E-EDUCATION: IMPLICATIONS FOR KNOWLEDGE TRANSFER VIA GLOBAL CO-OPERATIVE EDUCATION

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ABSTRACT
This paper reports on a radical and ongoing learning and teaching experiment in which a private multinational organization (Cisco) and traditional learning institutions (schools, colleges and universities) have combined to deliver a form of global co-operative education. From 1998, the Cisco Network Academy Program (CNAP) has been integrated into both undergraduate and postgraduate Internetworking courses in the Faculty of Information Technology at the University of Technology Sydney. The essence of the UTS implementation of incorporating the Cisco material into post and undergraduate degrees was to provide two educational outcomes. The first was to ensure students have a sound, theoretical and experiential, laboratory based, hands-on educational experience which should develop their enthusiasm to become investigative, motivated, lifelong learners. The second was to give students the opportunity to combine the gaining of industry certifications within the context of a traditional education. The research has been approached in two phases, one via observation and involvement by the researchers in both the implementation and teaching of the courses and the other by the use of unstructured interviews with lecturers and students. This paper outlines the issues that result from the integration of the Cisco e-learning model and quality assurance process into an IT academic environment. The topics covered include educational outcomes, organisational impacts and change management concerns. The researchers conclude that if there is a sense of participation and ownership of the program as a whole – and we believe Cisco is aware of this – there will be effective e-education knowledge transfer in a globally cooperative environment. Content tracks, quite rapidly, the changing nature of the IT and networking industry in which practice is often well ahead of the learning typically going on in universities. The requirement to retool and re-train regularly is changing the way our networking academics and faculty operates.

KEYWORDS
Knowledge transfer, co-operative education, e-learning, networking.

INTRODUCTION

Tertiary level Information Technology educationalists are in a quandary. They realise there is a need to provide their students with practical skills associated with hardware and software as well as theoretical and complex knowledge. Often these skill sets are vendor specific e.g. Microsoft word processing or operating systems as distinct from generic word processing or operating systems, rather than industry specific. This sometimes raises anxiety in the heart of the Institutions and the individual academies. IT educationalists are in a competitive environment with a plethora of institutions (public, private, profit, not for profit) offering IT education. Some employers, students and graduates are questioning the relevance of IT degrees and certain university IT graduates have been criticised for being too theoretical and *machine-shy*. The relevance of IT degrees are endorsed by a range of both the computer industry and vendor specific certifications e.g. CompTIA, Net+, Linux +, CCNA, CNE and MCSA. Industry certifications that can produce vendor specific knowledge are of benefit to the economic and employment prospects of graduates (Koziniec and Dixon, 2001) as well as to society as a whole where a shortage of skills is well understood. Job advertisements often require these certifications, as well as, or in preference to, other general, educational qualifications. Many of the vendor courses are CD-ROM

based and incorporate multimedia (of varying quality) that should assist learning. Online, media rich Internet enabled learning is a logical and partly realised next step.

Universities have struggled with the new media possibilities to implement online, interactive education, which requires massive investments in human resources, time and money. Fundamental problems in an academic environment include the lack of training in new technologies for academics responsible for courseware design and delivery in E-Learning (e.g. CREAM), (Nkambou et al, 1998). No less importantly, there is the growing dependence on commercial vendors of software for asynchronous learning networks (ALN). Difficulties are frequently encountered, for example, in integrating ALN technologies with the pedagogical knowledge and experiential learning requirements implicit in the more ambitious vision and strategy statements now being published by universities. (Lawrence et al, 2002). For example many universities in Australia, including UTS and Deakin University, implemented expensive online learning tools, such as TopClass, which proved unstable and not sufficiently scalable. These then had to be decommissioned after a few of years and replaced with another system e.g. Blackboard (Sawers and Alexander, 2000).

