Comparative Study of the Usefulness of Online Technologies in a Global Virtual Business Project Team Environment

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Lifelong learning is quickly becoming an integrated part of today’s working life because of the demand for keeping up to date with latest developments due to rapid change in technology and business. To maintain flexibility and quality, online technology is often used as a medium of educational service delivery. In this chapter, we examine a case where online technology has been used to coordinate virtual project teams (in an educational setting) around the world. The experience from the case study is that although online technology promises to offer an independent learning environment anytime and anywhere, only some aspects of the technology are useful depending on the nature of the task. In addition, there are behavioural and cultural issues, which can be exacerbated by underdeveloped personal relationships due to constraints imposed by online technology. The case study also shows that synchronous communication is not necessarily a better means to coordinate than its asynchronous counterpart. A challenge faced by online education providers is to find the right mix and how to come up with a framework that will provide optimal results.

BACKGROUND

The funding for universities in Australia has dropped from 89-90% fifteen years ago to about 50% by the end of 1999. At the same time, demand for education has increased simply because of the rapid pace of technological change and new business innovation. In the area of Electronic Commerce (E-commerce), the demand for courses has grown rapidly, from
hardly any subject offered in 1997, to almost all universities offering some form of e-commerce education. This is not only an Australian phenomenon. Universities around the world have come to realise that e-commerce education is very much in demand. Most business schools now have students enrolled in e-commerce.

Murdoch University is one of the four universities in the city of Perth, Western Australia. Perth is one of the most remote capital cities in Australia and in the world, being more than 4,000 km from the country’s other capital cities such as Sydney or Melbourne. Despite the tyranny of distance, Perth has a vibrant group of universities and is particularly active in e-commerce education.

Murdoch University is a medium-size university by Australian standards and is located in Murdoch—a suburb of Perth. The university is named after an academic and essayist Sir Walter Murdoch. “Planning for the university began in 1970. The second university to be established in Western Australia and the seventeenth in Australia, it was constituted on 25 July 1973 by an act of Parliament of Western Australia. In 1975, its inaugural year, Murdoch University enrolled 672 undergraduate students, had 6 full Professors, a dynamic young staff on a 254 hectares campus. Today, Murdoch offers more than 50 undergraduate programmes (majors) of study, has over 11,000 students enrolled, employs over 50 full professorial staff and includes a regional campus located at Rockingham” (http://www.murdoch.edu.au/about/murdoch.html).

According to the introduction on its Campus-Wide Information System (http://www.murdoch.edu.au/about/murdoch.html):

Murdoch University combines the best in university teaching with outstanding graduate satisfaction and a flexible outlook that let students design the degree they need for their future. The only institution in the country to have scored 5-stars for graduate satisfaction from the Good Universities Guide, for five years in a row, Murdoch has also been rated the best teaching campus of all Australia’s public universities by an

*Figure 1. Student Enrollment Numbers in Distance Education at Murdoch University*
independent national survey of university graduates. This high standing was enhanced by two awards in the Prime Minister’s 1998 Australian Awards for University Teaching. These honours constitute a “user’s bouquet” through which its students declare their belief that Murdoch provides one of the very best learning experiences in Australia. This progressive and dynamic university offers courses in: Biological and Environmental Science; Veterinary and Biomedical Science; the Law; Business and Information Technology; the Humanities; Mathematics; the Physical Sciences; Engineering; Education; and the Social Sciences.

In addition, this community-oriented university offers a particularly flexible degree structure which encourages students to boost their job prospects by completing two programs of study, e.g., Commerce and Mass Communication, Chemistry and Mineral Science.

Distance education at Murdoch commenced in 1975 (inaugural year) with six subjects. In semester 1 2000, there were 214 units on offer covering many discipline areas. Figure 1 shows the enrollments for distance education since 1989.

E-commerce teaching is mainly done through the Business School. The school is offering a Master of Electronic Commerce and a specialisation in its undergraduate degrees. The Master of E-commerce is a cost-recovery program for executives and the fee as of year 2000 is approximately US$10,000 per year. Cost-recovery courses of this type are popular because they address emerging issues or areas with a high demand.

