Internationalisation as a Change Dynamic in Engineering Education: Issues and Challenges

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Abstract

This paper examines some of the challenges faced by Australian universities in the context of increasing diversity of the student body in engineering classrooms. Rapid internationalisation in the form of increased enrolments from overseas applicants has meant that many universities are required to cater for the needs of students with varying levels of academic competence and qualification, and a wide diversity of language, culture and perception of academic learning. In this author's university in particular, there is also the added issue of a mix of postgraduate and undergraduate students in the same engineering courses. The dynamics of the classroom has consequently undergone radical change and addressing such change requires consideration from both a student and an academic viewpoint. This paper identifies some of the factors that have altered the classroom dynamics, discusses a number of strategies that have already been implemented to address them and comments on the more problematic areas that still affect teaching and learning for international students in engineering

1 Introduction

Many engineering schools around Australia have recently experienced a phenomenal change in enrolments in their engineering programs. In the University of South Australia (UniSA) the enrolments of local students in undergraduate engineering programs have declined in the past few years. At the same time there has been a large growth in overseas student numbers in both undergraduate and postgraduate coursework programs. In 2001 the School of Electrical and Information Engineering (EIE) had a total first year undergraduate intake of about 160 students and less than a dozen postgraduate coursework students. In 2004 the total undergraduate intake reduced to nearly half, while the total number of postgraduate coursework students exceeded 140. This has resulted in a huge change in the dynamics of the classrooms, where students now have a diverse range of backgrounds in terms of culture, language, expectation, previous qualification and knowledge. The diversity of the student body, their expectations and the widely varying levels of background knowledge poses a significant challenge to the way teaching and learning activities are conducted. This paper looks at some specific issues and challenges as they relate to teaching and learning, and attempts to provide a framework for managing these challenges.

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2 The issues

The overseas students enrolled in various postgraduate programs in the School of EIE obtained bachelor degrees in their home countries in various disciplines including Electrical Engineering, Electronic Engineering, Computer Engineering, Telecommunications, Computer Science, Information Technology, or a combination of these disciplines. These degrees vary significantly from one institution to another in terms of the body of knowledge and skills the students develop. As a result the students enrolled in postgraduate programs in UniSA are found to have varying levels of competence when it comes to the background (assumed) knowledge required to undertake a course in UniSA[1]. This leads to different levels of student performance and often frustration among the students who have deficiencies in the necessary background knowledge. In addition, because of the differences in academic cultures among Australian and overseas (particularly Asian) institutions some students initially have difficulties understanding and following the learning process fostered in a course and fall academically behind. In acknowledging that overseas students now form a significant proportion of our student population, these issues need to be addressed to more fully assist their outcomes and achievements.

Having said this, many academics strongly feel that the overall quality of students enrolling in the postgraduate programs is a serious issue that needs careful consideration. If students have some fundamental academic weakness, then the expectation of their ability to achieve high learning outcomes in postgraduate studies is greatly diminished. There is also an issue with the reactions of increasing number of overseas students when they fail a course. Some academics have recently been overwhelmed by the number of students pleading for reassessment of their final grades on various grounds, including financial hardship, and as fees for courses are not inconsiderable, their concern is understandable. Finally, the presence of both undergraduate and postgraduate students mixed into various courses has resulted in calls for differentiating the assessment items for the two cohorts. Given the varying levels of background knowledge of the postgraduate students it is indeed a challenge to separate their assessment tasks requiring the demonstration of higher academic achievement.

This paper will present and critically analyse the issues outlined above, along with some data and statistics. Finally some recommendations would be made with a view to enhance students' the learning experiences. The section below briefly presents the recent student enrolment trends in the undergraduate and postgraduate coursework programs of the School of Electrical and Information Engineering. Section 3 provides an outline of the methodology and tools used for this study. Section 4 presents an analysis of the issues and some recommendations to address them in the light of feedback provided by students and staff.

3 Internationalisation

The University of South Australia is positioning itself as an international university by recruiting more overseas students to study in Australia[2]. A commitment to internationalisation is evident in the University's Statement of Strategic Intent[3]. In addition the university has been actively pursuing new partnerships with overseas institutions to increase offshore delivery of programs in different countries. As a consequence international student numbers in both onshore and offshore programs have been increasing. Since this paper aims to analyse the issues presented by the increasing number of overseas students in onshore engineering programs, it would be appropriate to briefly present the recent student demography in the engineering programs.