To meet the needs of IT education and rapid up-skilling of the workforce, certain product providers have developed certification e.g. Novell, Microsoft and Cisco. Cisco appears to have taken full advantage of the new media and the Internet. Cisco, in an effort to ensure its reputation is not damaged by poor course presentation and/or course material, has invested in a system that relies on training educators to deliver technical information. It has set up a pedagogically sound curriculum, which is constantly being revised by technical and educational experts who make use of up-to-date learning research. It has put in place a quality assurance process, which includes instructor and student training, rich media, computer technology, pedagogy and the Internet to deliver networking education to help solve the shortage of skilled networking personnel (Navarro, 2002). The success of the networking program has meant that they are now partnering with other companies such as Sun and Hewlett-Packard to extend their knowledge transfer model to other areas of IT knowledge and certification.

The authors view the courses with which they have been involved as not only providing vendor skills but satisfying conventional educational standards and outcomes. An accepted and practised general principle by most teachers in the program is that they add these courses to ensure that they can cover weaknesses and achieve their stated educational goals. In effect, it is similar to using someone else's textbook but, in this case, it provides media rich, experiential learning in addition.

THE CNAP KNOWLEDGE TRANSFER MODEL

The global networking company *Cisco* recognized the skills shortage in well-qualified, trained networked administrators and engineers and set up the Cisco Network Academy program (CNAP) to provide online, quality training materials. This program (CNAP) is the largest e-learning laboratory in the world. This particular educational model levels the playing field by providing access and opportunity for lifelong learners of all ages in any location (e-Learning, 2002). The program utilizes the *Train the Trainers* model (Cisco Training Guidelines, 2002) as well as tackling the issue of the digital divide. There are three levels to this training model as set out in Figure 1 below. Cisco Academy Training Centre (CATC) instructors are trained by Cisco Approved CATCs (known as Super CATCs). These CATCs then train regional Academy Instructors within their region; and regional Academy instructors train local Academy instructors. CATCs are responsible for training, supporting and monitoring up to 30 regional Academies in their region. Regional academies are responsible for training, supporting and monitoring at least 10 local Academies in their region. The local academies are responsible for teaching students at individual educational institutions. The CNAP Knowledge Transfer Model is unique for the internationalisation of the program itself (149 countries are currently involved and have over 10371 Academy sites) assuring that a student, in any of those academies, will get the *same* quality of education. The effective use of IT, media, telecommunication tools and adequate management of groups required by this approach ensure an ongoing quality assurance and improvement process.

Cisco Networking Academy instructors are expected to pursue continuing education opportunities. There is a public non-profit organization called the Cisco Learning Institute (http://www.ciscolearning.org/) created by Cisco to further educational research and produce leading edge education tools such as Virtuoso. CLI Virtuoso focuses on a personalised learning experience to provide customized, on-demand curriculum. It is based on learner needs and requirements which are incorporated in the latest releases of Cisco Certified Network Administrator (CCNA) courses. Instructors are trained to use the Global Learning Network (GLN) before being qualified to instruct these personalised courses. This software now provides personalised feedback but in future is expected to generate 'tailored courses' based on student test outcomes. Schatz (2001) states that *we are on the verge of being able to provide learning customised for each specific learner at a specific time taking into account their learning styles, experience, knowledge and learning goals*.

