.   LITERATURE REVIEW

Use of Mobile Technologies in Education

Mueller, Wood, Pasquale and Cruikshank [4] studied the use of mobile (handheld) devices in higher education. The methodology of longitudinal analysis was adopted in this study. Conducted at one university over one teaching period with the duration of 16 weeks, the researchers documented students use of one mobile technology, that of the smart phone, in a designated undergraduate subject. Students reported that the smart phone device was easy to use, and they were optimistic regarding its potential role as an instructional tool. The findings indicated that students were self-directed in their use of the device, building their capacity as both interdependent (collaborative) and independent (individual) learners. The students explored smart phone functions and uses beyond the tasks provided by their instructors. They found

innovative ways to use the smart phones within and external to the classroom. Exchange of information and ideas emerged as the most frequent use of the smart phones. Findings recognized that academic staff ensure that clearly defined instructions for the use of smart phones as teaching devices are communicated and explained to students.

It is important to note however that although the study supported the use of a handheld device as a learning tool, their use as a "classroom instructional" device for learning and teaching purposes was more limited than student-directed use of the device for social communication (chatting and texting) in and outside the classroom. This study highlighted that the affordances of technology are dependent on high student uptake. Absence of student interest and motivation in the use of technology for learning will reduce the intended positive outcomes of the technology. The researchers suggested that student participation in identifying device uses for learning and teaching purposes increases student participation with the mobile devices [4].

Similarly, Ross, Morrison and Lowther [5] discuss the positive influences of wireless technology on learning experiences in education. Acknowledging that this study was conducted in a secondary school context, it does have implications for higher education. The study employed a qualitative methodology of interviews to explain the use of new technology tools, such as the iPad, within the school curriculum [5]. It found the use of the tablet devices improved the efficiency of teachers and the workflow of students with neither group constrained by time or space. Students reported being able to use multiple functions/applications of the iPad, namely: writing memos, calculating, and online information searches. For teaching staff, the device promoted technology leadership and efficacy; augmenting their ability to lead a technologically advanced teaching and learning space. Wireless technology tools, including tablets and smart phones, were identified by participants as "remarkably fashionable". Students and teachers were eager to use them, thus changing their worldview of learning and teaching. The authors maintain that exponential growth and adoption of wireless tools will shape learning and teaching practices in the near future. The availability of high-speed internet connection will be a primary factor in the efficient and effective use of this technology.

Morgan [6] explains how mobile learning can be enriched by utilising audio visual methods of communication coupled with the technological facility to communicate. Referring to student engagement in education, Morgan deliberates on the use of handheld wireless devices such as laptops, tablet PCs and smart phones. This study explores the additional utility of using mobile devices with publicly available applications such as mind mapping software and the WIKI collaborative platform. It reveals the popularity of social media platforms to further enrich the quality of mobile learning facilities.

Findings from the above studies suggest that mobile technologies in educational spaces are highly useful. This is primarily due to the quality returns from the devices' utility; specifying, effective and efficient communicative methods are enriched by the technologies' convenient accessibility in time and space.

In an earlier study Liu, Wang, Liang, Chan, Ko and Yang [7] focused on the WiTEC technology platform which made use of integrated mobile learning devices, wireless communication and network technologies. These researchers uphold that the use of this technology makes delivery and learning more effective when compared with traditional teaching and learning. Liu [7] noted previous research demonstrating that highly interactive classrooms not only increase the utility rate of class computers but also enhance students' attention and interest in learning. This being the case, the possibilities for technology enhanced learning, and learning spaces, are vast. The benefits include stimulating curiosity in learning, an important factor contributing to deep learning. The goal here is to create learning and teaching spaces that promote understanding and application to real life – where educational objectives are realized, including subject and course level learning outcomes, graduate attributes, capabilities and qualities. In addition, WiTEC technology enables the teacher to monitor each student's learning status so that teaching and learning activities can be adjusted and prompt feedback of assessment for learning can be given.

Conversely, Gay, Stefanone, Grace-Martin and Hembrooke [8] reason that wireless technology for educational purposes cannot be adequately understood and taken up through a one-size-fits-all mentality. They argue that different learning and teaching environments, course content, pedagogical models and curricular philosophies influence how wireless technologies can be used most effectively.

In recent years there has been a paradigm shift from the traditional teacher-oriented to a more interactive student-oriented, higher education environment. Engagement with, and participation of, students is prioritized, with teachers encouraging students to use familiar technology as part of their learning experiences. While many new audio visual and IT related products have been developed to meet this demand, no one product has met all the needs of the contemporary classroom as effectively as Wireless Learning Technologies (WLTs). Features like 'share my screen', interactive white board, live editing, recording, e-exams, e-polls, quad screen display and, most importantly, seamless display of peripherals ranging from PCs to smart phones, means that WLT offers a range of products to suit various requirements.

Use of technology education in Singapore

With respect to the introduction of on-line education in Singapore, Koh, Kin, Wadhwa and Lim [9] identify certain benefits of mobile technology: motivation for student learning, enhanced capacity for assimilation of knowledge, and greater knowledge retention of the subject matter. The researchers make reference to increases in motor co-ordination which arise due to stimulation caused by the activity of on-line game playing. They further explain 'push factors', which refer to the external forces influencing the utility of gaming; as well as 'pull factors', which refer to the internal motivating factors that stimulate teachers to utilise gaming in the field of education.

