Blended Learning for the Indo-Pacific[1]

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***Abstract*—Information Technology disciplines make up a significant proportion of the degrees taken by international students at Australian universities. These programs are primarily delivered on-campus, but are increasingly using e-learning techniques and becoming, in effect, blended. This provides the opportunity to offer international students part of their program by distance education before, or instead of, traveling to Australia. This could complement the campus-based education provided and complement initiatives by China, Australia, Japan and the United States for regional development. However, Australian university academics have little background or training in e-learning and program designs have not made use of the flexibility this provides. In this paper, we discuss how computer professionals can be trained online to deliver online training to students of the Indo-Pacific. The application of learning theory to support distance learners is also discussed in this paper.**

***Keywords*—Training, Employment, educational institutions, teaching, Australian educational system, assessment, cognitive learning theory, social learning theory, Indo-pacific, blockchain, microcredentials**

I. Introduction

Chinese universities are forming joint ventures with institutions in the Indo-Pacific and providing scholarships for citizens of the region to study in China [1]. These initiatives have been accelerated by China's Belt and Road Education Plan [2]. However, these are based on the use of conventional campus based education. Australia could complement these initiatives using new forms of blended learning, which merge campus with online learning [3]. This would allow students of the region to work together online [4].

Degree programs in computing disciplines (Computer Science, Software Engineering, Information Systems and Information Technology) make up a significant proportion of those undertaken by international students at Australian universities. The programs are primarily delivered on-campus in Australia. These programs increasingly use e-learning for part of the teaching and are becoming, in effect, blended education. The opportunity exists to offer part of these programs by distance education, with the student in their own country, before they travel to Australia for more advanced tuition.

Delivery of distance education online requires skills which few Australian university academics have. The computing disciplines offer a unique advantage in this regrade, as its practitioners are already proficient with the design and use of sophisticated online applications. It is proposed that computing academics, and practitioners who teach part-time at universities, be trained in e-learning design and delivery.

In this paper, we discuss how computer professionals can be trained online to deliver online training to students of the Indo-Pacific. The application of learning theory to support distance learners is also discussed.

II. International Students in Australian Higher Education

Of the 391,136 international students studying with Australian higher education institutions in 2016, 29% were outside Australia ("offshore"). Of the offshore students, 57% were studying at a partner institution, 36% at an Australian campus in another country, and only 7% by distance education [4]. This suggests scope for more distance education students.

Student visas for on-shore international students require them to study full time. As well as imposing a financial burden on the student it also precludes some forms of concurrent learning pedagogy where students study part-time while also gaining practical experience in their discipline. There is a demand for part-time study, with 26% of offshore students, where these visa rules do not apply, studying part-time in 2016 [5]. The provision of distance education would further facilitate part-time study integrated with work.

Of the Australian international students in 2016, 9% were studying "Information Technology" [6]. It is not clear if this includes students studying in business and engineering schools, classified in the official statistics as "Engineering and Related Technologies" and "Management and Commerce." Based on our experience of teaching classes of computing students, these may make up to 25% of all international students.

Master's by Coursework and graduate diploma students make up 49% of all those studying IT, followed by Bachelor's and Diploma students at 47% [5], with Doctorate by Research students making up the remainder. There were less than five Doctorate by Coursework international students at Australian institutions in IT in 2016.

The statistics for international IT students suggest that there is considerable scope to offer distance education courses, particularly for part-time graduate students.

III. Australian Education and The Indo-Pacific

In 2016, 67% of international students studying with Australian higher education institutions were from Indo-Pacific

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countries [7]. Australia has a tradition of educating students of this region, from the 1951 Colombo Plan. During the decades of the plan, there were 20,000 university students from the region educated in Australia [8].

Development of the region has been one focus of China's Belt and Road initiative. While most attention has been on transport infrastructure, China's initiative includes a Belt and Road Education Plan [2]. Chinese universities are forming joint ventures with institutions in the Indo-Pacific and providing scholarships for citizens of the region to study in China [1]. These education initiatives use of conventional campus-based tuition and so could be complemented by other nations providing distance education.

In response to China's China's Belt and Road initiative, Australia, Japan, and the United States announced a partnership for Indo-Pacific infrastructure, in July 2018 [9]. No mention of education is included in the initial announcement. However, online education might be included under the heading of technology:

> "We will uphold these principles as we mobilize investment in infrastructure, such as energy, transportation, tourism, and technology that will help stabilize economies, enhance connectivity, and provide lasting benefits throughout the region." [9]

It should be kept in mind that alongside China, the other rising economic power in the region is India [10]. Chinese students are the largest cohort of international students at Australian universities at 27%, followed by India at 11% (in 2015) [11]. While India currently provides fewer international students than China, it is the world's second-largest market for e-learning after the US [10]. This is despite considerable difficulties in having distance education recognized as legitimate formal education in both India (and China). This is an area which we propose Australian computer professionals can assist universities: e-learning combined with later campus based education for a "Colombo Plan 2.0".