3.1 Enrolment trends in Electrical and Information Engineering programs

The enrolments of local (Australian) students in the undergraduate programs of the School of EIE have declined in the last few years. Figure 1 clearly shows that the entry of local students in these programs have reduced to half over a four year period from 2001 to 2004. The number of overseas students commencing undergraduate studies remained almost same during that period. As a consequence the overall entry into undergraduate programs is on decline since 2001 as depicted in Figure 2. An important issue is that more than a third of the students commencing undergraduate studies were international students in 2004 compared with only 17% in 2001. This represents higher student diversity in purely undergraduate courses.

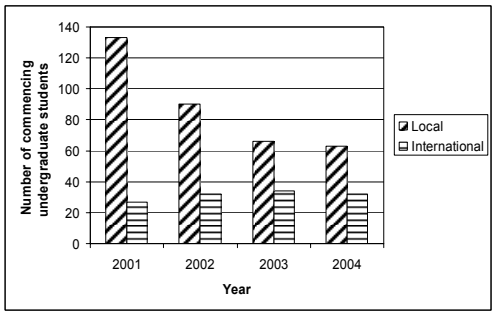

Figure 1 Local and international student numbers commencing undergraduate studies

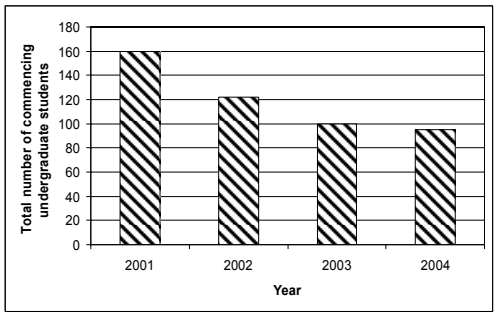

Figure 2 Total student numbers commencing undergraduate engineering programs

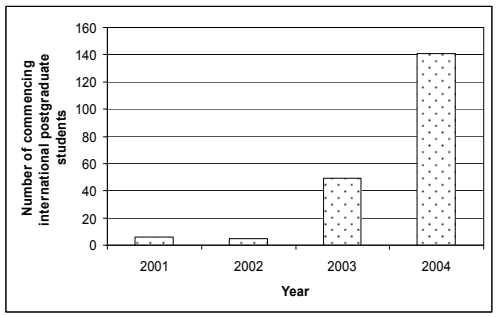

Figure 3 Number of students commencing postgraduate coursework programs in EIE

The increase in the number of international students commencing postgraduate coursework programs (Masters) in the school has been phenomenal as shown in Figure 3. These students enrol in courses which are also available to undergraduate students either as core courses in the third or fourth (final) year of their studies, or as technical electives in the fourth year. As a result of the declining local student numbers in undergraduate programs and a large increase in international student numbers, many courses now have more international students than local. This represents a major change in the demography of the student population in upper level courses. In 2004, out of a total of 181 students enrolled in the course EEET 3025 Computer Communications and Networks 72 were local students including 2 postgraduates, and 109 were overseas students among which 82 were postgraduates. However, in 2001, there were 79 local students including 8 postgraduates, and only 14 overseas students including 3 postgraduates. The same trend is evident in majority of the upper level courses offered to both undergraduate and postgraduate students. The consequence, as stated earlier, is a huge shift in

student demography in relation to their language and cultural backgrounds, perception of higher education, and background knowledge.

4 Methodology

The author has been involved in teaching upper level courses taken by both undergraduate and postgraduate students of various disciplines within the School of EIE. With the increasing number of overseas students in the class the author became aware of the wide variation in the background knowledge of these students as well as the difference between their experience of university education in their home country and that in Australia. In general, the discussion of the changes in classroom dynamics presented in this paper draws heavily on the following:

- The author's experience and reflections
- Numerous interactions with students both in class and out of class
- Discussion in the school's teaching and learning committee meetings
- Numerous discussions with academic colleagues
- Discussions with international student advisers and learning advisers

In addition, the discussion presented here draws from the experience of participating in a cross-cultural workshop. The workshop was facilitated by an academic staff from the Flexible Learning Centre of the University of South Australia who is responsible for professional development on international students. It was attended by academics, tutors, international student advisers and learning advisers. The main focus of the workshop was to discuss the issues for international students, exchange ideas, and share good practices.

The author also conducted a survey using the questionnaire given in Table 1, which was sent to all academics in the School of EIE. Ten academics completed the survey. The overseas student numbers in their courses ranged from 30% to 98%, the average being 65%. Eight of them had at least 50% overseas students in their courses. Results from this brief but useful survey have been used to underpin the author's own experiences of teaching in a diverse classroom.

5 Analysis of the issues

A number of issues concerning international students were briefly presented in Section 2. In this section an informed opinion about those and other issues would be presented based on the findings of the activities outlined in the previous section.

