Strategies in an Introductory Statistics Unit to Promote Interaction between Local and International Students

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Abstract

This paper reports on a study undertaken for a project which explored changes in teaching practice and procedures to promote opportunities for interaction between local and international students. Incorporating new activities or approaches to teaching style can be problematic for content-focussed units, such as in the mathematical or physical sciences. This study outlines how a variety of opportunities for interaction were employed in an introductory level statistics unit. Activities were integrated into existing unit structures, with different strategies devised for lectures, tutorials and the unit's online learning management system.

Introduction

In recent decades internationalisation of higher education has come to be seen as important at some institutions, influencing institutional policy with concomitant effect on teaching and learning strategies (Chang, 2008). The perceived need to internationalise in response to globalisation has led institutions to examine the preparation they provide both their international students and domestic students for dealing with a globalised world (Knight & de Wit, 1995; Leask, 1999). As noted in Knight (2003; p.2-3), internationalisation is 'the process of integrating an international, intercultural, or global dimension into the purpose, functions, or delivery of post-secondary education'.

Zha (2003; p.251) outlines different approaches to internationalisation, describing a 'process approach' in which the international dimension is developed through an integrated programme of institutional policies and activities in teaching, research and services. Within teaching activities and course delivery this can involve modification of course content or changes in teaching practices, as part of the internationalisation of the curriculum.

There is a strong argument that it is cross-cultural interactions, both within the course context and informally, that provide the best opportunities to prepare students for dealing with the intercultural situations and global issues they will meet ahead. Chang (2008) contended that internationalisation of the curriculum should also include ways to facilitate engagement between domestic and international students. Trahar and Hyland (2011, p.630) noted perceptions of the 'richness' of opportunities in modern higher education due to cultural diversity and the need for students and staff to work together to effect intercultural student interaction.

Intercultural perspectives and the ability to effectively engage with other cultures were seen as desirable by students themselves (Leask, 1999). Studies internationally, such as in New Zealand (Ward, Crabbe, Cooper, Ho, Holmes, Masgoret & Newton, 2005), suggest domestic students generally have positive attitudes towards international students. A willingness to interact, however, does not easily translate into intercultural discourse. Other studies suggest that interaction between peers across diverse national groups is minimal (Sawir, Deumart, Marginson, Nyland & Ramia, 2008). Contact occurs most often among students who have similar cultural origins (Dunne, 2009). And yet it is beneficial for students to interact with other students and staff, particularly in their first year of studies. Lizzio (2006, p.2) emphasised the usefulness of such interactions: 'Students' success at university depends on their sense of connectedness.'

Sanderson (2011) presented the case for more research projects into internationalisation teaching practices to provide a consolidated list of teaching praxis used to bring the internationalisation element into higher education. Work is being done in various institutions and higher education centres and there are many ideas being presented for developing internationalised course content (Jackson & Huddart, 2010). This paper will refer to a project originally funded by the Australian Learning and Teaching Council (ALTC).

Project

From 2008 to 2010, the ALTC funded a project, *Finding Common Ground: Enhancing Interaction Between Domestic and International Students* which 'explored the benefits of, and obstacles to, interaction among students from diverse cultural and linguistic backgrounds' (Arkoudis, Baik, Borland, Chang, Lang, Lang, Pearce, Watty, & Yu 2010, p.6). It also sought to identify successful examples in Australian university teaching of the enhancement of such interactions. The project highlighted the potential benefits of peer interaction. It also noted that in courses of study with significant content, challenges for academic staff lay in the perceptions concerning the time required to facilitate increased interactions.

The *Finding Common Ground* team developed an Interaction for Learning Framework in six parts (Arkoudis et al., 2010, p.31-32):
1. Planning interactions;
2. Creating environments for interaction;
3. Supporting interactions;
4. Engaging with subject knowledge;
5. Developing reflective processes; and,
6. Fostering communities of learners.

Funding was awarded by the ALTC to a team at Murdoch University in Western Australia to explore how the framework could be implemented across a range of disciplines. The Murdoch project in 2011 built on this framework to inform and facilitate the development of strategies for increased opportunities for students to interact outside their cultural groups in a variety of units of study. Within these diverse learning contexts, participating academics developed activities for cross-cultural discourse while maintaining the integrity of the learning processes in the unit programmes. The following study of a particular unit illustrates that even a content–based course can be adapted to incorporate activities which promote cross-cultural interaction.