**SETTING THE STAGE**

The use of online technology to support educational activities has received much attention due to the popularity of the Internet (Goldberg, 1997). The Web has opened up enormous opportunities to allow teaching and learning to be carried out in innovative ways where geographical distance and time constraints are no longer barriers. The traditional model of having everyone sitting in the same place to listen to a lecture is no longer necessary. With a computer and a modem, teachers and students can interact with each other anywhere anytime. Michael Zastrozky (research director/academic strategies) of the GartnerGroup concludes that “Students are ‘going to school’ less and getting more content electronically”. His forecast is that this trend will increase. He also points out that there is a 70% chance that “Competition will push 80% of traditional higher education institutions in the US to deliver 60% undergraduate content through distance learning by 2003” (GartnerGroup internal presentation).

Breaking through geographical limitations and allowing learning to be done remotely is not new. The development of distance learning and education by sending paper-based teaching materials to students and/or with open learning programmes on TV has been an effective way to provide off-campus education. In fact, under certain circumstances, this is still the most effective way to diffuse education to remote communities. What makes the Internet and online technology so unique is the ability to use a low-cost medium to provide highly interactive teaching and learning. Such interactivity can be synchronous or asynchronous. Synchronous interaction normally happens in real time, such as using online chat systems, which allow teacher and learner to interact instantaneously. This kind of environ-
ment is important if the mode of study is of a highly interactive nature such as a class
discussion. Asynchronous interaction happens when communication is not happening
instantaneously. An example of such interaction is using electronic mail or bulletin boards,
where both the teacher and learner send messages to each other to be read and responded to
at leisure. Asynchronous interactivity provides a non-intrusive way of communication such
that both parties can have time to reflect before responding.

Murdoch University puts a lot of emphasis on distance education. Distance education
means students studying externally without physically coming on campus for lectures or
tutorials. Traditionally this was done using paper-based courseware that was sent off via
postal systems. For some subjects, such as those taught in the areas of IT and Media Studies,
sending off floppy disks, CD-ROM, audio and videotapes as well as printed materials were
the only means to conduct distance education. The External Studies Office (ESO) manages
distance education at Murdoch University. The office acts as an intermediary between
students and academic staff. Students enrolled in distance education are called “external
students”.

Over the latter half of the 1990s, the Internet has provided valuable opportunities for
educational institutions to deliver off-campus education online. Murdoch University, given
its strategic position, has seized the opportunity by initiating the Murdoch Online project.
According to Murdoch’s description:

Murdoch Online provides a gateway into the University’s use of the Internet for
teaching and learning purposes...

We seek to integrate the Internet’s capabilities for rapid communications, multimedia
delivery and access to worldwide online resources, with capabilities in quality of
teaching, and in personalised, individualised communications and support. Diversity of
users is one of our most valued characteristics, as online units provide for full time and
part time students, for on campus and external students, for novices and experienced
users, and for school leaver and mature age students.

Using a commercially available virtual learning environment, WebCT
(www.Webct.com) as well as a range of other means (in-house), the university provides over
90 subjects in Web-based mode. The Murdoch online project involves the migration of Web-
based courses to WebCT. Students can study a significant portion and in the future the whole
degree through WebCT. For example, the Computer Science degree can be obtained by study
in fully distance education/online mode. Such flexible and accessible approach to education
delivery is gaining popularity. There is a strong demand—particularly among students who
are currently employed—for shifting from traditional on-campus mode to online mode of
education.

For subjects in the areas of e-commerce and Internet studies, using online technology
as a delivery medium is a natural development. One advantage of online delivery is that
students who are doing such subjects either already have experience in using the Internet or
will be doing so as they progress through their course of study.

The management of the university (both at the chancellorcy and deans’ level) sees online
education as a strategic development and with significant competitive implications. The
Teaching and Learning Centre (TLC) manages the online initiative and the group consists of
technical support personnel, online course designers, educational specialists working to-
gether with academics to achieve the best outcomes for both staff and students.

The Teaching and Learning Centre and the External Studies Office are somewhat independent of each other. It would be interesting to observe their impact on each other as the online project managed by the TLC nears completion. For example, the ESO requires all assignment submissions from external students to go through them because they provide assignment tracking and reporting facilities (to ensure good turn-around time for submitted work) as well as providing administrative support for external students and academic staff dealing with external students. WebCT provides facilities for assignments to be submitted directly to the academic staff marking the assignment. With the use of WebCT, there is then no outside body ensuring the timely return of the marked assignments.