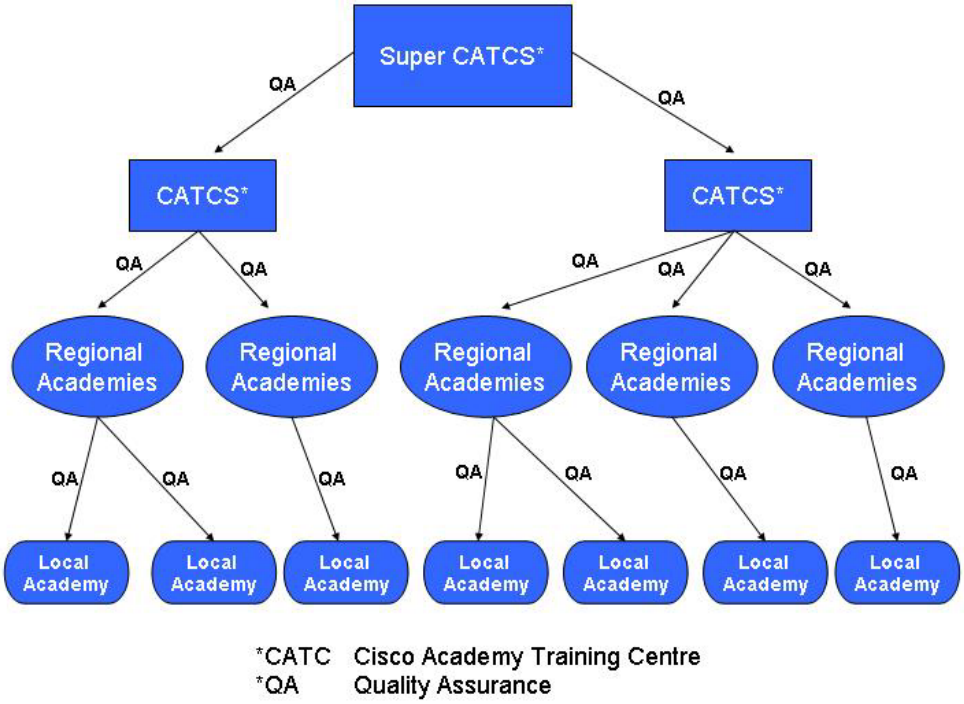

Figure 1. CNAP Distributed Knowledge Management Model for Instructor Training

CNAP IMPLEMENTATIONS IN AUSTRALIA AND UTS SPECIFICALLY

The Faculty of Information Technology at UTS and other institutions, e.g. Swinburne University, Curtin, Queensland University of Technology, Murdoch University and Monash University, have adopted CNAP with various degrees of enthusiasm, using a range of approaches to deliver the Cisco material within traditional courses. A decision was taken at UTS to embed the curriculum into its IT program at both graduate and undergraduate levels. The Graduate programs typically attract practising professionals as well as those seeking retraining. The first six months of the graduate program will typically fast track a retrainee into the essential knowledge and skills of a networking professional. At undergraduate level the courses are pitched to provide essential network knowledge (as compulsory or core subjects) as well as allowing for a major. Both groups get the benefit of being in a supportive learning environment as well as being prepared to take industry certification if they so choose.

The alternative is that students, to gain a position, will do these certifications via intensive and expensive courses. The economic benefit to a student is clear enough. At UTS our courses prepare students to sit for their Cisco Certified Network Associate (CCNA) and Cisco Certified Network Professional (CCNP) Certifications. Details are found at http://iwork.uts.edu.au. The essence of the

UTS implementation of *incorporating* the Cisco material into post and undergraduate degrees was to provide the following educational outcomes:

1) Students should have a sound, theoretical and experiential, laboratory based, hands-on educational experience which should develop their enthusiasm to become investigative, motivated, lifelong learners. 2) Students should be highly skilled and ready to take industry certification. This gives students the opportunity to combine the gaining of industry certifications within the context of a traditional education.

The traditional, university educational model where the university and the lecturer stand alone, not interconnected with society, organisations and other educational institutions will not produce competency in the knowledge society (Harasim et al, 1995).

PEDAGOGICAL APPROACH

CNAP applies effective learning techniques and best practices using multimedia tools, online material, online assessments and *practical skills lab activities and assessments* (particularly advantageous for the complexity of the Networking subjects but not necessarily exclusive to them). Internationalisation of the material is particularly important as is making the material non-gender and non-country specific. Below are quoted some of the advantages that showed on the results of the research:

- The Web-based Curriculum is designed by a network of professionals in the field and other multidisciplinary backgrounds. It presents, to a broad spectrum of students, explanations of technology using graphics, animation, colours and sound to aid the easy understanding of complex concepts. It is all the time available online from multiple remote locations, providing advantages from the accessibility point of view and for the affordable publishing of the updates.
- Frequent Online Assessments reduce the administrative work yet the delivery of assessment allows educators to increment the quantity of them as an educational technique. The following points also apply: standardization in the evaluation in quantity and quality of the knowledge obtained during the different stages of the course; flexibility with the time to be disclosed; automated statistical analysis of assessment results, applied to the suitability of the assessment itself or to the evaluation of the progress in the student body. Instant student feedback is provided to students in the form of areas to concentrate their learning.
- Practical Skills Activities and Assessment are key issues for these types of courses where the potential positions in industry require students to have these highly sought-after networking skills. The student must demonstrate in the practical assessment specific skills to pass the subject. This provides an environment in which the learner can "actively construct an internal representation of knowledge by interacting with the material to be learned" (Sherry, 1996). Motor learning is applied aiming at Procedural memory (Squire, 1987).
- Use of asynchronous online discussion tools. The asynchronous nature of discussion boards allows time for reflection and the dissociation from time and space (Rheingold, 1994).
- Kinaesthetics- (activities that involve body position and movement) are also applied in this program to improve the learning process.
- Other educational online tools like Virtual Classrooms (for learners), Internet-Based Communities (for educators), Online Instructor's guide (recommendations from the Instructors and suggested improvements in teaching methods) and the Work-Based Learning Website (job opportunity search engine for students) are CNAP services available online for the use of the student body or educators.

The research project involved an analysis and evaluation of the key areas of this Program (with its effective academic learning exploitation and popularity) that are positioning it over the ones with more traditional educational delivery techniques in Networking subjects.

METHODOLOGY

This research reports on an exploratory study of the impact on e-education of Knowledge Transfer via Global Co-operative Education. The research has been approached in two phases, firstly via observation and involvement by the researchers in both the implementation and teaching of the courses and secondly by the use of unstructured interviews. The first set of interviews with eight lecturers was undertaken in December, 2001 and the second set of interviews with ten postgraduate and undergraduate networking students were undertaken in April and May 2002. (See Appendices A and B). Denzin and Lincoln (1994) submit that *unstructured interviewing provides a greater breadth than the other [interview] types, given its qualitative nature*. The research was not only seeking to understand the reaction of the lecturers and students to this global e-education experiment but also to seek out any risks or issues of concern. Denzin and Lincoln (1994) point out that the *...goal of unstructured interviewing is understanding; it becomes paramount for the researcher to establish rapport*. A rapport engendering, semi structured interview approach was adopted to both elicit issues and risks and constrain the interview content to the research focus.

MAKEUP OF THE LECTURER SAMPLE

Of the lecturers interviewed five (5) had worked as coordinating lecturers and all eight had been instructors and had been trained under the CNAP model - *train the trainer* [CNAP Quality Assurance Plan and Academic Operations Guide v3.0, Oct 2001]. Coordinating lecturers not only teach classes but also take overall control of the whole student cohort for the subject - arranging for other lecturers, writing out the course outline, devising the assessment and taking care of the marks for the cohort.

Table 1. Background information on Instructors

Lecturers	**M/F**	**Training level Semester Completed**	**Semester(s) taught**	**Role: Instructor**	**Role: Coordinating**
1 Lecturer A	F	4	1	1	X
2 Lecturer B	F	5	1, 2	1,2	2
3 Lecturer C	M	4	1, 2	1,2	1,2
4 Lecturer D	M	4	1, 2	1,2	1,2
5 Lecturer E	M	4	1, 2	1,2	X
6 Lecturer F	M	1	X	X	X
7 Lecturer G	M	8	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5
8 Lecturer H	M	5	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4

MAKEUP OF THE STUDENT SAMPLE

Of the ten students who were interviewed eight were postgraduate students and two were undergraduates and two of the postgraduates already had passed their CCNA examination. Six of the eight postgraduate students had worked or were working in networking environments. The student sample was studying a range of subjects which included CCNA semesters 1, 2, 3 and 4 and Cisco Certified Networking Professional (CCNP) semester 7. Of the three students undertaking CCNP Semester 7, none had done Semesters 5 or 6 which they intended to undertake in the next University semester.