Context of the Study

One of the Murdoch University units which took part in the project was MAS180, an introductory unit in statistics. The quantitative nature of the unit means teaching activities are content-focussed and sequential with significant time constraints and so allow for minimal changes in teaching strategies. However, interventions in the normal mode of delivery of the unit could still be made in order to promote internationalisation. It was found that implementation of the framework did not require a significant re-writing of MAS180 content.

MAS180 is taken by students in a variety of degree programmes across the university. This service-teaching unit is usually taken in the first year of university studies and is a core unit in a many types of Business/Commerce degrees. The MAS180 cohort also draws from the Social Sciences, Education, Sports Science, Law and Politics. Approximately a quarter of on-campus students in this unit are international. In addition, there are some domestic students with English as a second language.

This is a challenging unit for students with a lot of content covered quickly, and requires good English comprehension skills in addition to mathematical competency. This is a challenging unit for teaching staff also, as they often encounter students in this service-teaching unit who lack confidence in their mathematical skills and are nervous about and/or disinterested in studying statistics.

This particular semester offering of MAS180 had 145 internal students in nine tutorial groups. Four tutors (including the lecturer) taught between one and three groups each. (A cohort of 41 external (off-campus) students were also enrolled in this unit.)

The standard teaching format for MAS180 consists of three 50-minute lectures and one 50-minute tutorial per week. Lectures are normally content heavy, presenting theoretical concepts and then working through applications and examples in a formal lecture theatre. Tutorials are also content-focussed. Students are asked to attempt a series of practice questions and bring their answers with them to the tutorials. In a typical tutorial, the tutor moves through the class reviewing student work and recording tutorial marks, then presenting a summary of the salient statistical topics, answering any queries, and finally completing worked solutions to the practice questions on the board. There is little spare time in either lectures or tutorials to allow for complete changes in teaching approach or full-scale discussions.

Strategies

In spite of the challenges, the decision was made to explore ways to foster student interaction in MAS180. The interventions in the normal presentation of lectures and tutorials were designed primarily to raise the level of contact and relations between local and international students in this introductory level unit. It was hoped that in MAS180 the activities would encourage discussion and exchange of information between small groups within tutorial classes and within the lecture cohort, both face to face and online.

Teaching strategies for this unit were developed in accordance with the first four points of the Interaction for Learning Framework developed for the '*Finding Common Ground*' project by Arkoudis et al. (2010). The final two framework points dealing with higher level reflective

processes and fostering communities of learners were seen as more relevant to higher level studies within degree programmes.

The planning phase focussed on how to create a variety of opportunities for interaction in different environments, with separate strategies devised for lectures and tutorials. Tasks were developed to incorporate interaction into existing unit structures. As information about MAS180 had already been published, in accordance with Murdoch University policy no change could be made to assessment allocations. However existing allowances for tutorial participation marks provided some impetus for student involvement in new tutorial group work.

Online activities which were implemented involved blogs on the discussion board hosted on the university's Learning Management System, designed to link with tutorial activities. These required students to work together in small groups to become familiar with some of the statistical jargon commonly used in the analysis, interpretation and presentation of information, and test their shared understanding of statistical terms and the context in which they are used. A good understanding of statistical terms is important as many words are in common use in the English language, but are used differently in the statistical context (see Kaplan, Fisher & Rogness, 2010). These terms can be particularly confusing for international students.

Lecture discussion questions were designed to promote and support interaction by showing students the value of international perspectives in local and global arenas. The discussion topics were chosen specifically so that new insights into the topics could be gained by talking with students of different cultures, to encourage interaction. Though it would have been desirable to hold the discussions in a more conducive environment than a lecture theatre, time constraints and the imperative of continuation with the lecture content made this idea impracticable.

Though cross-cultural interaction was the goal, it was still considered important for students to engage with the subject knowledge when working on these activities; to investigate the statistics used in these questions. In later lectures worked examples drew on these same discussion topics in an effort to reinforce the previous student interactions and connections as well as the statistical content.

In introducing new lecture and tutorial activities for this study, the challenge was to make them coherent, relevant and interesting and clearly aligned with the content of the unit (Chang, 2008). Ideally students would not see the activities as out of place in the unit and would understand that if they took part in these activities their studies would benefit. It was hoped that tutors working with interacting class groups would experience more cohesive and engaged student cohorts; that students would feel more connected to their tutorial groups; and so be encouraged to attend classes and perform more confidently.