**CASE DESCRIPTION**

In 1999, two new subjects in the area of electronic commerce were established. One was at the introductory level, providing students with initial understanding of the Internet and related technology such as the Web browser, HTML, TCP/IP protocols, multimedia applications over the Internet. Here we call it Subject A. The second subject (relates to this case) was about understanding the business models of E-commerce and the management, legal and governmental issues related to E-commerce and the Internet (here we call it Subject B). Given both subjects involved teaching about the Internet and E-commerce, the logical approach was to conduct all of the teaching and tutorial activities using the Internet itself. Subject A was run using WebCT. As Subject A did not involve team-based projects, not all the findings from this subject would be relevant here. However, we believe that some of the findings from Subject A would be generally relevant to all online coursework. Over 80% of the students preferred to attend classes as well as have all the course material online. Just over 1% percent wanted to attend classes with nothing available online and about 10% did not want to attend classes with everything available online. As most of the students were enrolled in "internal mode" (class attendance needed), the students seemed to be saying that they wanted (if given the choice) “face-to-face” contact as well as having course material available on demand. Therefore it appears that pure online mode of enrolment is attractive to students who for some reason (perhaps working) or other are unable to attend classes. This conclusion substantiates the authors’ experiences when handling queries from students wanting to enrol.

In Subject B, a slightly different alternative was used. Instead of using a preestablished environment, standard Internet tools such as e-mail, FTP, subject Webpages, ICQ and mailing lists were used. WebCT was not used as there were many project participants who were external and it would have been difficult to insist on all the participants using WebCT because of the steep learning curve for the participants and the costs involved for the organisers.

The key assessment item in Subject B was a virtual team project. Students from 12 universities in Australia, the United States, Latin America and Europe (see Figure 2) worked together in small teams, each with four students (one per university), on development of a business plan. Each global virtual team (GVT) was free to choose a business venture, but the plan was supposed to be about a venture that used E-commerce in one or more aspects of the company (e.g., marketing, delivery or customer support). This case study examines the communication issues involved in working on a project in a GVT environment. The
communication issues were not part of the subject or of the project itself. We were interested in finding out how effective faceless communication could be. The unique nature of the GVT project provided us with a good opportunity to carry out this study.

We studied the communication technologies used and looked at some related communication issues unique to working in virtual teams.

Six online technologies were used to support the working of each Global Virtual Team (GVT) and they were:

1. Subject mailing list
2. Team mailing list
3. Person-to-Person (P-to-P) email
4. Interactive chat
5. Forum (a.k.a. electronic messageboard)
6. Group Webpage (display of completed work)

**Subject mailing list**

A subject mailing list was set up within each local university. The purpose of the subject mailing list was to enable announcements to be made to the class and mutual support to be built for resolving subject matters. All local students were asked to sign-up onto the subject mailing list so that announcements and updates would not be missed. The subject mailing list was set up using Majordomo listserver software and an archive of the mailing list was kept for historical reference. Students had permission to send email to the list but they were told that no personal attack and slandering was allowed and common netiquettes were to be observed at all times. The list owner (in this case the subject coordinator) had the right to remove anyone who repeatedly violated such rules.

**Team mailing list**

Team mailing lists were set up for all participating teams at the GVT command headquarters (University of Texas, Austin). UT-Austin was responsible for technical support and coordination of these lists. Each team mailing list was only accessible by team members within the team and the coordinator at each university - normally the professor of the subject. Student members, who were often from different universities, used the team mailing list to

*Figure 2. The Set-up of the Global Virtual Team Project*
familiarise themselves and to coordinate their project work during the course of the GVT exercise.

**Person-to-person email**

Person-to-person email was used to directly communicate with an individual within a team or within the local class. This was necessary if two persons were sharing a task for the GVT or within the class. The functionality that was offered by person-to-person email was similar to that of mailing lists in the sense that it was just another email system.

**Interactive chat**

An interactive chat forum was set up by one of the North American universities to allow synchronous interactive communication. This was done because there were times when team members needed to discuss issues where interactivity was important (e.g. finalising issues when closer to due dates). The chat forum was Web-based and to send off a message, participants needed to click a ‘submit’ button every time. This was cumbersome and many eventually turned to more responsive tools such as Internet Relay Chat (IRC) or I Seek You (ICQ).