IV. Teaching computer professionals to deliver online training

The conventional approach to designing and delivering higher education programs for computer professionals is to have a team with computer professionals and educational specialists. However, education and training are recognized specialist skills within the computing field. It is suggested that computer professionals who have education skills are best equipped to design and deliver education about computing. These professionals also have an additional advantage when designing and delivering online education, due to their knowledge of computing technology.

The qualifications of computer professionals are accredited in Australia, Canada, Chinese Taipei, Hong Kong China, Japan, Korea, the United Kingdom and the United States, under the Seoul Accord [12]. The Australian signatory to the Seoul Accord is the Australian Computer Society (ACS). When certifying computer professionals under the Seoul Accord, ACS requires competence in at least one "specialism." The specialisms are derived from the Skills Framework for the Information Age (SFIA) [13]. Five of the SFIA Skills and thus five areas of specialization for computer professionals relate to education and training [14]: development assessment, development management, learning delivery, learning design and subject formation.

SFIA provides a brief description of each of the education and training skills required. SFIA skills are specified at several levels of expertise. This enables computer professionals working in higher education institutions to be formally certified in education relevant to their discipline. Such certification could be of value to Australian universities seeking to improve the quality of their education. Computer professionals can apply their training in the systematic design of systems to the educational process [3].

A. Acquiring Education Skills Through Blended Learning

Blended learning combines online and offline (classroom) techniques. Also, these can be combined with teaching students who are already working in the field they are learning. The bending can be within a course, with the students studying online for hours, days or weeks, then attending a face to face class. Alternatively, the blending can be less granular, with whole courses, semesters, or years, being online, alternating with face to face tuition.

Education research (discussed later under "theory"), suggests that blended learning has superior outcomes to pure online or classroom-based learning. However, practical considerations of logistics and resources are likely to have a more substantial effect. Coarse-grained blended learning will suit international students, where they can study part-time online in their own country, before traveling to undertake more intensive campus-based programs (perhaps continuing their part-time study online when returning home). Computer professionals learning to teach at a nearby institution may be able to take advantage of a finer blend, attending a class weekly. It should be noted that even notionally on-campus classroom-based courses now contain some online component.

B. Acquiring Education Skills Through Mobile Learning

Online learning has typically assumed the use of a desktop or laptop computer, with a keyboard and a screen approximating the size of a paper textbook. Mobile learning aims to deliver learning through a mobile device, such as a tablet computer or increasingly a smartphone.

Learning Management Systems (LMS) such as Australian developed Moodle, are now available with mobile device compatible interfaces, either via a responsive web interface, an App, or both (Moodle offers both). While the LMS offers a mobile compatible interface, the educational content still needs to be designed with a mobile user in mind. Video and document content needs to be designed to be readable on a mobile device and learning in smaller chunks, suitable for a mobile user with small amounts of time to study (such when on public transport).

Not all of a course needs to be designed for a mobile course. For example, readings, videos, podcasts, and quizzes can be designed for short bursts of study, while longer assignments require extended periods of work.

An example of short, learning modules which are part of a larger unit is the Australian National University's "coffee course" series [15]. Each course takes place over four or five days, with a short reading, video and writing exercise each day. This is intended to take the student 20 minutes per day. There

are currently fourteen courses in the series. Staff who complete ten modules, and write a 400-word reflection, receive a certificate.

C. Acquiring Education Skills Outside Coursework

SFIA framework is not prescriptive as to how skills are to be acquired, nor the details of how they are applied. Similarly, the ACS does not specify how applicants acquire skills [14]. As with other soft skills, education and training may be acquired outside conventional coursework, with hands-on experience being a useful adjunct to formal coursework.

E-portfolios provide a way for students to document their experience gained through other coursework and practical experience. The student can be provided with a template of all the skills they are required to demonstrate and then fill this in with evidence. The evidence may be accompanied by a few paragraphs explaining its relevance and reflection on the learning. An assessor then checks the evidence is sufficient.

One way to ensure the learning is relevant and credible is by dogfooding: using the same learning techniques to teach the computer professionals as you want them to use in their teaching [16]. Exposing professionals to teaching techniques raise their confidence that this will work and it is something they can use.

