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International Collaboration in Teaching and Research-Monash University Australia
and Luleå University of Technology Sweden.

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Abstract

In this paper a collaboration program between universities from opposite sides of the world is described. This program came about after a meeting of academics from Luleå University of Technology in Sweden and Monash University in Australia at an international education conference just like this one. Then from a simple start involving academic staff visits to learn about each other's engineering courses, research programs and facilities, a collaboration has developed which now involves research and teaching in many diverse fields of study, not just engineering. The collaboration includes inter-university research programs, regular research and teaching staff exchanges, undergraduate and post graduate student exchange programs and some novel features such as the conducting of undergraduate lectures via the internet, live and simultaneously to student audiences in Sweden and Australia.

The paper describes the how the collaboration came about, what is involved in the collaboration, the use of the internet for conducting inter-continental classes and the technology used to do this, the benefits of the collaboration program to the universities involved and the future hopes for the collaboration.

1. Introduction

Luleå University of Technology is a modern university of about ten thousand students in the north of Sweden about 100 km south of the Arctic Circle. Monash University is Australia's largest university with about forty five thousand students and its main campus is located in Melbourne in the south-east corner of Australia, about as far away from Luleå as it is possible to get. Despite being on opposite sides of the world these two universities are now closely entwined because of a collaboration program that has developed over the past five years. This collaboration grew out of a meeting of staff from the two universities at a European education conference [1], following which a Swedish academic was invited to Australia for a short fact-finding visit. The visit of the Swede (the second author of this paper and an electrical engineer) to Monash's department of Electrical and Computer Systems Engineering engendered such interest that in 1997 a teaching exchange of electrical engineering academics was initiated. This involved one academic from Luleå going to Monash for six months and two Monash academics each going to Luleå for three months. Following this a formal international staff exchange program between the two universities began. This was supported financially by the Swedish government [2] who are very keen to promote international contacts for their universities.

It soon became apparent to those involved that great benefits could be attained by extending the program to include collaborative inter-university research and by the sharing of each university's unique intellectual and physical resources amongst the staff and students of both universities. The program was expanded and again financed by the Swedish government [3] so that now, regular staff exchanges bring expertise

from one university to the other and the specialized laboratories and facilities at each university are used by staff from both universities for research and development. Undergraduate and post graduate student exchanges have started and undergraduate classes that were previously taught only at one university or the other are now taught simultaneously to students taking the subjects in both countries. This is done by video conferenced lectures and tutorials conducted over the internet and these subjects have thus become common to the courses at both universities.

What follows is a discussion of the extent of the current collaboration program, its future development and funding sources, the use of the internet to deliver lectures to classes on both sides of the world and the technology used to do this, the problems encountered in doing so and what is being done to counter the problems.

2. The Extent of the Collaboration Program

i. The Teaching Exchange Program

Teaching exchanges between the two universities this year have seen five Luleå academics spend a semester each in one of four Monash departments-Electrical and Computer Systems Engineering, Computer Science, Mathematics and Business. Six Monash academics spent or are currently spending an academic quarter in Luleå in Electrical Engineering, Mathematics and Computer Science. Two Monash academics spent five weeks over their summer break in Luleå taking a concentrated course on Mobile Communications before returning to Monash to begin the normal academic year.

ii. The Student Exchange Program

Students from each university regularly spend extended periods of time studying at the other university. For example last year two Monash undergraduates were studying for a full year at Luleå University. Language was not a problem for the students. Luleå plays host to about 150 international exchange students each year so most classes are delivered in English if there are any non-Swedish speakers in the class (the level of English of the Swedish students is such that this presents no difficulties to them). Three Swedish Masters degree students spent a semester at Monash doing their thesis work under the joint supervision of Monash and Luleå academics. Several PhD students from Monash visited Luleå with their supervisors for short periods to meet researchers working in similar fields to their own and Swedish PhD students have likewise visited Monash.