In summary, the activities in the first week of semester were ice-breakers in the first lecture and first tutorial sessions; in Weeks 2-4 there was tutorial-based group work for an online blog activity; in Weeks 3-4 there was follow up blog group reporting with associated short discussions in tutorials; in Weeks 3 and 8 lecture discussion questions were introduced; and in Weeks 8-14 there were short discussion activities at the beginning of tutorials.

It is important to note that there were workload implications in the development and implementation of these strategies. As with all new unit materials, the planning and preparation for the activities, especially those outside usual teaching experience, took time and effort. Extra lecture slides were required for lecture discussion activities, after research into the relevant topics. Information pages on the glossary activity and the associated discussion blogs in the online unit were time-consuming to set up and manage as students often enrolled late or changed tutorials in the first two weeks of semester. Monitoring of the discussion blogs became part of the online discussion board monitoring routine, so required minimal extra attention. None of this was overly onerous with most of the necessary arrangements completed early in the semester.

Dissemination of information about tutorial activities had to be planned and communicated clearly to ensure all tutors understood and felt comfortable with what was required. Meetings were held in the week before the commencement of semester classes to outline the project and discuss its implementation. All four tutors were experienced in teaching introductory statistics at Murdoch University and were able to make useful comparisons with previous levels of interaction in classes. Multiple tutorials were taken by three tutors allowing comparison of interactions in different tutorial groups also. It is relevant to note that most tutors were of international origin themselves and could present an international student perspective in these discussions.

Surveys

Management reviews with tutors during the semester were planned to allow for reflection on and possible modifications to the internationalisation activities. They were held in the two non-teaching breaks in Weeks 5 and 9, and again in the week after the end of semester classes, Week 15.

The reviews included surveys of tutor experiences in the tutorials with a standard set of questions answered by all tutors individually in their roles as research assistants. These survey questions related to the study goals: to raise level of interaction between international and local students in MAS180; and to encourage discussion and exchange of information between small groups within tutorial classes, face to face and online.

In the surveys, tutors were asked to comment on the benefits and challenges of each of the new teaching strategies used in the tutorials, from both the tutor and student perspectives. Tutors were asked to report any general feedback from students about these activities made during tutorials, and to make general comments themselves. The survey also asked tutors,
  • "Have the activities been interesting, coherent, relevant and aligned?"
  • "Any other ideas? What future activities for this unit could draw upon student diversity to develop subject knowledge and skills in working across cultures?"
  • "Were there any identifiable academic benefits from this programme – either for our international students or for all students in general?"
The author (lecturer) also completed a similar set of questions about the implementation and outcomes of each of the new lecture strategies.

Responses from the tutor and lecturer surveys were collated by the author and results are given in Tables 1, 2 and 3 below, grouped according to initial class activities; blog and other tutorial activities; and general comments.

Table 1: Initial class activities

Week 1 First lecture	Students were invited to say hello to each other in first lecture, where they were from and why they were studying statistics. The lecturer highlighted the range of backgrounds in the student cohort – local, rural, interstate, international, mature age, straight from secondary school.
Lecturer comment	*"There was a lot of interaction between students, with some moving across benches to say 'hello'. It certainly 'broke the ice' and the rest of this unit information lecture was completed in a friendly atmosphere which persisted for the first week of lectures."*
Week 1 First tutorial	Students were instructed to move around the room and find out what courses others were doing. They were stopped at a certain point and asked to sit with person they were talking to in pairs at a computer. They then worked through the introductory worksheets together.
Tutor comments	*"Time well spent to get students to know each other."* *"Really good activity with the relaxed students, chatting and making friends."* *"Obtained wonderful results when they did work together."* *"Some students were reluctant to work in pairs."* *"At least they knew someone by the end of the tutorial."* *"The usual late-comers complicated the process."*

Table 2: Blog and associated tutorial activities

Week 2	The lecturer focussed on the statistical terms already covered in the lectures. Students were told they would be put into small groups of 3 in tutorials and would be asked to post versions of the meanings of a set of statistical terms in an online discussion blog.
Lecturer comment	*"External students were very quick to actually post definitions of some statistical terms. Internal students began postings on the blog through the week as tutorials were held. It was encouraging to read the blog postings online, and to be able to comment on them and guide students in their misunderstandings of the terms."*
Tutor comments	*"Took time to put students in groups."* *"A few students did not respond to their group members to complete the task assigned."* *"There are no marks for this posting exercise so they were not very keen."* *"Some students started to say, "I'll do this word if you do that word", and had to be reminded to work together."* *"Those students that posted blogs could get feedback."*
Week 3 & Week 4	Tutors put 2 words from the blog list on the board - e.g. 'representative' and 'biased' - and selected a group to explain those words to the rest of the tutorial students. A brief discussion was held.
Tutor comments	*"Excellent feedback with active discussion."* *"Good idea, especially when there are a few different meanings for words in English."* *"Student attendance was volatile."* *"Outcome was excellent – students were interacting with each other."* *"Good choice of words to explain."*

