



Science without Borders: students' perceptions of international exchange

Rosanne Quinnell, Chong Eng Tay, Michelle Kofod, Noel Whitaker and Julian Cox

Faculty of Science, The University of New South Wales, NSW, Australia

rosanne.q@unsw.edu.au

Abstract: *Scientists view their disciplines as being practiced collaboratively with discussion and debate ignoring national borders. Clearly the international arena cannot be understated for our practice of research and its importance to infuse the global nature of science into science education. In an exchange program developed between the Faculties of Science at an Asian university (NUS) and an Australian university (UNSW), students were provided an opportunity to study science in another University, in a foreign country. To define the educational benefits of the exchange program, we obtained responses from UNSW and NUS science students, through pre- and post-program questionnaires, regarding their perceptions of the program and their motivations for joining the program.*

Students from both Universities appreciated participating in the program and found it met their expectations, with "development of inter and intrapersonal and self management skills" and "learning more about the host country's culture, wildlife and environment" being most prominent. However, the two cohorts differed in their sense of the level of integration of the exchange program into their science degrees. UNSW students view Science without Borders (SwoB) as sitting outside their core curriculum whereas the NUS students view their Australian experience as very much a part of their degree program. This means that there is a mismatch between the perceptions of the students in the SwoB program and the way science is practiced. This paper provides background to the SwoB program, an analysis of the student experience as well as a critique of the current 'global positioning' of higher education in the sciences, as we grapple with increasing 'global literacy' in science.

Background

The Science Without Borders (SWoB) initiative, which began in 2005, derived from a widely held view of the merits of 'internationalisation' within the Faculty of Science at UNSW. SWoB began as a joint undertaking between the Science faculties at UNSW and NUS. This collaboration aimed to forge closer institutional links through the establishment of a reciprocal arrangement for the transfer of credit for selected undergraduate courses (curriculum development) and a structured inter-faculty student exchange program (student development), and to provide students with a global perspective in the context of their studies by way of fostering the development of their global literacy in science. While 17% of students at Australian institutions are from overseas (Australian Bureau of Statistics, 2007), less than 5% gained an overseas study experience (Olsen, 2008) suggesting Australians, relatively, do not place a high level of importance on gaining an international experience during their university studies. While some of the latter students are undertaking a full program of study, a very different proposition to a short-term exchange, the numbers of students at UNSW enrolled specifically in exchange programs suggests incoming students are more comfortable than outgoing students with such programs.

To date, the SWoB program has produced numerous positive outcomes including greater cultural and social awareness among the participants and the formation of a student society dedicated to promoting social and academic interaction among science students regardless of their ethnic, social or academic backgrounds. The program has addressed the needs of students entering an increasingly globalised work environment. The work of Wiers-Jenssen (2008) suggests we will expect to see that SWoB participants, who have gained overseas educational experiences, are more likely to seek and obtain employment internationally. The curriculum was designed to offer students the opportunity to:

- gain a broader understanding of inter-cultural relationships;
- develop self-confidence;
- broaden their perspectives on Science;



- live in another culture, which may be required in the future, and;
- work in a multicultural team, which may be required in the future.

International study experiences – the justification

Science, as the discipline context in this study, is very much aligned with the notion of scientists as a global community of scholars. Central to teaching global literacy² is acknowledging the role of (science) research-active staff in the development of curricula and the international mobility of our students. One could argue that academic staff members in science are, by default, globally literate as they are operating successfully in a global context, if they are defined as 'research active'. The appointment and promotion criteria for academic, particularly senior, positions require evidence of the potential to 'lead' beyond the limits of the employing institution i.e. to have a research profile of national or international standing. The question then becomes, how well does success in global science research lead to infusion into curricula and subsequent teaching of global literacy in Australian science curricula? Student international mobility is approached through a diversity of student exchanges (including vocational placements, exchange programs, field schools, internships and other study abroad programs). At UNSW, science students appear more reluctant than students from other faculties or disciplines to take up these opportunities. In fact, very few (~4%) international programs offered by Australian institutions focus on science (Olsen, 2008).

The landscape

Academia is driven increasingly by 'league tables', such as the Times Higher Education Supplement (THES), which emphasise research (as a proportion of research-active staff) and science (as science-based journals have easily measured indices). Further, 'international' metrics derive from the number of students and the proportion of academic staff that are international (Marginson & van der Wende, 2007), as well as the strength of international relationships, though these are largely research-related. The relationship between Higher Education (HE) ranking on the THES and commitment to global literacy is unknown. We know that teaching-intensive staff members are less likely to gain opportunities to study overseas (Schuerholz-Lehr, 2007) hence the experiences of teaching overseas are less likely to inform classroom practices. Indicators of global literacy among staff include prior international experience, employment in another country and participation at international conferences (Schuerholz-Lehr, 2007).

