Cisco Based Curricula in University Units

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Abstract

The introduction of the Cisco Networking Academy Program (CNAP) curricula in the School of Computer and Information Science (SCIS) at Edith Cowan University (ECU) in Western Australia has been achieved via the introduction of a new minor in internetworking which is comprised of six new Cisco based units. These units are currently being offered and are all fully subscribed. The introduction of vendor based units in the university has raised issues concerning the nature of university based study and the role of practical assessments within university units. The commitment required in terms of investment, both in staff training and equipment is considered.

I. Introduction

The proliferation of information technology applications has led to a rapid increase in computer networking units within universities. There are many ways by which such units are currently taught. Some universities focus primarily upon theory and do not have a hands-on approach whereas others prefer a mixture of theory and practice.

Recently an increasing number of universities have themselves introduced vendor based education into their courses [1] [2] and this has raised issues concerning the nature of university based study and prompting the observation from Barnett that "*No longer are academics in the position of near monopoly that they have long held (for the past 100 years) in defining what is worthwhile knowledge"* [3]. Abelman has described vendor based certification when comparing it to more traditional university education as a "A parallel universe" [4]. Within Australia the predominant reason students undertake university education is to improve their employment prospects [5]. Furthermore, universities have had to face a *"growing clamour from industry for the graduates it employs to have more work-related skills"* [6]. The Dawkins higher education policy statement noted that: *"In the past institutions have not paid much attention to employers' views about course design and content. On the other hand employers have complained of a lack*

of relevance of courses to their needs, while taking little action to address the problem. That model is unsatisfactory for both higher educational institutions and employers…" [7]. Many university students have enrolled in Tertiary and Further Education (TAFE) studies after completing their degree study at university. A recent article in the Australian noted that *"Students are moving from the university sector to vocational education and training in their tens of thousands to improve job prospects*" [8] . The fast moving nature of technology is a factor favoring the integration of vendor certification programmes within universities particularly in the area of computer networking. Fage notes that: *"In the networking industry, technology changes too often and too quickly to rely on traditional means of certification, such as universities and trade associations. Because of the investment and effort required to keep network certification programs current, vendors are the only organizations suited to keep pace with the changes"* [9]. Previously the authors had lectured on in house developed networking units based upon the needs of employers [10] [11] [12]. Such units required a large commitment of time to initially set up and did not include the extensive ecourse and laboratories available under CNAP. These in house developed networking units were difficult to keep up to date. CNAP regularly updates its curricula based upon the needs of the networking industry. It should also be noted that the CNAP has international recognition which is particularly useful for students who may relocate interstate or overseas, either when they have completed their CNAP studies, or enabling them to complete their these studies in another country. It should be noted that the CNAP online assessments are kept separate from the internal unit assessments. The CNAP units taught at Edith Cowan University (ECU) cover the Cisco Certified Network Associate (CCNA) and the more advanced Cisco Certified Network Professional (CCNP) and may also sit for the CCNA and CCNP certifications externally. At ECU the CCNA based units are used to provide a foundation for more advanced studies.

2. Vendor based education and Cisco

Cisco is a major vendor of Internetworking equipment worldwide. Through its CNAP it has *"Launched in October 1997 with 64 educational institutions in seven states, the Networking Academy has spread to more than 150 countries. Since its inception, over 1.6 Million students have enrolled at more than 10,000 Academies located in high schools, technical schools, colleges, universities, and community-based organizations"* [13].

Online learning material is made available through the CNAP in a number of languages and students can if they wish use this provision. Another advantage to educational institutions of CNAP participation is an extensive range of laboratory exercises for students to work through that have been developed specifically for the CNAP recommended Cisco equipment. Participating CNAP academies are not charged for the use of ecourse material yet there are associated costs in becoming an academy.