V. Theory

Mobile learning can be seen as a logical development of paper-based distance education, radio, TV and computer media, into the current wireless handheld realm. As with previous developments, the technology becomes of less interest as it comes into routine use, and the emphasis changes to the educational possibilities and pedagogy [17]. Later work has looked at education as a process, with activity theory, to explain the process by which students are guided to an outcome, by cooperatively producing objects using tools [18]. May forms of mobile device use in education are adaptions of existing practice. An example is mobile technologies used to annotate teaching sessions [19]. A traditional part of teacher professional development has been to have a peer sit in on a class and make notes to improve practice. Such peer observations can now be made using a mobile device to annotate a video of the class [19]. The same technique could be applied to a remote synchronous, or asynchronous, class, where the interactions between the teacher and students would be annotated. This would require expansion of existing tools, either in the form of a modified annotation App, or built into the LMS itself.

Some studies have pointed to experimental evidence that asynchronous e-learning provides better learning outcomes than face to face classes (with synchronous delivery the least effective) [20]. This is the opposite of conventional wisdom, which holds that synchronous learning is better than asynchronous and that a face-to-face classroom is a superior form of this. However, the assumption that classroom-based learning is synchronous has been questioned [21]. In practice, students are not all doing the same thing at the same time in a classroom, and it may be the asynchronous nature of a real classroom which makes it superior to a video conference.

Learning activities can be divided into categories such as Instructive, Practice-Based, Metacognitive, Constructive, Communicative, and Collaborative [22]. However, it is likely an activity will encompass several of these. Lessons will typically start with foundation knowledge. Many aspects of IT involve communication, collaboration and are practice-based. At a deeper level, meta-cognition is required for the planning and execution of projects. A neglected area for IT and other "hard" sciences are to have students reflect on their learning, thus the need for constructive aspects.

VI. Flip the Online Teaching Course

A typical online teaching course for Australian university academics will be run over a 12-week semester [23]. Despite being provided online, such courses typically teach a traditional form of classroom instruction. Those teaching at a university are encouraged to think of themselves as a "lecturer," with the primary form of instruction speaking face-to-face with students in one-hour blocks. This approach does not fit with current Australian university practice, where lectures are recorded, and only about 30% of students turn up to the live event [24]. Teacher training should reflect this reality by teaching online and blended learning.

A. Computer Professionals as Teachers

Computer professionals, with their skills in computers, are ideally placed to lead the change in thinking and practice with university teaching. It is proposed teacher training be flipped, with online delivery discussed first and face-to-face treated later, as an adjunct to this. Also, the assessment should be introduced earlier along with collaboration. Student teachers can be encouraged to reflect on their own experience as an online student and how this will improve their teaching. An e-portfolio can be used to encourage this reflection while forming part of the summative assessment [25].

It takes time and practice for a teacher to develop skills. The aim here is to provide initial training for the basic skills, so the computer professional can then gain experience by teaching, alongside further study. The use of further online and face-toface modules can then further develop skills.

B. Block-chain and Micro-credentials

Mobile online learning allows for more targeted learning, over much shorter periods than face-to-face courses. A student may undertake their studies in much smaller units of learning.

However, Australia’s educational system does not formally recognize very short units of learning, commonly called micro-credentials. Also, paper-based certificates and their electronic facsimiles are not well suited where an individual could have hundreds of such documents. A blockchain based testamur provides one alternative.

The New Zealand Qualifications Authority (NZQA) planned to recognize micro-credentials from tertiary education organizations from 22 August 2018 [26]. The NZ micro-credentials would require between 1 and 8 weeks study, making them much shorter than a degree. If this approach is successful, it could be adopted by Australia, to provide the flexibility of short courses, with the endorsement of a government education framework. At present, it appears the micro-credentials would be a supplement to, not a replacement for degrees.

A consortium of forty-seven Australian and New Zealand universities provide "My eQuals," a website with electronic academic transcripts and graduation documents for their graduates [27]. The website allows a graduate to provide controlled

access to prospective employers to certified digital evidence of their qualifications. However, this system assumes that a student will have a handful of qualifications and that the details will be required in human-readable form.

A student may take hundreds of short courses, each of which can be a micro-credential itself, and each from a different provider. Prospective employers, professional bodies, and educational institutions, will want to be able to read this data automatically and match against requirements. One technology which may be of use for this is micro-accreditation with block-chain [28]. The use of a public block-chain would allow a verifiable, detailed list of qualifications from many providers.

VII. Conclusion

Computer professionals can be trained online, to deliver online training, to students of the Indo-Pacific. This can support an approach based on activity theory, with students are guided to an outcome, cooperatively producing objects using tools [18]. This approach would complement the campus based education offered and complement initiatives by China, Australia, Japan and the United States for regional development. Examples of online courses delivered by higher education institutions in Australia and North America have been shown to produce similar results to face-to-face delivery [29]. Computer professionals skills in digital technology can be leveraged to jump-start Australia's e-learning offerings.

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