5.1 Background knowledge

There is general consensus among academics on the wide variation in the background knowledge of the international postgraduate students. These students come from a wide variety of institutions and have completed different degrees. Depending on their specific discipline area they may not have studied particular contents as part of their undergraduate programs. For example, a student who has completed a bachelor degree in Electrical Engineering which focused mainly on electrical energy systems and drives may not have adequate background knowledge in telecommunication networks and the underlying theory to undertake an advanced (postgraduate level) course. Indeed some students have indicated that although their undergraduate programs were in the general area of Electrical Engineering they had particular focus either on power systems or electronics etc. Similarly many students stated that their undergraduate degree programs did not have adequate electronics, digital logic and

Table 1: Questionnaire used for survey

1. Have you experienced a significant increase in overseas student numbers in your course(s)?
2. In your course, approximately what % of students was from overseas?
3. What % of overseas students do you think experienced difficulties in the course due to lack of adequate level of background technical knowledge?
4. What % of overseas students do you think had difficulties in communication, i.e., difficulties following instructions in lectures/tutorials?
5. What % of overseas students do you think experienced difficulties in the course due to late arrival?
6. What % of overseas students do you think experienced difficulties in the course due to work commitments?
7. Did you have overseas students pleading for reassessment of their final grades in your course?
8. If yes, approximately what % of overseas students pleaded for reassessment?
9. What reasons did they mostly give when pleading for reassessment?
10. Please tell us your experience about the overseas students' perception of plagiarism?
11. Did you find any strategy particularly useful for addressing any of the issues outlined above or for enhancing the learning experience of overseas students?
12. Do you wish to make any other comment or observation in the context of the above issues?

microprocessor contents. Many would argue that a graduate in the areas of Electrical, Electronic, Telecommunications or Computer Engineering ought to have fundamental knowledge in these subjects. However, all the academics surveyed agreed that some international students lack the necessary fundamental knowledge in key areas leading to difficulties in their postgraduate studies. One academic said that 60% international students had difficulties while the average obtained from all survey responses is 36%. Clearly the lack of adequate background knowledge is viewed by academics as an important issue for international students. In Section 6, a structured project-based learning strategy[1] the author has found useful for addressing this problem would be presented.

Another problem closely associated with the one presented above is the wide variation in the standard of the qualifications the students have from their home countries. Take the case of India for example where a very large proportion of postgraduate coursework students come from. India has a very large number of higher education providers ranging from renowned institutions like the Indian Institutes of Technology (IIT) to regional private colleges/universities. Hundreds of thousands of students every year aspire to get themselves admitted into an IIT program. However, only a few make it through the extremely competitive entrance examination. The IITs have very high quality educational programs driven by well qualified faculty members. IIT graduates are known to develop good technical and generic capabilities and are quite capable of pursuing higher degrees in foreign institutions. There are many other renowned universities in India. Their high quality educational programs provide students with opportunities to develop adequate knowledge base and skills. However, the same cannot be said for many regional colleges/universities offering engineering programs, especially the private sector ones. In many cases the degree programs do not have balanced curriculum content, lack in student centred learning activities and practical project work, lack adequate infrastructural facilities, and also lack qualified faculty members. Many of our past and existing international students have confirmed this in relation to their own learning in their home institutions. It is highly unlikely that a first class honours degree from such an institution would enable a graduate to develop the same level of knowledge base and skills as that from a reputed institution like IIT. It would however be very difficult for Australian universities to accurately evaluate the qualities of such a wide

range of degree programs offered by so many overseas institutions. The current practice of recruiting students based on their academic performance (grade point average or honours class) in undergraduate studies is likely to continue for the foreseeable future.

5.2 Communication skills

On average the academics surveyed stated that 28% of the overseas students have difficulties in communication that leads to difficulties in learning. Many of them are not able to follow the instructions comfortably and not able to communicate effectively during the class. Some students at times construe different meaning to what is actually presented. However, when the lecturer asks the class whether the discussion of a certain topic is clear or whether there is any question, most international students would either remain unmoved or just nod their heads giving a false indication that they have no problem. But in reality many of them have difficulties in understanding and many have questions which they are very shy to ask. Among the strategies to deal with this situation one found to be useful by most academics surveyed comprises the following:

> At the end of each class ask students to anonymously write down answers to the following questions and collect their responses:
>
> - What did you like about the lecture today?
> - What did you not like about the lecture today?
> - What is the most important thing you have learnt today?