Table 2. Background information on Students

Students	M/F	Training Level (Sem)	Semester (s) studied	Work Experience	CCNA/CCNP	P/grad	U/grad
1. Student M	M	2	1	No	No	P	
2. Student N	M	7	1,2, 3, 4	Network Support	Yes	P	
3 Student O	M	7	1,2,3,4	Network Support	No	P	
4. Student P	M	7	1,2,3,4	Network Engineer	Yes	P	
5. Student Q	M	4	1,2,3	Network Specialist	No	P	
6. Student R	M	4	1,2,3	No	No	P	
7.Student S	M	4	1,2,3	Systems Administrator Instructor	No	P	
8.Student T	M	4	1,2,3	Network Engineer	Yes	P	
9. Student U	F	2	1	No	No		U
10.Student V	F	2	1	No	No		U

RESEARCH OBSERVATIONS

Our CNAP subjects are in high demand across the faculty.. Practising professionals, who may have no specific need for the certification, say that this is one of the few ways in which they can get to do these courses**.** The researchers argue that the Cisco Network Academy Program (CNAP) and Cisco's Global Learning Network (GLN) models are example of technologists and educators working collaboratively to provide high quality, online material and useful practical material to ensure that e-learners are receiving the same quality of service globally**.** The effective synergies of each of the arms of the diagram in Figure 2 produce high quality educational outcomes which are further discussed below.