Australian context

The exchange program offers an opportunity to determine the views of UNSW students on international education compared to a comparable cohort from NUS. NUS offers us the advantage of being a highly ranked HE provider, higher than any Australian institution if the aim is to improve ranking (a somewhat cynical view). Although if the aim is to provide our students with enhanced opportunities to become more internationally mobile and, thereby, globally literate then an evaluation such as this can inform how we map this undergraduate offering into a global landscape.

Methods

The students from both institutions undertook an exchange during the break in the middle of their academic year at the host institution during its long break at the end of the academic year. The students were given grades for the exchange that counted for credit towards their program of study. Courses offered were primarily in environmental biology with NUS offering the choice of a language course, in addition to these, for UNSW students.

² From Schuerholz-Lehr 2007 p 183

Global literacy: Ability to function effectively in the global community. Concern with the condition of all human beings, no matter where they live. Acquiring an understanding of what is happening around the world, and not judging but respecting others' rights to live those differences (Bender-Slack, 2002). Contrary to cultural relativism or ethno-relativism that denotes a theoretical framework which assumes that cultures must be understood relative to one another and that behavior always needs to be assessed within its cultural context (Bennett, 1993), global literacy focuses on individuals' values, belief systems, and behaviors.



UNSW and NUS Science students were recruited into the study from participants in the SWoB program 2008/09. Students were surveyed online using Likert-scale and open-ended response questions as to their demographic, motivation, challenges and perceived benefits with respect to the program, and their confidence in living and studying abroad (surveys returned $n = 35$ NUS, and $n = 11$ UNSW). Not all students completed all parts of the survey. The response rate is low which renders this research a case study rather than a study on science international exchanges at large.

Open-ended responses were analysed for consensus themes and categories derived from these; comment categories were ranked according to the number of students whose comment fell within that category. Note that a student's open-ended response could be counted in more than one comment category. Consent from participants to use their surveys responses for research purposes was obtained via embedded questions within an online survey. Responses from students who chose not to participate in this study were removed before analysis. Ethics approval reference: UNSW HREC 08/2008/19. Note: student responses related to program administration have not been presented.

Results

Profile of students

More females than males (approx. 71% from UNSW and 77% from NUS female) participated in the exchange. While this gender difference is intriguing, a more broadly based survey would need to be conducted to ascertain if this difference is a feature of other international exchange programs.

All but one student from UNSW had travelled to another country prior to participating in the program, while all NUS students had travelled to another country and 11 of them had been to Australia before. In addition to English, all NUS students speak another language as do all but two of the UNSW students. At UNSW, at least, there are approximately equal numbers of males and females enrolled in undergraduate science, leading us to question whether there are factors that make it more difficult for male students to engage in such programs.

Motivation to participate in an exchange

In the pre-program questionnaire, students were asked "What motivated you to join this exchange program?" Both UNSW and NUS students commented that their main motivation was to travel overseas and have fun. Comments from NUS students show that they have a secondary, academic agenda, which our data suggests is not shared by their UNSW counterparts (Table 1).

Comment category	UNSW n = 11	NUS n = 35
Desire to travel overseas and have fun	1 (n = 10)	1 (n = 23)
Personal and social development – relating to the development of life skills	2 (n = 5)	4 (n = 3)
Knowing about country - relating to learning more about the country's culture, flora, fauna, etc.	3 (n = 3)	3 (n = 7)
Academic interests – relating to subjects / modules offered in the program	4 (n = 1)	2 (n = 17)

Table 1: Motivations of UNSW and NUS students to participate in Science without Borders. Open-ended responses were analysed for similarity and the categories generated from this. The number of students whose comments lie in each category were tallied and ranked.

Challenges of the program

The top three comment categories for each university's students before and after the program are shown in Table 2. At the outset of the program, there are differences in the concerns of UNSW and NUS students, NUS students being concerned about the challenges of a new environment and the fieldtrip (about which they had been briefed by the NUS students from previous years). There is



strong alignment between the two cohorts at the end of the program with all students being most concerned about managing their time and the workload. These are high-achieving students. Although most NUS students had travelled overseas, many were still concerned about adapting to a new environment prior to the exchange program; this was not true for UNSW students. Further, UNSW students were more concerned about the need to manage their time well before they embarked on the program. However, after the program, the majority of students from both universities expressed similar concerns about time management, and learning how to live independently and relate well to others. This could indicate that the exchange program may be useful in helping to develop some essential graduate attributes.