Many academics reported that they obtained very good feedback on their teaching as well as greater understanding of the difficulties the students were experiencing. This feedback could then be used in the next class to address the issues requiring attention or to revisit a topic the students had difficulties with. It is true that many international students would not speak out in the class for fear of being humiliated due to their poor English, or perhaps with concerns about the proper ways to address their lecturer. However, they may feel more comfortable writing anonymously about the issues that concern them. There is ample evidence in literature that such an approach is useful[4,5].

Many academics stated that some international students have difficulties preparing an assessable written assignment or report, and often gets poor marks. Many of them do not have the required level or experience of presentation skills and find the task extremely daunting. As a result they perform poorly in courses requiring them to present their work in front of an audience. The skills necessary to write professional quality reports and to make presentations cannot be acquired in a day or two. Many of the international postgraduate students said that they did not do any professional communication course during their undergraduate studies. The Learning Connection at UniSA has a number of guides available online[6] to assist students in preparing assignment reports and make presentations. The learning connection also provides English language services[7] particularly targeted toward the NESB international students. However, many international students do not seem to know the existence of these guides and services despite the fact that they are informed about these in various ways including in orientation week and in course information booklets. Many international students appear to be overwhelmed by the enormous amount of information available online when they have more pressing need to get on with the assignment and be able to submit it in time. Some students are simply overwhelmed by the new culture and its requirements and need time to get used to its ways of operating. It may therefore be useful to run hands on workshops on professional writing, oral communication and presentation skills as refresher courses from time to time for international students. Such workshops would be most useful if

offered at regular intervals especially during the second half of the semester. In addition it would also be useful to have a course on professional communication and presentation as a core in all postgraduate coursework programs. It would be best to make this course available in the first semester of the study. The Learning Connection has also developed guides to assist academics in dealing with various issues while teaching international students[8]. However, some academics are not fully familiar with the contents of these guides and have not been able to engage with them due to other commitments. Once again many staffs have indicated that running workshops at suitable times could be more useful.

5.3 Perception of higher education

In traditional Asian system of education there is a perception that the teacher knows everything and so there is some reluctance to challenge the teacher. As a result students may see their role in the classroom as mere audiences with teacher playing the major part. This is predominantly teacher centric education[9] as opposed to the Australian system where emphasis is increasingly being placed on student centred learning[10] in which the student takes more responsibility for their learning. Often, international students, particularly those from Asia, find themselves in this completely new situation where they are asked to engage in learning activities that require researching and problem solving on their part. As stated above there are a number of guides available that outline good practices which can assist in addressing some of these issues and make learning inclusive for all students. However, it is essential that academic staff become more aware of the issues so they can engage students in meaningful dialogues on possible strategies which could help adequately address some of these learning issues. The workshops that are held by the Learning Connection for academic staff are helpful, but staff attendances in these workshops are very low. One effective way would be for heads of schools to encourage staff by talking to them personally and monitoring the staffs' awareness of issues in teaching international students and ways to improve their delivery of classes.

5.4 Plagiarism

Plagiarism has been a major issue in many courses especially those requiring students to submit written assignments. Plagiarism takes many forms some of which are listed below:

- Copying some one else's design and demonstrating it to the lecturer as his/her own.
- Compiling a practical report based on another student's practical work and results.
- Copying someone else's written assignment and presenting it as his/her own.
- Making quotes from books, journals, conference proceedings or the Internet without due acknowledgement.

Some academics feel that many international students do not know exactly what constitutes plagiarism. Many students are not familiar with in-text referencing as they did not have to use such referencing in their previous studies. While the latter may be true for a large proportion of international students, their not knowing the first three items in the above list is particularly problematic to come to terms with. Yet some international students resort to this type of plagiarism. Why they do it? It has been difficult to find answers to this question as most students doing it deny doing it in the first place. All course information booklets provide links to the university's plagiarism policy. The Learning Connection has a number of guides to help students understand what plagiarism is and how they can avoid it[11]. However, academics report that an increasing number of students are found to be plagiarising assignments. Many

staff participating in the workshop suggested that explaining what plagiarism is and the university policies in relation to plagiarism in the first lecture, and then reinforcing them in subsequent lectures would be useful. Hands-on workshops for students run by professional staff would also be useful. However, it is important that students are clearly informed about these workshops and then motivated to attend them before their assignments are completed.