iii. Research Programs

The cross-university research programs have developed in the areas where there are similar research groups on both campuses -intelligent robotics, digital signal processing, antenna design; or where there are research groups with expertise in one area that can see the value in working with a group from the other university who have expertise in a different but complimentary area such as telemedicine and neural network theory. These projects are progressing well and are producing results that are published at conferences and in the literature. Some of the projects have industrial support from Swedish industrial backers.

iv. Future Collaboration

The current collaboration is mostly in the technical areas-Engineering, Mathematics and Computer Science, but staff at both Luleå and Monash are working on research and teaching collaboration in other disciplines such as Nursing, Business, Fine Art, Education and Librarianship. There have been inter-university visits of staff from these disciplines in order to map out the way ahead for research and teaching collaboration.

v. Funding the Collaboration

The STINT grant [3] from the Swedish government has been the mainstay of the funding for this program. It is paying half the salary of one Swedish academic (in order for him to co-ordinate the collaboration), the airfares involved and the rental of the flats used for accommodation. Smaller grants from Monash University have been used to set up the Monash end of the internet video conferencing and to provide some travel expenses. Further funds are being sought from Australian sources and an application to the EU for funding of this international education program is in preparation.

vi. Accommodation and the Cost for Exchange Participants

The exchange program is now so regular that flats and houses in Luleå and Melbourne have been rented on a permanent basis to provide accommodation, free of charge, for the visiting academics. The cost of the basics of life are very similar in Luleå and Melbourne and each university pays its staff members their normal salary whilst on exchange so that they are in no way out of pocket by participating in the exchange program. However travel between Luleå and Melbourne involves about thirty hours of flying with a minimum of three flight changes and there can often be missed connections with additional delays. Even the shortest visit to the other university can require an extended period away from home.

3. The Common Classes taught by Video over the Internet

There are many specialist areas of electrical engineering that an interested student may choose to study but no university can be expected to have experts in all of these areas. For example two such specialist areas of study that are of increasing importance due to the rapid expansions being made in telecommunications are Electromagnetic Compatibility (EMC) and Antennas and radio Propagation (A&P). Luleå University has expertise in EMC but this has been unavailable at Monash University. Monash has expertise in A&P and this expertise has not been available at Luleå. In order to make both of these increasingly important areas of study available to electrical engineering students at both universities a means was sought whereby the expertise of one university could be shared by students at both universities. Video-conferencing between the universities is one way of doing this. An internet-based video-conferencing technology, Marratech [4], was selected to enable students at one university to view and listen to lectures being delivered at the other university.

Luleå and Monash each have special rooms equipped with video cameras and microphones, appropriate lighting, computers with large amounts of RAM (more than

500 M seems to be desirable), computer data projectors and internet connections as well as seating for twenty or more students. These rooms were used to present the lectures, live at one end of the internet link (Figure 1), and as a wall projected image at the other end of the link (Figure 2 -shown on a computer screen rather than the wall image for ease of capture). The image projected by the data projectors at either end of the link was the Power Point Presentation of the lecture, overlaid in one corner at the lecturers end of the link by a video image of the remote audience, and at the remote end of the link by an image of the lecturer (or the local audience). The software sends the Power Point presentation (that is loaded and controlled at the lecturers end) to the remote end and also permits the lecturer to write directly over the power point display at both ends using a graphics stylus. When the lectures are delivered to a remote audience with no local audience the lecturer can present the lecture from his/her office if it is equipped with the appropriate computer, video and audio equipment (Figure 3)

For the past two years the A&P subject has successfully been delivered from Monash live to students at Monash and via the internet in real time to students at Luleå. Because of the scheduling of prerequisite subjects in the different courses the EMC subject could not be taken simultaneously by students at both universities so early last year the EMC subject was delivered live to the Luleå students from Luleå and later in the year the lectures were repeated from Luleå and delivered to an audience of Monash students via the internet.