Week 8 to Week 11	Modification: Put True or False question on board for students to answer/discuss at start of tutorial.
Tutor comments	*"There was a bit of discussion between students – only minimal."* *"Good compared to sitting and saying nothing as they usually do."* *"Non-threatening situation, as they only need to guess True or False."* *"Definitely beneficial for the students as they are quite unsure about these statistical terms."*

Table 3: General comments

General tutor comments	*"Activities have been interesting to students and relevant to their learning outcomes."* *"It was really interesting, coherent, relevant and aligned."* *"The glossary was an excellent idea for both local and international students."* *"Improved confidence level and class participation."* *"I am keen for students to attempt the statistics questions for their tutorial and the 10% tutorial allocation specifically encourages this. I do not feel that further marks should be taken from the assessments structure."* (Author's note: It was interesting that all of the tutors opposed the idea of allocating dedicated marks for group work or blog entries.) *"I have enjoyed the experience so far. And I can see that parts of this would be worth doing again."*
General student comment	*"It was a problem to get some students to contact other group members in order to work on their blog postings. As a result few postings were made in some tutorial group blogs."* (Author's note: On-going poor attendance at some tutorials contributed to this also.)

At the end of the semester, all MAS180 students were asked to complete an online unit survey. An extra student survey question relating to the interaction strategies was included in the online unit survey:

> MAS180 had extra activities this semester to try to encourage interaction between our domestic and international students. Please comment on whether you had structured opportunities for discussions with other MAS180 students in tutorials or lectures and how useful these were for you.

Student responses were optional, but some interesting comments were made. Responses varied from, *"I have met some international students but have not had lengthy discussions with them,"* to, *"Yes, the tutorial and lectures helped me lot (sic) to learn more and interact,"* and even, *"They are great!"* One international student said they *"had not noticed any extra activities,"* and thought, *"the interaction between domestic and international (students) worked quite well."* This student saw the activities as a normal part of the statistics course, which suggests that the teaching strategies were indeed aligned with the content of the unit.

Discussion

The comments from students, tutors and the lecturer indicate that activities were useful in encouraging interaction between students in general. The initial ice-breaking sessions, as

described in Table 1, proved particularly effective in both the first lecture and tutorial, drawing positive comments from the tutors. Students were happy to relax and share their stories with each other in both the first lecture and tutorial sessions.

These activities allowed for more student interaction and cross-cultural opportunities, in conversation and in working together. It was disappointing that some international and local students enrolled/engaged with the unit late (after 1-2 weeks). Thus they were not able to benefit from these early activities.

The blog activity was time-consuming to organise and outcomes varied. In tutorials, students were placed in groups of three and each group was given a set of four statistical terms. Each group was asked to post the meaning of each of their terms in the online discussion blog, together with an example placing the term in a statistical context. It was explained that each week postings from the online blog would be highlighted and reported in the next tutorial. Group postings were anonymous and visible only to others in that tutorial. (External (off-campus) students had their own blog group too.) Tutors and the lecturer could view and make constructive comments on the blog postings to assist students in their understanding of the statistical use of these terms.

Outcomes and comments on the blog and associated tutorial activities are described in Table 2. These were heavily dependent on the level of effort of student groups, but had some pleasing results both in terms of student interaction and statistical understanding when carried out correctly. Tutors encountered the natural reluctance of students to be part of new groups and to meet outside class to do extra work. The online activity would probably be improved by modifying the group selection process, using larger cohorts in the online blogs and allocating a small assessment component to this exercise.

At the suggestion of tutors through the review process, further targeted statistical activities for the beginning of tutorials were introduced and continued over the semester. Tutors would put a True or False question on the board for discussion, e.g. 'Sampling distributions depend on sample size.' Whether these activities significantly raised the level of interactions in tutorials later in the semester is unclear, as students are more comfortable in tutorials and naturally interact more in the latter stages of semester. However as non-threatening introductions to tutorials, tutors found the activities "definitely beneficial for the students" (see Table 2).

The discussion questions in lectures reinforced statistical concepts and drew attention to the general use of statistics in international and local arenas. Topics were chosen for which international perspectives would be seen as useful in discussions with local students.