Comment category	UNSW (n = 11)		NUS (n = 33)	
	Pre-rank	Post-rank	Pre-rank	Post-rank
Managing time and workload - issues related to coping with studies and exams.	1 (n = 5)	1 (n = 6)	3 (n=7)	1 (n=14)
Living independently and relating to others – issues related to independent living and learning how to live and work with others	2 (n = 4)	2 (n = 4)		2 (n = 5)
Culture / language – issues concerning adaptation to cultural differences and/or learning a new language.	3 (n = 2)	3 (n=1 in each category)		3 (n = 5)
New environment – concerns about day-to-day living, e.g. transport, food and accommodation			1 (n=9)	
Field trip – issues about coping with the demands of the field studies.			2 (n=8)	

Table 2: Challenges of participating in Science without Borders as perceived by UNSW and NUS students pre- and post-participation. Open-ended responses were analysed for similarity and the categories generated from this. The number of students whose comments lie in each category were tallied and ranked.

Benefits of the program

Students were asked “What do you hope to get out of the exchange program?” before the program and “What are the important things you have learnt?” at the end of the program. Table 3 summarises these data. It appears that UNSW students found the exchange stimulated their emotional and developmental, rather than cultural interests, while cultural interests remained important to NUS students.

Comment category	UNSW		NUS	
	Pre-rank (n = 11)	Post-rank (n = 9)	Pre-rank (n = 33)	Post-rank (n = 34)
Inter- and intra-personal development, self-management skills, self-awareness	1 (n = 8)	1 (n = 6)	2 (n = 12)	1 (n = 21)
Learn more about the host country's culture, wildlife, environment	2 (n = 6)	3 (n = 2)	1 (n = 15)	2 (n = 15)
Have an overseas educational experience / new academic learning experience	3 (n = 4)		3 (n = 10)	3 (n = 5)
New experiences, fun & excitement		2 (n = 4)		

Table 3: Benefits of participating in Science without Borders as perceived by UNSW and NUS students pre- and post-participation. Open-ended responses were analysed for similarity and the categories generated from this. The number of students whose comments lie in each category were tallied and ranked.

Learning outcomes

The success of the program in meeting students' expectations, with respect to the intended learning outcomes of the program, was determined by asking the students to rate how much they thought the program would help them to achieve the stated learning outcomes before the program and how much



they felt the program had actually helped them to achieve the learning outcomes after the program. Generally, the program met the expectations of students in most of the learning outcomes. The learning objectives that fit Schuerholz-Lehr's (2007) summary definition of 'global literacy' are:

- gain a broader understanding of inter-cultural relationships;
- live in another culture if required in the future;
- work in a multicultural team if required in future.

For UNSW students, the program did not seem to be effective in developing their level of self-confidence, however, the program seemed to have a positive impact on the students' willingness to work in a multicultural team if required in the future (Table 4). For NUS students, their willingness to work in a multicultural team seemed to have dropped after the program, while most of the other learning objectives fell slightly below their expectations. On average, before and after the program, NUS students had given a higher rating for the learning outcome "Broadening your perspectives on science" when compared to UNSW students (Table 4).

Learning objectives. (post-survey) How much has SWoB helped you to:	UNSW (n = 9) % helped a lot	NUS (n = 34) % helped a lot
<i>Gain a broader understanding of inter-cultural relationships</i>	66.7	55.9
<i>Live in another culture if required in the future</i>	44.4	67.6
<i>Work in a multicultural team if required in future</i>	77.8	44.1
<i>Develop self-confidence</i>	55.6	41.2
<i>Broaden your perspectives on Science</i>	33.3	55.9

Table 4: Percentages of students who indicated that SWoB helped them a lot to develop in areas of cultural relations, self-confidence, and to broaden their perspectives in science. The first three learning objectives fit the definition of 'global literacy'.

Confidence in living and studying abroad

Students were asked: *Having participated in the program, how confident do you feel now about living and studying in another country?* Students were asked this in both the pre- and post-survey and there was little difference in the levels of confidence between the two survey points. The results demonstrated that the program provided a good opportunity for the personal development of all students, especially in the area of developing self-management skills and creating greater self-awareness. However, responses of UNSW students seemed to reflect a more open attitude towards the whole learning experience where the responses of NUS students seemed to focus more on the new knowledge gained from the courses. For example:

From UNSW students:

"How colourful a place the world is and how much there is for us to experience out there."

"the scope of interesting people in the world, even those from UNSW. there's no harm in trying something out, as long as you get something good out of it"

From NUS students:

"I have learnt a lot about the Australian culture and history which I did not know before cultural and society of Australians."

"university diversity in UNSW. general knowledge about the wildlife biology of Australia, environmental issues. learning outside the classroom."