The authors [9] highlight the positive influence of learning with technology, referring to it as 'ease to learn'. These researchers conclude that the use of web 2.0 online social applications, in conjunction with open-source learning management systems, can be highly beneficial. They contend that success is due to the nature of the collaborative activities and teaching experiences derived when these technologies are put into practice.

Analysis of wireless learning technology (WLT) in Singapore

A WLT platform is marketed as providing solutions for shared access to a display or projector to facilitate interaction and comparison, moving seamlessly from one presenter to another. Any wireless AV solution should be easy to use, easy to maintain and be cost effective. It should support an unlimited number of users with both a wired or wireless connection or by extending to other sites using a VPN connection. With scalable solutions to suit every size of application, the WLT should offer a choice of products which are all packed with innovative features. These are strong reasons to justify the reliance of government, military, transportation networks, hospitals and businesses on WLT technology in Singapore.

Using a content analysis approach, a paper published on the World Education site (www.worldeducation.com) evaluated the WLT solutions available in Singapore. The attributes for comparison included: installability, usability, performance, usefulness and vendor support. These factors were considered the most common in decision-making processes in buying and using a WLT system (see table below).

A recent WLT solution designed in Singapore that does not feature in the World Education evaluation is the ProVEOS system [10].

III. METHODS

Market Analysis

WLT has been widely used in several higher education institutions across the globe. For example, the ProVEOS platform is operational in the following locations: North Carolina University, University of Southern California [11], James Cook University (Singapore/Australia), and Republic Polytechnic, Singapore [12].

There are generally five market segments for wireless presentation solutions in Singapore: education, retail, financial, hospitality and healthcare. The education segment covers the basic to advance wireless presentation network and collaboration requirement which forms the main bulk of the demand. However, it is also the segment that has the most competitors. Major competitors include Apple, Microsoft, Jackson, Thinkwave and WOW Vision [13]. The other smaller players in the Singapore market include Kramer, Avaya, InFocus, WiJet Video and Aver. The table below presents a comparison of major WLTs available in Singapore.

TABLE I.   COMPARISON I

Name	Manufacturer	Platform	Price	Grade
ClarisWorks	Apple	Mac	NA	Adult
Excel	Microsoft	Windows	339	Adult
Grade Quick	Jackson	Windows	70	Adult
Thinkwave	Thinkwave	Windows	80	Adult
ProVEOS	WOW vision	Windows	NA	Adult

In order to ascertain the usefulness of the WLTs it is necessary to undertake a comparison based on primary attributes such as installabilty, usability, performance, usefulness and support provided by the vendor. This set of attributes has been established as an evaluation scale in previous studies [14]. The studies utilise a scale of 1 to 5, where 1 indicates very disatisfactory, 2 disatisfactory, 3 average, 4 satisfactory, and 5 very satisfactory.

TABLE II.   COMPARISON II

	Installabi-lity	Usability	Perfor-mance	Usefulness	Support
ClarisWorks	4	3	4	4	0
Excel	4	3	4	4	3
Grade Quick	3	3	3	4	3
Thinkwave	4	4	5	5	5

Source : http://www.educationworld.com/a_tech/tech109.shtml

The table above can be compared with the table below which uses the same criteria and the same scale to ascertain WLT ProVEOS system's performability.

	Installabi-lity	Usability	Perfor-mance	Usefulness	Support
*ProVEOS	5	4	5	5	5

Source : based on a survey of 15 respondents at JCU Singapore at the conclusion of a ProVEOS training workshop.

The findings on ClarisWorks, Excel, Grade Quick and Thinkwave are published by Education World, a free online resource for comparitive analysis of WLT platforms. It should be noted that the online resource is managed by a company that provides a WLT platform and therefore it is difficult to verify if the papers published on the site are entirely independent. Nevertheless, the criteria of usability of the WLT platforms and the five point scale can be used to match findings against the evaluation of the ProVEOS system. This evaluation was done by users from a higher education institution. The comparison indicates that WOW-Vision (ProVEOS)'s performability, according to the small sample survey, ranks well in comparison to other WLTs in term of installability, usability, performance, usefulness and support. Except for usability, the rest of the attributes score very high. Although the 'usability' criterion ranks comparitive with the other highest ranking WLT system,

it does not score as high as the other attributes. The lower score for usability indicates a problem with the friendliness of the user interface. This is mainly due to a lack of an icon-based user interface. The current system employs a text-based interface. The overuse of text reduces user experience.

IV.   CONCLUSION

WLT has grown immensely over the last decades. It has contributed to more efficient and effective learning and teaching environments in higher education. WLT has helped both students and teachers in the education industry by allowing learning technologies, such as classroom management, to go wireless. In addition to increasing overall productivity and creativity in applications, WLTs ought to be cost effective, making initial investment friendly. The reduction in installation and maintenance costs positions WLTs as an extremely viable solution for small and large education institutions alike.

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