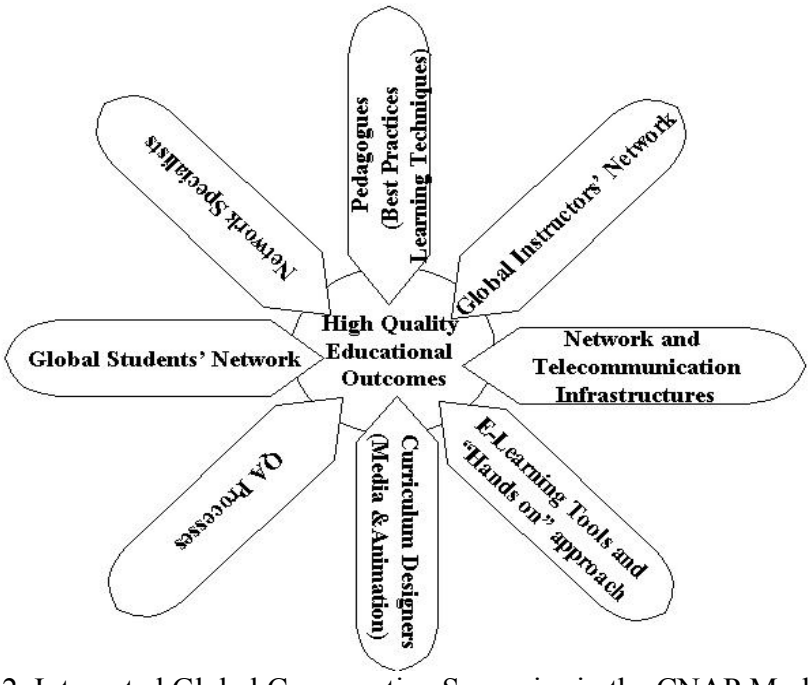

Figure 2. Integrated Global Co-operative Synergies in the CNAP Model

EDUCATIONAL OUTCOMES

Summary of the results of the student's interviews are found in Appendix A. The learning process has excited the students and motivated them to be more inquisitive and proactive in their education. It encourages exploratory learning rather than passive acceptance of knowledge from on high. The *guide by the side* model is not only preached but practised. Previous research (Navarro, 2002) has indicated a high degree of lecturer and student satisfaction with the CNAP model, particularly with the practical activities, which were felt to positively re-enforce theoretical knowledge. Both lecturers and students were enthusiastic about the high quality of the online material and links to further content on the web which has promoted exploratory, interactive learning. The popularity of these courses has meant that strict quotas have been applied to classes. Another phenomenon that has been observed is the increase in the number of students attaining high passes. Previously when Networking subjects were offered in the traditional, lecture mode, the failure rate was consistently high. Practical modes of assessment are mandated. In addition to online multiple choice assessment, students have to set up networks in a defined amount of time, demonstrate that the networks are working and troubleshoot any errors that the lecturer may introduce into that network. Additional design activities, projects, essays are incorporated where necessary and at the discretion of the teaching group. The CNAP program encourages team collaboration both among the student body doing the course and the network of Cisco trained instructors from around the world, creating a diverse, large virtual community of educators.

Our observations are that students demand extra access to laboratories for learning. This enthusiasm creates its own resource problems. The students who were interviewed in April and May 2002 identified the following strengths of the program: the encouragement of practical, hands-on work with routers, switches and hubs; the ability to study the material anytime, anywhere; the way the program fostered collegiality among the students studying together in small groups. They identified some weaknesses in the program: the need for more equipment; the lack of time to carry out the practical work in a three hour session; difficulty with group work and the need for more challenging laboratory exercises. Three of the ten students could see no weaknesses in the program whilst one did not like the fact that the course was mandated by a vendor and one stated that reading online material did not suit his learning style. These weaknesses are addressed by the quality assurance process so that continual and incremental improvements are made.

When questioned about the Quality and Suitability of the Academy materials all students found it helpful and commented on the advantages of the graphics and multimedia presentations in the material. One stated that the material completely achieved the objectives for CCNA but was of insufficient depth for a masters' course. Although CiscoPress publishes books that closely mirror the online material, one student felt the books were too expensive and another had not looked at the books as she/he thought they would be too different from the online material. When asked to rate the overall quality of the material, five selected excellent, one selected excellent/good, three selected good and one selected sufficient.

The researchers asked the students about their overall impressions about the Multiple Choice test. Six out of ten felt they were acceptable One student commented that s/he would prefer more options as happens in the CCNA examination whilst another felt some of the answers were too Cisco specific. Another felt it was easy to guess the answers.

Students were asked to comment on the fact that student results in Networking subjects had been improving since the CNAP program was introduced. Two believed there had been an increase in cheating with the online exams, namely by cutting and pasting the questions which is expressly forbidden under the Cisco/Academy agreement. Three felt the increase was because more experienced industry people were entering the courses. Two believed the students were putting in more effort while one felt that the study anywhere, anytime was a factor in the improvement of grades. The other two did not have an opinion.

ORGANISATIONAL IMPACTS

The lecture system of delivery is not used in this model. Small groups, fully laboratory based, are the norm. Mini lectures may be given but the emphasis is more on individual, web based learning, study and incentive time, group work, practical tasks and mastery multiple choice tests. Three computer laboratories have been equipped with racks containing routers, switches and hubs for the students to do practical lab work – anecdotal evidence from graduates suggests that the hands-on nature of the courses helped alleviate issues of machine shyness previously experienced. There is effective use of the telecommunications infrastructure with students participating in online forums and interacting with highly graphical material that enables students to visualise complex concepts. The University has boosted the amount of money spent on equipment and laboratories. It has increased the number of trained staff to deliver this material to small student cohorts (30) rather than the traditional way of delivering a lecture to over 300 students. Administrative, technical and academic staff has had to cope with timetabling complications and co-ordination of final practical examinations. Some academics' comfort zone has been seriously eroded by such new demands, particularly when they are required to continuously upgrade their qualifications to become certified technically as CCNAs and CCNPs as well as CCAIs. Many of our undergraduate and postgraduate students work for different corporations, many of which have encouraged their staff to enrol in our practical, media rich networking courses. Private schools in the Sydney Metropolitan area have sent their teachers to our university for instructor training. These teachers have introduced the subjects to their senior computing students.