**Forum**

Forums are a kind of electronic message board. They were set up to allow team members to communicate by posting notes and replies. The key difference between forums and mailing lists is that forums require users to actively access the messages while the mailing lists normally deliver the messages to a user’s email inbox. The forum used in GVT was set up by one of the North American universities using a Web-based interface.

**Group Webpage**

Group Webpages were hosted on a central Web server by a North American university. The purpose of the group Webpages was to provide a team noticeboard to post work completed at different stages. Group Webpages were not used for normal communication but were used to demonstrate completed stages of the work. The Webpages would then serve as a basis for discussion and improvement of the work. All groups were required to post their final product onto their own team’s Webpage.

In order to study the usefulness of individual technologies during the course of the GVT exercise, Murdoch students participating in the GVT project were asked to complete a survey of the usefulness of each online technology at the beginning, halfway and end of the project. The rating was from 1 (totally useless) to 5 (most useful). Because of the evolving nature of the team relationship, we suspected that different technologies might be useful during different phases of the project. We also collected survey data on student experiences on communication issues. Correlation analysis was carried out on the “usefulness of technology data”. Student responses from the beginning of the project were correlated with their responses at the mid-stage of their project. The responses from the mid-stage of the project were correlated with the responses at the end of the project. This showed trend in students’ responses to a particular technology. Figures 3-8 show the histograms of student responses for each stage of the project for each technology that we studied. The x-scale is the
response (1 - 5) and the y-scale is the number of students who gave a particular response.

**Results and Analysis**

*Subject mailing list*

The usefulness of subject mailing list was found to be decreasing during the course of the project (see histograms in Figure 3).

At the beginning of the GVT project, the subject mailing list was fairly useful (mean = 3.4) mainly due to the need to receive subject information and guidance from the local subject coordinator. Since most students were new to the experience of working in a Global Virtual Team, the subject mailing list also served as a common source of shared information. As the subject progressed, students were involved more in GVT teamwork and the usefulness of the subject mailing list decreased. The usefulness decreased to 3.2 and then 3.0 at the end. Figure 3 shows a pattern of the responses (normal curve) shifting to the left of the scale as time went on. Correlation analysis of the responses between beginning and midway (coeff. = .756, p = .000), then midway and the end (coeff. = .900, p = .000) shows that the experience was consistent with the majority of the class.

*Team mailing list*

The usefulness of the team mailing list was always higher than the subject mailing list, presumably due to the need to work closely with overseas team members. The team mailing list was almost the only feasible way to do so. The mean values of usefulness in the beginning, midway and end are 4.2, 4.4 and 4.4 respectively, indicating its importance is increasing over time (Figure 4).

*Figure 3. Usefulness of subject mailing list over time.*
Correlation analysis indicates the change in experience from beginning to the end is strongly correlated (beginning to midway: coef. = .819, p = .000; midway to end: coef. = .875, p = .000) again suggesting a consistent pattern amongst the class.

Histograms in figure 4 show that the responses are skewed towards the high end, suggesting that the GVT mailing list was very important to the project and the trend was an increasing one as compared to the subject mailing list which had a decreasing trend. Together with the outcome from Figure 3, it shows that as the project progressed, the subject mailing list became less useful.

**Person-to-Person email**

The usefulness of person-to-person (P-to-P) email was an interesting phenomenon to observe because it did not show a monotonic trend from beginning to end. P-to-P e-mails usefulness varied from being not particularly useful (midway) to more useful (end). At the beginning, usage of P-to-P email was consistent with a mean usefulness of 2.84 but dropped to 2.65 midway and increased to 2.97 (figure 5) at the end of the GVT experience.

This variation can be due to the way project teams were set up and the allocation of tasks within a team. In the beginning of the project, there would have been more group discussion while towards the end, individuals were allocated specific tasks. With specific responsibilities, P-to-P email was more useful because there was a specific person to contact to complete the project as is depicted in the last histogram in Figure 5.

*Figure 4. Usefulness of Team Mailing List Over Time.*
Interactive chat

The usefulness of online chat was limited partially due to the slowness of the technology and it was cumbersome to use. In fact this led to the use of alternative chat facilities such as IRC and ICQ. Histograms in Figure 6 reflect the unpopularity of the official chat facility with the mean usefulness falling from 2.66 in the beginning to 2.58 midway but rising back to 2.68. The skew towards the low end of the scale (all three diagrams in Figure 6) reflects the average usefulness of the technology.