At ECU the internetworking laboratories have been established using Cisco equipment that was obtained at significantly discounted price as ECU is a participating Cisco Networking Academy and over AUS$300,000 was spent on implementing both a CCNA and a CCNP based laboratory. The cost of setting up only a CCNA based laboratory would be significantly lower. Participating academy courses are required to ensure that staff teaching on CNAP programs have attended and passed the appropriate CNAP instructor training therefore funding is also required for training and accommodation and travel costs to the training academy if this is not local to the institution. However, such required training is beneficial as staff delivering Cisco based units will have acquired a firm background in both the practical and theoretical requirements of these units. CNAP notes that "*Through the tiered support system, every Academy has a "parent" Academy. Cisco Systems trains the Cisco Academy Training Centers (CATCs), the CATCs train Regional Academies and the Regional Academies train the Local Academy Instructors who then educate students"* [13]. The assistance obtained from the Regional Academy and the CTAC has proved invaluable.

3. The CNAP program at ECU

The introduction of the CCNP and CCNA based CNAP curricula in the School of Computer and Information Science (SCIS) at ECU in Western Australia has been achieved via the introduction of a new minor in internetworking which is comprised of six new Cisco based units. These units are currently being offered and are all fully subscribed. Before ECU became a Cisco academy the authors conducted a questionnaire in which students undertaking other hands-on networking units were asked if they would like the opportunity to undertake study for the CCNA curricula as a part of their course. A majority of 38 out of the 48 students were in favour, 2 were against, 7 neutral and 1 student provided no answer. These results were used to show that there was an interest in studying the CCNA based curricula by a relevant group of enrolled students.

An important consideration was the need to adhere to the CNAP quality control requirements for instructors to have passed the instructor courses which are distinct from the CCNA or the more demanding and advanced CCNP qualifications. The cost of CNAP CCNP instructor training at around AUS$2000 is higher than that for CNAP CCNA instructor training and lasts for 2 weeks for each of the four CCNP instructor training courses. The time requirements of such training as well as transport, accommodation and living expenses also need to be considered. Such courses help to ensure that staff attain an appropriate standard in both the knowledge and skills required in this rapidly changing field. In the first author's opinion the cost of this training represents incredibly good value for money with intensive instruction conducted in small classes taught by dedicated, highly knowledgeable and experienced staff. The availability of qualified instructors could also present extra staffing issues as can the need for technical support staff to maintain the

extra equipment used in CNAP based units. To cover the possibility that a single trained instructor may be unavailable due to sickness or job change it would be sensible to ensure that at least one other staff member also undertakes this training.

Much consideration was given to the design of the laboratory. It should be noted that such permanent cabling attached to walls and other structures must be undertaken by accredited personnel and there are heavy fines for contravening this requirement within Australia. The cable runs carrying the permeant network cabling were left uncovered to allow students to trace the cabling. A colour code was also adopted for various types of network cabling. Interruptible power supplies were also used as power protection to avoid the loss of expensive equipment due to power surges. Because of health and safety requirements the maximum number of students is restricted to a maximum of 20 students working in pairs. There was also the question of whether to allow each pair of students to have their own routers and switches next to their workstations or whether to place all of the routers and switches in a communications rack as is often the case in industry. The authors visited other CNAP academies to investigate their laboratories. The final design chosen was similar to that used in the industry in which the routers and switches were stacked within a telecommunications rack. This allowed the students to operate in a more realistic situation and allowed them to make mistakes with the non-permanent network cabling of internetworking devices within the laboratory rather than make such mistakes within an actual work environment.

Another question considered was the use of non Cisco equipment to enhance student's experience. This could be a problem but is partly offset by the tendency of Cisco to adopt international standards where feasible. A question sometimes raised is that of the ethics of running units from a single commercial provider. However, the choice of using the CNAP was made only after an thorough search of similar offerings and was based upon the extensive nature of their ecourse, laboratory exercises, assistance provided and on the range of topics covered.

The Cisco equipment obtained via Cisco curricula at ECU has led to the development of further non CNAP based units as well as the use of the Cisco equipment by research students. The internationalisation of the curricula is exemplified by the multitude of languages available for delivery of the CNAP ecourse material. This raises the question of employer expectations of the English proficiency of graduates and the use of multilingual skills in both academic and commercial environments. However, it was observed that nearly all of the students whose first language was not English chose to use the English language version of the CNAP ecourse.