CHANGE MANAGEMENT ISSUES

Certification and the provision of online education by commercial entities have its opponents (Thatcher, 2002) and this is certainly true of some lecturers at the University of Technology, Sydney. Some academics argue that such technical knowledge is not sufficiently theoretical for the halls of higher learning and wonder about what they call the *MacDonald-type franchising* of education. (Lawrence et al, 2002). Others fear that their jobs will be taken over by the multi-national providers of education, especially when they see that the quality of the material is way beyond that which an individual lecturer may prepare. Some academics are reluctant to deliver certification training, especially when they realise that the instructors must become certified to teach the program and must regularly renew their certification. In traditional academia, there is no further requirement for ongoing validation of their ability to teach a course after initial employment (Koziniec and Dixon, 2001). However, on balance, the academics in our IT faculty who have been trained are enthusiastic and keen to participate in this unique pedagogical opportunity.

Technologists at Cisco are also affected by such change management. For example, the technologists *are learning all about pedagogy, curriculum task analysis and sequencing, psychometrically sound testing, rubrics, student reflection, stems and distracters, national and local standards and much more (Ward, 1998).* This global experiment (CNAPS and the Global learning Network (GLN) may be viewed as an individual and social revolutionary educational technique, which could possibly solve deficiencies in the quality of education for the masses. Internationally, it allows for delivery of common knowledge in different languages in different countries. It represents knowledge for everyone, anywhere or, in smaller scale, within nations where it could be applied for national policies in quality of education. (Navarro, 2002). The one constant is the importance of the teacher in the educational outcomes of students.

CONCLUSION

Given the current state of education, it seems that such an educational model can only be produced with significant resource allocations. Our research aims to further investigate the educational, organisational and change management outcomes of co-operative arrangements/partnerships between global organizations (multinationals) and educational organizations.

Overall, our experiences both from the lecturers' and students' viewpoints have been positive. The rigid quality assurance process requires modified behaviour from academics as they are required to be continually re-skilled in unfamiliar ways. This relationship has had extremely positive outcomes for staff competence with absolutely up-to-date technology and opportunities to transfer the most modern networking concepts in a timely way. The researchers believe that provided there is a sense of participation and ownership of the program as a whole – and we believe Cisco is aware of this – there will be effective e-education knowledge transfer in a globally cooperative environment. Content tracks, quite rapidly, the changing nature of the IT and networking industry in which practice is often well ahead of the learning typically going on in universities. The requirement to retool and re-train regularly is changing the way our networking academics and faculty operates.

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APPENDIX A
Summary of Student Interviews

The first three tables in this appendix are a summary of the results obtained by interviewing the student sample. Table A:1 summarises strengths and weaknesses of studying under the CNAP model, Table A:2 presents an overview of how the sample viewed the academy material while Table A:3 outlines the overall impression of the CNAP model. Table A:4 data was taken from 85 students (a mix of post graduate and undergraduate students) from three different Networking subjects under the CNAP, Systems Software and Networks (UTS BSc/BIT Program, March 2001), Networking 1 (UTS Grad Dip. IT/BComp) June, 2001) and Networking 2 (UTS BSc/BIT Program, Dec. 2001).