According to general feedback from the class, synchronous communication was not really essential for the business plan development process. This change of pattern was consistent within the group with a correlation coefficient of .847 (p = .000) when measuring the change in usefulness from the beginning to midway and .795 (p = .000) from midway to the end. Apart from the usability of the original chat tool, many from the class found that having to meet and chat online at different time-zones was inconvenient because the Australians need to stay up/ wake up early in the morning while the Americans had to stay up late in the evening. Many only resorted to interactive chat during the last stage of the project when a final consensus was needed.
Figure 6. The Usefulness of Online Chat Over Time.

Forum
The usefulness of forum was also low. The forum was not originally part of the support system because it was thought that with the other technologies in place, there was no need to have the forum implemented. Eventually, it was set up because some teams had difficulties accessing email.

For the local students, forum was in general not used because the team mailing list was sufficient to handle most correspondence. The mean usefulness of the forum had dropped from 2.6 (beginning) to 2.3 (midway) then to 2.0 (end) with a strong skew towards the low end of usefulness (see Figure 7). This change in pattern was consistent among the respondents with correlation coefficient of .639 (p = .000), from beginning to midway and .748 (p = .000) from midway to end.

Group Webpage
Group Webpages were used continuously to display the completed work during the course of the GVT exercise. The mean usefulness of group Webpages had grown from 2.3 in the beginning to 2.5 midway and to 2.7 at the end (see Figure 8).

This is understandable because as the GVT exercise approached the end, more and
more materials were posted on the Webpages and members could discuss how to finalise the submission. This increased use of the Webpages indicated the Webpages’ usefulness.

Based on the Global Virtual Team exercise in which we participated, our results show that the usefulness of an online technology depends on the type of work being carried out and the stage of the project. It also depends on the requirements of the project as set out by academic staff. As a project whose final outcome was to produce a business plan, we found that the most useful technology was a team-based group mailing list while the least useful technology was a group forum. This could be because the mailing list was already playing the role of a virtual forum so there was no need to have an extra place to post information. Results from another study (Subject A) indicate that the forum was the second most important tool during the beginning and midway of an introductory course where group work was not required. It went to third place at the end.

Although the concept of virtual project teams is innovative, it does create new challenges from a course management perspective. These challenges are due to the lack of understanding amongst team members. Traditionally, a project team can meet face-to-face and communicate using synchronous and highly interactive medium such as teleconferencing. In the case of the standard Internet applications, communications are often confined to asynchronous modes such as email (including mailing lists) and bulletin boards (e.g., newsgroups, forums). Even though synchronous communication is possible, it is often not
feasible due to bandwidth limitations – particularly links to Latin America.

Other communication issues that arose during the project were:

- insufficient understanding of the cultural/personal background of the team
- overcoming time-zone differences
- the lack of standardised assessment weighting
- differences in workload expectation of the subject of which this project was part
- accessibility to Internet connectivity
- use of appropriate technology at the right time

**Cultural/Personal Background of the Team**

Working in a multicultural team can be an enriching experience for a team because it can bring together different views which are often valuable to the project. However, without developing prior understanding among members, cultural diversification can become a barrier to collaboration. Some teams experienced cultural differences so severe that it became a debilitating factor to the team. The so-called cultural factor can be more than just social norms, manners, and attitudes toward individuals. Some teams found that even the different subjects they were doing created different expectations from their assessors. In the virtual team project, there were students doing different degrees (and/or majors) and the
expectation of the subjects was possibly different. For example, a student enrolled in an IT degree would be putting more emphasis on the technical aspects of the project than those enrolled in a Master of Business Administration. Such differences can be a complementary asset but can also create tension.

**Time-Zone Differences**

Another barrier to collaboration, particularly in a set up like this, was the overcoming of time-zone differences. When project team members had to work synchronously, it was often necessary for them to be online at the same time. With time differences up to 20 hours, some discussions were happening very late at night for some team members and in the early morning for others. This may explain why asynchronous communications such as email and forums were the most useful tools during the project. Only a small number of teams considered synchronous communication over the Internet useful, although this might have been different if voice and video communications were made available.