4. Practical Assessments

Within networking courses practical hands-on assessment is becoming very popular. Murphy

notes: *'"That practical 'hands on' skills and knowledge is fundamental to conceptual understanding. That knowledge is more transferable to different situations when acquired by a gradual process of conceptual understanding"* [14]. CNAP incorporates both theoretical and practical knowledge. Tarrant observes that: *"In fact both practical skill and knowledge of certain principles are jointly sufficient for success. "This should warn against any scheme in which practical knowledge is rigidly separated form theoretical knowledge"* [15].

Before becoming a Cisco Academy the authors had incorporated practical assessments in networking units that they had taught. This form of assessment was implemented after the results of a questionnaire to students had revealed that out of 67 questionnaire respondents 28% thought that that practical assessments were a very good idea, 45% a good idea with 21% students neutral and 3% a bad idea and with none agreeing that it was a very bad idea, with 3% not answering this question. It should be noted that the practical assessment component only accounts for 10% of the overall unit mark. This practical component is inline with school graduate attributes.

Not unsurprisingly there is also a need for practical assessments to be incorporated into CNAP delivery. One of the problems with practical assessments can be the time required to conduct them. This is especially relevant when the assessments are undertaken with large classes. The very success of the Cisco based units has led to resource problems due to the current enrolment doubling compared with the previous semester. However, in view of the recent trend of decreasing student numbers enrolled on IT based units such a situation could well be regarded as a benefit. The need for students to use particular devices such WAN simulators, known as Adtrans, has created a bottleneck in student work and consequential assessment procedures and more are now required to be purchased.

5. The use of the Cisco based laboratory development

CNAP curricula is currently pursued by both TAFE and ECU students [16]. TAFE students who have successfully undertaken Cisco and/or Microsoft based study along with other TAFE studies can gain exemption from a year of the required university study needed to obtain their degree as part of a joint TAFE/ECU articulation programme. This has provided another input stream to the university via TAFE. There are also students undertaking CNAP units from other faculties such as Business, Engineering and Education, with some education students intending eventually to teach on the CNAP program themselves. There have also been cross enrolments from other universities not offering the Cisco Program.

Cisco based curricula must be matched to the time constraints of university units and a large amount of learning material needs to be covered. Damage or wear and tear of equipment needs to

be factored into costings. The more successful the units are the more students will use the equipment and more wear and tear will take place. Service agreements can be entered into to cover this but this comes at an extra cost. Changes made to curricular need to be reflected in the unit provision and sometimes in equipment. Such changes help to ensure that CNAP based units are regularly updated to reflect changes within the networking industry.

6. Safety and Security

Safety is of vital importance and it requirements have both legal and ethical implications [17]. Extra hazards can exist when compared with those present many Computer Science (CS) workshops, for example tripping over cables, bending too low or stretching too high when cabling equipment. Therefore the laboratory design needs to take into account such potential hazards and staff and students using the laboratory also need to be aware of these risks.

There is also the need to ensure the security of Cisco equipment in the two Cisco based laboratories and the need for these laboratories to be supervised by staff. Tying up laboratories for this use can be problematic.

7. Conclusions

There are many benefits to universities, staff and students to be gained from participation in the CNAP program and some interesting challenges for teaching and management staff previously involved in more traditional units. Overall the net gain to participating students is very good in that they are able to use equipment that they would not usually be available to them during their studies. There can be a significant investment of time required by staff to acquire the both knowledge needed and their instructor certification and staff considering the CNAP option need to be aware of the likely extent of such commitments. The international scope of the CNAP is of potential benefit to students who may relocate internationally or interstate. It is also an advantage that students are able to use the CNAP extensive ecourse and laboratory instruction sheets. Furthermore, the Cisco equipment can be used to develop new units and can also be used in research programmes. Importantly there are also extra safety considerations compared to typical CS programming laboratories.

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