One lecture early in the semester began by focussing on world poverty levels (Reddy & Minoiu, 2007). Students discussed the following in small groups:

> It has been claimed that world poverty has decreased since 1990. What does this mean? What statistics would you use to describe world poverty? How do you compare poverty levels of different countries?

This was a useful 15 minute exercise, grounding the study of statistics in a real world situation. It put international students centre stage by giving them an opportunity to share their knowledge in the discussion. This was unfamiliar territory as discussion questions are unusual in mathematics and statistics. The author (lecturer) noted that generally students engaged well - some students were keen and talked across benches, others just within their rows. Some apparently 'international' students were obviously involved in this activity,

speaking animatedly with those around them. A variety of interesting answers were put forward later to the student group as a whole.

Encouragement to voice statistical terms in directed conversation is important for statistics students, especially early in their studies, and this short exercise was worthwhile from that perspective alone. A link to a web blog on world poverty issues was placed in the online lecture material for interested students.

In a later lecture on sampling distributions, students were quoted some recent research on interaction between international and domestic university students in Australia and New Zealand (Leask & Carroll, 2011). They discussed with those around them different topics drawn from the results of the statistical analysis in the report, e.g. 'Did they 'often' have conversations with students of a different ethnic group than their own?' A class survey was taken and the proportion of students who did have such conversations was compared to the proportion quoted in the research. The appropriate form of sampling distribution was considered and the chance of obtaining such a sample result from this distribution was calculated.

The activity was successful with a lot of discussion taking place, engaging domestic and international students. They were thinking about their own levels of interaction with students of different backgrounds for the sake of their studies rather than being confronted about it directly. This activity was also well-aligned with student expectations of their use of statistical analysis. It was a very worthwhile exercise as it also highlighted the used of sampling techniques and distributions in a relaxed and interesting format. The students witnessed their lecturer dealing with a spontaneous survey and its unknown result, and could model the way it was discussed and analysed. As suggested in Francis (2013), this may assist in educational transfer of theoretical knowledge to new situations.

These discussions in lectures were well-received by students with the author (lecturer) observing constructive interactions between students, and they also enhanced the course material. The international focus given by the discussion topics may have been valuable in other ways, not just to create opportunities for interaction. For example, the curriculum was internationalised, and so students had opportunities to become aware of the usefulness of their studies in dealing with international issues and of the importance given to this aspect of their studies in statistics.

The teaching initiatives also involved deeper approaches to learning (Biggs, 1999) to develop understanding of the unit content. The more reflective discussion exercises gave students the chance to review and evaluate the use of statistical concepts in more practical situations. This was a welcome by-product of these internationalisation activities, which not only promoted interaction between local and international students, but also deliberately presented statistical problems in international contexts to reinforce the expectation that students would develop skills in dealing with global interests and different cultures. Related material in international contexts was incorporated into a worked lecture example, and into assignment and examination questions.

Based on the feedback from tutors and students as shown in Table 3, it appears that the intervention activities were successful in promoting student interaction in general, from early in the semester. Tutors noted an improved confidence level among students and greater class

participation. Activities were said to have been 'interesting to students and relevant to their learning outcomes' (see Table 3).

The activities have been useful for all students in this unit and have at least given opportunities for international students in particular to engage more with local students at Murdoch University.   It seems that internationalisation strategies can be effectively incorporated into an introductory level statistics unit which could make a positive contribution to the structured development of intercultural interactions and competence within the framework of a degree programme.

At the same time the activities have highlighted the advantages of varying the standard approach to teaching statistics. Using discussions in lectures, online blogs or changes to tutorial activities that promote the use of statistical language and the provision of examples grounded in practical applications can only enhance opportunities for learning for students. As noted in Poladian, Barbour, & Kelly (2013), "Students desire and request a variety of resources but focus on traditional modes of engagement." A variety of discussion and written formats and opportunities to see statistics in practice complement other teaching activities or online resources.

Conclusion

In quantitative subjects, there is a large amount of content and teaching methods can be constrained by the requirement of moving quickly through associated methodology and examples. This study in a statistics unit has highlighted ways in which teaching activities can be varied, without necessarily affecting assessment structures, or taking focus away from content. This suggests that in the context of internationalisation, even in content-based courses, a targeted review of course materials can allow small changes in teaching style that can have notable, beneficial effects for students. For institutions which place value on internationalisation and want to signal a change in their culture in this regard, this study has shown that content-based courses of study can play an effective role by promoting intercultural interaction.

Acknowledgements

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