5.5 Late arrival

Although every effort is made to encourage students to arrive in Australia well before the commencement of the semester many students arrive late, some arrive after the commencement of classes. In some cases students arrive 3 or 4 weeks after commencement of classes. What they miss in these 3 or 4 weeks is not the end of the story. On arrival they have pressing needs to find somewhere permanent to stay, buy items necessary for their daily life, get their enrolments (online) done, possible timetable clashes sorted out, library card done etc. So, they end up missing more learning activities and the consequence is that they inevitably fall behind. Some students are found to be unable to make up for the lost time. The university has been discouraging students not to arrive after the first week of the semester. However, some students still arrive late. The main reason they cite for being late is the delay in obtaining Australian visa. They obviously do not want to wait for another six months since they have completed all formalities and paid their tuition fee. It would be in the best interest of the students however to inform them of the consequences of late arrival and advise them more strongly against late arrival.

For those who manage to arrive just before the beginning of the semester also miss the orientation program. For these students it would be useful to run a concise version of the orientation program in week 3 or 4 of the semester. Such orientation programs can be run in the evenings or in the weekend to maximise participation. Some hands-on workshops may be included on UniSA's online learning environment, writing reports, making presentations, plagiarism etc. Most academics agree that an orientation program run three or four weeks into the semester would be very useful as students would then have many questions in relation to their learning, services, facilities and policies.

6 Further strategies: structured project-based learning

Many Asian students might initially feel uncomfortable with student centred learning approach such as project-based learning where they have to take a more active role. However, there is plenty of evidence in literature that project-based learning assists in developing important graduate qualities such as problem solving and lifelong learning. In fact project-based learning is inevitable in engineering education to give students opportunity to prepare themselves adequately for their profession. However, in classes where there are students from diverse backgrounds with widely varying levels of knowledge and skills it is essential to adopt a structured approach[1,12]. This is done initially with clearly defined small projects that enable students to review the necessary background knowledge. Many courses such as Advanced Digital Design[1] or VLSI Design[12] require the use of state of the art CAD tools for design, modelling and simulation. It may be a daunting task for the novice user to master the use of such tools which are often complex in nature. The early projects can be designed to enable students to easily learn how to use these tools. These early projects must be supported by detailed step by step project guides so that students can comfortably navigate through the most useful features of the tool and design a useful system at the end. This assists in enhancing students' satisfaction, confidence and motivation. The problem of diversity in

students' background knowledge is greatly diminished using this approach as students can make significant progress in their learning by engaging with the early projects in their own time. After completing a few small projects the students will be prepared to take on more complex projects. The later projects should be designed with progressively increasing levels of complexity requiring progressively deeper levels of problem soling, creativity and imagination. The final project can be designed as a capstone project challenging the knowledge and skills the students have developed so far. The need for different assessment items for postgraduate and undergraduate students enrolled in the same course can be met by assigning different (capstone) projects for the two cohorts. The feedback received from the students in the last couple of years has indicated high student satisfaction with this approach as well as higher student achievements[1,12].

7 Discussion

In the context of declining local student numbers, international students provide the life line for many engineering schools across Australia. Therefore it is important that we look at how these students can have the best possible learning experience during their study in Australia. The discussion in this section is divided into four major categories.

Quality of intake: It is important to ensure that the students entering engineering programs of study have the necessary fundamental knowledge in their respective disciplines. This would require a careful evaluation of the qualifications obtained by prospective students from overseas institutions both in terms of the students' performance as well as the quality of the programs and the institutions.

Student orientation and awareness: Late arrival of students needs to be avoided. Students should be encouraged very strongly to arrive in Australia at least two weeks prior to the commencement of the study period and participate in university wide orientation programs to enable them to sort out many issues in relation to their studies before the official study period begins. This would also give the students time to settle into life in the new environment. A second condensed orientation program for international students is proposed, to be conducted 3 or 4 weeks after commencement of the semester. It will be useful to incorporate hands-on sessions on how to use university's resources including online learning resources in the orientation program. Small interactive workshops on presentation and report writing skills, and on the university's plagiarism and assessment policies, can be very useful. These can be conducted as a series of workshops throughout the semester.

Professional development of staff: Continuing professional development of academic staff on issues concerning teaching international students and on ways to successfully teach in a diverse classroom will no doubt be useful. Sharing examples of good practices will be very helpful in this regard. Face to face dialogue among staff and with students will also be helpful. Above all there has to be an acknowledgement on the part of all staff that the international students are not only in a foreign country, but are operating in an environment new to them and an education system different from what they are used to.

Curriculum and delivery mode: At the curriculum level, it appears that a core course on professional communication and presentation for international postgraduate students would be useful to boost their performance in all courses. As far as engineering education is concerned project-based learning is a very effective way for students to gain professional skills. However, in a diverse class it is essential to design project-based activities with due regard to

all the students' backgrounds. Structured project-based learning can be used in diverse classrooms to provide students a stimulating learning experience.

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Biography

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