**Lack of Standardised Assessment Weighting and Workload Expectations**

Due to the various subject structures, team members from different universities found it difficult to demand equal commitment from their teammates. For example, some subjects were allocated only a small percentage of their total assessment weighting to this project, say 10%, while others were allocated a significant portion (up to 35% or more). Such differences automatically created an ‘expectation gap’ where students who were doing subjects with a high assessment allocation saw the project as being more important than the others did. This often formed the spark of dispute amongst team members. Added to that was the importance of studies to the individual team members. Some team members were studying part-time with a heavy work schedule, while others were studying full-time and this project was part of the last subject to be passed before graduation.

**Internet Access**

Accessibility to resources that allow team members to work online was another major barrier to effective collaboration. Although basic Internet access was available to members in project teams, regular and reliable access was not guaranteed. Some team members only had access to Internet facilities during laboratory time (two hours per week) and the line speed left a lot to be desired. After hours access was not always possible. When heavy demands were put onto Internet access as a key to effective collaboration, such as exchange of large document files, real-time chat and frequent email communication, not being able to carry out such tasks effectively was a major frustration. Even though in cases when accessibility was guaranteed, the differences in line speed, reliability and places where such access could be made were critical. The differences between laboratory access, often up to 100Mbits/sec, as compared to modem access, which can sometimes be as low as 14.4Kbits/sec, became in some cases the difference between working effectively and a major impediment.

**Use of Appropriate Technology at the Right Time**

The usefulness of each online technology usually varies over time and therefore it may be helpful to provide different online technologies at different stages of the project by
mapping the technology to the communication needs at the time. This is especially important when project participants are not fully knowledgeable about the appropriate use of each technology. Such participants become confused by the plethora of technologies available and frustrated when they use a technology at the wrong time and get little or no satisfaction from the usage. Knowledge of the use of the appropriate technology has implications for distance learning in general.

**CURRENT CHALLENGES/PROBLEMS FACING THE ORGANIZATION**

The challenges facing virtual project teams both as an educational exercise and in a real working environment are how to coordinate teams which rely on the Internet to support team activities and making team members feel that they share the same team spirit. This may involve creating a new governing structure which enables teams to work together through a collaborative spirit instilled by team members themselves rather than external forces. Due to the differences in expectations, virtual teams are often more vulnerable to failure because of problems related to the coordination and alignment of team members’ expectations. It is proposed that more thorough “ice-breaking” exercises are carried out by team members before the start of any significant cooperative venture.

In general, coordination among faculty members can also be a challenge. Faculty members usually teach in environments where coordination is within their university’s structure. When cross-university projects such as this one take place, a ‘meta-level’ virtual team of faculty members needs to be created in order to ensure good coordination. Although a forum for such a meta virtual team was there, it was not used extensively to its full advantage. The development of meta-level coordination team is important when a tightly knitted structure is needed in teams with fluid organisational form where team members have competing needs.

Virtual teams are more than just using coordinating technology to enable disparate groups to communicate. It has more to do with how such technology can make up for the lack of face-to-face communication and understanding. In such cases, the development of a team spirit, a common objective for the team, self-governing policies and finally a membership sharing the same vision and goal would facilitate proper functioning of the team. Although interactive technology such as video and audio conferencing over the Internet makes this possible, it is the sharing of intellectual and emotional space that forms strong bonds within a team. How to really develop such sharing processes is still a challenge in virtual team
APPENDIX

Participating Universities and number of Participants

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environments.

FURTHER READING


Computer Science Education.


REFERENCES


Simpson Poon is an Associate Professor of Electronic Commerce and Founding Director of the Centre for Electronic Commerce and Internet Studies at Murdoch University, Perth, Australia. He received his Ph.D. from Monash University, Australia. He has collaborated with international companies such as Arthur Andersen and Ericsson to work in consultancies for both the public and private sectors in Australia and Singapore. Simpson has published in scholarly journals such as Information and Management, International Journal of Electronic Commerce, European Journal of Information Systems, International Marketing Review, Journal of Marketing Management and Journal of Products and Brand Management.

Simpson's contributions to E-Business research have been reported in national newspapers in Australia and he has been interviewed by the Australian Broadcasting Corporation in a national program.

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