Table A:1. Experience of Studying Under this Model

Strengths	Weaknesses	Choice of Model	Any problems	Method of solving
Interacting with routers		CNAP	Group work	No ideas
Collegiality with other students, hands-on work	Mandated by Vendor	CNAP	Difficulty in understanding some questions	Doing a lot of overtime on routers
Hands-on	Need more equipment	CNAP	Lack of equipment	Doing overtime – 24*7
Practical work	Online reading of material – not best for me	CNAP	Was cramped in old building – great in new building	The new building has solved any problems
Practical work Online materials	3 hour teaching block is too short	CNAP	Time to do cabling etc.	Overtime practice
Practical work	Need to discuss Chapter tests with group	CNAP	No major problems	N/A
Flexible learning, anytime, anywhere, study at own pace	Interaction between student and lecturer is less	Combination of tradition and CNAP	You have to be highly motivated	Thinking about how much you are paying for the course and your grades
Hands on, practical	Labs need to be more challenging	CNAP	None	N/A
Practical, anytime, anywhere	None	CNAP	Unable to access classroom out of class	Came back later
Practical work and interesting theory	None	CNAP	Not enough time	Lecturers give us extra time

Table A:2. Academy materials Quality and Suitability

Level & Depth	Helpful	Advantages	Disadvantages/suggestions for future improvements	Overall Quality
Suitable	Yes	Read at home Multimedia		Excellent
Suitable	Yes	No comment	Semester 7 needs rewriting for professionals	Sufficient
Suitable	Yes	Graphics help	Books – they are too expensive More printed material	Excellent
Suitable	Yes	Going deeper via useful links	More real life situations – challenge labs	Excellent/good
Suitable	Yes	Up-to-date	N/A	Good
Suitable	Yes	Completely achieves objectives for CCNA- not enough depth for a masters' degree	Correct typos in lab materials More lab activities	Excellent
Suitable	Yes	All the material is there to be covered	Threaded Case Study is confusing – there is no set answer to it	Good
Suitable	Yes	Graphics, multimedia	Text could be larger in online material. Too much material in first semester.	Excellent
Suitable	Yes	Interesting graphics – clear explanations	Books – have not looked at the CiscoPress books as thought they would be too different	Good

Table A:3. Overall Impressions

Fellow students' Attitude	**Practical work**	**Mc tests**	**Why results going up**	**Future**
Well liked	Just right	No problems	No idea – perhaps some students are cheating by printing out exams	Should continue
Similar to commercial training	Great	Not overly keen – Cisco specific answers	Some students are cheating via copy and paste. Should change way tests are delivered	Great idea – could be implemented better
Well liked	Fair	Okay for most part – easy to misread – but questions are worded to make you think	Our students have more work experience when they join the course. We have better equipment	Great for technical education
No complaints	Fair – but sometimes cruel, realistic and difficult but most manage to pass	Prefer more choices as in CCNA test	More experienced industry people are joining the course	It is the way to go
Mainly satisfied	Labs are too easy more challenge labs	They should stick to the curriculum	More experienced industry people in course	Real goer
Like it	N/A	Good – you can gauge the level of knowledge	Students are preparing more	Good – it takes advantage of time
Happy with it	N/A	Okay but you cn still guess to pass the exam	Students are putting in more effort	It should stay but with a few modifications
Good	N/A	Okay – like it.	Students have more access to the material – can study anywhere, anytime	It should stay as it benefits students
Enjoy it as it is different from other subjects	Useful	Bit too specific in Semester 1	No real idea although as my brother is now doing Semester 1 he asks me for tips.	It should stay as the teaching model for the future.
Like it	Stressful sometimes	Okay	In her year was also given written exam so results were lower	Keep to this

Table A:4. Sample of Student Impressions of the Model – 2001

The following data sample was taken from 85 students (a mix of post graduate and undergraduate students) from three different Networking subjects under the CNAP, Systems Software and Networks (UTS BSc/BIT Program, March 2001), Networking 1 (UTS Grad Dip. IT/BComp) June, 2001) and Networking 2 (UTS BSc/BIT Program, Dec. 2001).

Question	5 (Max)
The class was interesting and enjoyable.	4.30
"Best Practices" and good teaching strategies were modelled during the training.	4.06
The order of course topics aided my learning.	4.20
The activities and labs helped me achieve the stated course objectives.	4.09
The lesson assessment tools helped me evaluate my knowledge of the lesson.	4.17
Group work aided my learning.	4.12
Overall, the course materials were of high quality.	4.46

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