Integration of the exchange into the degree

One of the points of differences between the two cohorts is in the level of integration of the exchange program into their science degrees. Our local students seem to view SWoB as sitting outside their core curriculum whereas the Singaporean students view their Australian experience as very much a part of their degree program. This is evidenced by the fact that NUS participants from the previous



year were an important source of information for current NUS participants and the enrolment is greater at NUS than at UNSW and NUS students viewed the exchange as an opportunity to "broaden their perspectives on Science" to a much greater degree than UNSW students. A compounding factor for Australian students is that the importance of global exchange programs in Science is perceived to be low across the Australian HE sector-at-large, recall that only 4% of exchange programs in Australia focus on Science (Olsen, 2008).

The NUS student responses have revealed to us how science, in this case mainly biology, is taught very differently in Australia, as perceived at least by these students. The NUS students commented "the method to impart knowledge is totally different from Singapore", "there are more fieldtrips and hands on" and "the education system is highly interactive and the information transfer can be easily grasped by students." This hands-on element in learning science seems to be a point of difference in how we teach and will be explored more thoroughly at a later date. This may explain why UNSW students expressed little (if any) concern about the field trip (Table 2).

Discussion

Australia is key player as a provider in the international education market (ranked 3rd from the 2006 data) (Verbik & Lasanowski, 2007). By having a large international student body, Australian universities score well on this aspect of the THES. If we look at the other direction, local students studying overseas, preparing our local students to be internationally mobile when they graduate seems to be the end-game. Wiers-Jenssen's work (2008) provides evidence of the critical link between participation in exchange programs and increased international mobility after graduation.

A study conducted by Llewellyn-Smith and McCabe (2008) showed that students' desire to travel and the opportunity for fun and excitement are the primary motivators for undertaking an educational exchange, and in our study and for the students participating in SwOB, we agree. However, our analysis showed that there were subtle differences in the way the UNSW students and NUS students responded to the question. NUS participants seemed to be more motivated by academic interests compared to UNSW participants whereas more UNSW students were motivated by reasons related to personal and social development and least motivated by academic interests. UNSW students did, however, view the program as helping them to prepare for working in a multi-cultural team, which is an indicator of global literacy.

UNSW has recently introduced a BSc International, which includes an overseas study program as a critical component. We expect that this study will inform discussion on how to best present global literacy in a science curriculum.

References

- Australian Bureau of Statistics, (2007). Australian Social Trends No: 4102.0. Retrieved September 9, 2009 from [http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/51EE403E951E7FDACA25732F001CAC21/\\$File/41020_2007.pdf](http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/51EE403E951E7FDACA25732F001CAC21/$File/41020_2007.pdf).
- Llewellyn-Smith & McCabe (2008). What Is the Attraction for Exchange Students: the Host Destination or Host University? Empirical Evidence from a Study of an Australian University *International Journal of Tourism Research*, 593-607 Retrieved October 30, 2008 from DOI: 10.1002/jtr.692
- Marginson, S. & van der Wende, M. (2007). To Rank or To Be Ranked: The Impact of Global Rankings in Higher Education *Journal of Studies in International Education*, 11, 306. Retrieved June 8. 2009 from <http://jsi.sagepub.com>
- Olsen (2008). International Mobility of Australian University Students: 2005 *Journal of Studies in International Education*, 12, 364 DOI: 10.1177/1028315308314939 Retrieved June 8. 2009 from <http://jsi.sagepub.com>
- Schuerholz-Lehr, S. (2007). Teaching for Global Literacy in Higher Education: How Prepared Are the Educators? *Journal of Studies in International Education*, 11 (2), 180-204. Retrieved June 8. 2009 from <http://jsi.sagepub.com>
- Verbik, L. & Lasanowski, V. (2007). International Student Mobility: Patterns and Trends. *The Observatory on borderless higher education*. Retrieved August 23 2009 from http://www.eua.be/fileadmin/user_upload/files/newsletter/International_Student_Mobility_-_Patterns_and_Trends.pdf



Wiers-Jenssen, J. (2008) Does Higher Education Attained Abroad Lead to International Jobs? *Journal of Studies in International Education*, 12 (2), 101-130. Retrieved June 8, 2009 from <http://jsi.sagepub.com>

© 2009 Rosanne Quinnell, Chong Eng Tay, Michelle Kofod, Noel Whitaker and Julian Cox

The authors assign to UniServe Science and educational non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to UniServe Science to publish this document on the Web (prime sites and mirrors) and in printed form within the UniServe Science 2009 Conference proceedings. Any other usage is prohibited without the express permission of the authors UniServe Science reserved the right to undertake editorial changes in regard to formatting, length of paper and consistency.