3.1 Problems to be overcome with the video-conferenced lectures.

i. Different Time Zones and Different Academic Periods

Luleå University divides its academic year into four quarters and has a long break in its summer (June-August). Monash University runs a two semester academic year with a long break in its summer (December-February). Thus a lecture series cannot be scheduled that would match the academic norm at both universities (i.e. for a quarter or semester respectively). A compromise has been made whereby selected lectures are delivered to the Monash students alone from the start of their first semester and then when the Luleå students begin their quarter combined video-linked classes begin. Monash has a one-week mid-semester break during which the A&P lecturer goes to Luleå. During this week and the two following weeks the lecturer conducts catch up lectures to the Luleå students alone and runs an intensive laboratory program. For two weeks the regular lectures are delivered in Luleå and video-conferenced to Monash. This means that about 60 percent of the lectures are video-conferenced and the other forty percent are delivered twice.

The time difference between Luleå in Sweden and Monash in Australia varies between 8 hours and 10 hours depending on which country is running "summer savings time" at any particular time of the year. Fortunately the lecturers for the A&P subject can be scheduled to run between 4pm and 6pm in Australia, which corresponded to 8am till 10 am in Sweden



Figure 1
Delivery of a video-conferenced lecture from Monash University

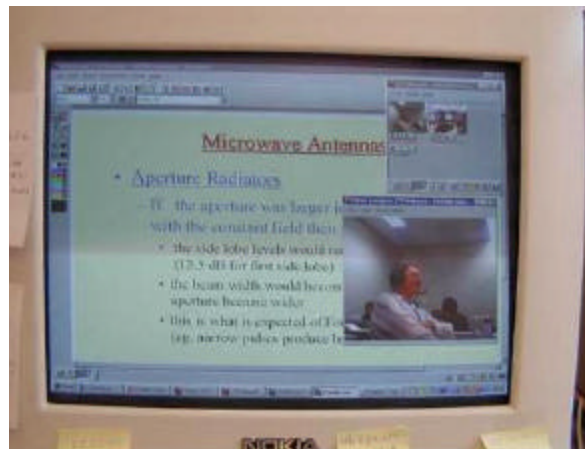


Figure 2
What is projected to the audience at the other end of the video link



Figure 3
The Lecturer in his office in Luleå taking a class

ii. Technological Problems

The internet-connected Marratech software would occasionally crash and would lock up the computer. This stopped the lecture at either end of the link for quite some time as the computer needed to be re-booted, the Marratech reinstalled and the network connection recreated. To compensate for this conference phones were installed at either end of the link so that communication could be quickly established and the lecturer could talk through the lecture without the inter-net link, whilst simultaneously trying to re-boot the system and reconnect the video link. This not a very satisfactory situation and so an investigation for technical fixes or alternative link methods is underway.

Another technical problem that is under investigation is a very disconcerting long delay echo (up to a second or so) that is heard by the lecturer from the internet-link.

4. Future Plans

The program is expanding with new disciplines joining the collaboration as previously mentioned. One new aspect to the collaboration worthy of note is the recently developed linkage between the aerospace course at Monash University and the space-electronics course at Luleå University which is based at Luleå's affiliate campus in Kiruna (the most northern city in Sweden, well above the arctic circle). Up to ten Monash students a year will spend a semester at Luleå/Kiruna and a similar number of Luleå students will come to Monash. This linkage is valuable not just because of the student exchange and the complimentary expertise at each university but because this linkage is part of a wider linkage to other universities such as Toulouse in France and to associated industries such as the Airbus program and the Swedish government's ES Range space program.

5. Conclusions

The Luleå-Monash collaboration program is progressing well with continual staff and student exchanges, productive inter-university research programs, expanded subject choices available to students and new academic disciplines joining the program. There are continuing problems to be solved such as finding new funding to support the program and devising some fixes for technological problems associated with the internet based video link.

6. References

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