

Teaching smarter to improve the English communication proficiency of international engineering students – collaborations between content and language specialists at the University of Western Australia *

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SUMMARY: *The current controversy surrounding recently released immigration statistics on international student graduates of Australian universities and the ongoing debate on literacy standards in our schools form the context for this paper. A variety of explanations have been offered on how it can be that a large portion of international students graduating from Australian universities are being granted permanent residency in Australia with lower International English Language Testing System scores than those required for university entry and professional employment. An equally wide variety of explanations has been offered on the purported slippage of English literacy standards in schools. While the focus of this paper is on academic English literacy skills, and while it certainly turns a spotlight on international students, it is not, however, the intention in this paper to enter fully into either the first controversy or the second debate. The purpose of this paper is rather to examine disparities that seem to exist between international and Australian student performance in the professional development component of their engineering programs at the University of Western Australia (UWA). These disparities are evident in data of students enrolled in Introduction to Professional Engineering (IPE), the foundation unit for the professional development of engineering students at UWA. In contrast to the technical component of the degree, this unit depends heavily on English communication skills. Collaboration between content and language experts in 2006 and 2007 seems to hold promise of achieving more equitable outcomes for international students. This collaboration has reversed the widening gap in the pass rates of international and Australian students in the unit. It is hoped that this will, in turn, lead to improved international student retention rates in the degree.*

1 ENGLISH LANGUAGE SKILLS, INTERNATIONAL STUDENTS AND PERFORMANCE IN ENGINEERING PROGRAMS

Whatever we think of the recently released Birrell report (Birrell, 2006) and the subsequent flurry of media and academic interest that surrounds it (see, for example, Ewart (2007), Barthel (2007) and

Bretag (2007)), Australian universities are now, as never before, being called on to examine their English language admission standards and support mechanisms. If, as Birrell's report indicates, one third of our international student graduates gaining permanent residency in Australia are not achieving the International English Language Testing System (IELTS) band 6 scores required for admission to Australian universities, we may well be concerned. The raising of immigration requirements for permanent residency to favour IELTS band 7 and above applicants in 2007 means that international student graduates will be under increased pressure to demonstrate competency if they wish to remain in Australia at the end of their degree. IELTS band

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6 denotes mere competence in English, while IELTS band 7 denotes the much higher proficiency standards necessary for professional employment.

Explanations for the low performance of international graduates on IELTS tests vary widely. There are those who find fault with university admissions procedures and standards, others who express concerns that universities may not be doing enough to ensure that international students improve their English language levels to professional standards throughout their degrees (see, for example, student views on this issue in the media release by the National Union of Students and National Liaison Committee for International Students in Australia Inc. (2007)), and still others who point to the fact that graduating students often lack recent familiarity with the IELTS test and therefore naturally struggle with it. Despite these differences in opinion about causes for low performance, there is one issue on which most of those involved in Australian tertiary education would likely agree. This is that it would be a great disservice to international students who undertake studies in Australia if they were not enabled to develop adequate English language skills for professional employment in Australia by the time they graduate, should they so desire it.

It would be an equally great disservice to local students if we were to not facilitate their ongoing academic English literacy development in our universities. Just as there is a controversy surrounding immigration statistics, IELTS scores and higher education, there are debates on English literacy standards in our schools. In this paper, we intend neither to engage fully with the arguments and controversies surrounding international students in higher education, nor to enter into debates on curricula and standards in our schools. Although academic tertiary literacy is more of a challenge for some students than others, denying bright but less highly literate students opportunities for higher education would have consequences. It would reduce our international student intake and the accompanying benefits (ie. educational, cultural, economic, etc.) that this provides. It would also restrict our local student base and have long-term social and economic implications. This paper does not provide a cost-benefit analysis of these issues, but presumes a commitment to ensuring adequate ongoing tertiary skills development for all students who require it.

The engineering field at Australian universities presents an interesting picture. It seems that international students perform on par with, if not better, than their Australian counterparts, despite the fact that international students often speak English as an additional language or dialect. It has been proposed that international students are highly motivated to pass units due to the higher penalty of failure in light of the additional burdens they face (eg. upfront fees, relocation, economic and

social pressures, etc.), resulting in better relative international student pass rates (Dobson et al, 1998; Department of Education, Science and Training, 2004; Mackintosh & Olsen, 2003). International student success is most apparent in the technical component of their degrees, which comprises knowledge of mathematical and physical principles, and modelling and analytic techniques. This component does not rely as strongly on English language ability.

It is the professional development component of the engineering degree that raises some cause for concern. This component requires the student to possess the ability to comprehend spoken and written English well, and effectively communicate both verbally and in writing. It focuses on generic skills, including not only effective communication, but also team work, problem solving and critical thinking skills. It also includes awareness of social, cultural, ethical, environmental and a plethora of other issues associated with the practise of engineering in a societal context. It seems that certain students, including a relatively high proportion of international students, require a disproportionately high level of English language assistance in order to succeed in this component of their engineering course.

The study detailed in this paper demonstrates that the University of Western Australia (UWA) international engineering students enrolled in the Introduction to Professional Engineering (IPE) unit have traditionally been at much greater risk of failure than local students. The international students have scored significantly lower in this unit relative to Australian students and have displayed significantly lower pass rates. Although the unit had been deemed successful in improving the communication skills of the majority of Australian-born, native English speaking students, it would seem that the minority of overseas students, and others at risk such as local students for whom English is not their first language, were being left behind. Equality of input has not necessarily led to equality of outcomes; in fact, the gap between international and local student performance in the unit, up until 2006, had been widening.

As a result of this widening gap, a communications focus stream was introduced in IPE in 2006. This stream was intended to assist all students who were deemed at risk of failing the communication component of their course to perform better in this area. Setting up the stream involved considerable collaboration among language and content experts at UWA. The success of this stream, however, justifies this effort and seems to indicate that in order to assist students who struggle with aspects of their study such as communication, it is sometimes necessary to treat them unequally.

2 METHODOLOGY

IPE is the UWA engineering foundation unit for the professional development of engineers. This core first-year unit lays the foundation for the professional development component of the engineering degree. Throughout this unit, students gain an appreciation of the engineering profession beyond the technical aspects, and develop an understanding of issues such as those surrounding the multidisciplinary aspects of engineering and social and cultural influences on engineering practise. IPE is the only unit in the curriculum entirely dedicated to the professional development of engineering students. Professional development continues throughout the engineering degree, but it is intertwined in the technical units and is thus difficult to separate for the purpose of studying the performance of various student groups. We therefore studied the relative success of international students in the professional development component of the engineering degree by looking at the students enrolled in the IPE unit from 2001 to 2005.

Two complementary methods were used. Firstly, student IPE unit marks for the academic years 2001 to 2005 were analysed to reveal any statistically significant differences between international and standard enrolments, and to determine any relationship between international student success in the unit and the English competency entry avenue through which they had qualified to study Engineering at UWA. This component of the study involved sample numbers of 194 international students and 1862 standard enrolments. Secondly, we surveyed and interviewed international students who had been enrolled in the unit in 2004 and 2005. A total of 88 international students were contacted.

Integral to the issues under discussion are the entry avenues available to international students to satisfy the university English language requirements. At UWA there are 33 listed entry avenues identified for international enrolments, comprising 55 English language testing mechanisms (UWA, 2005). These entry avenues consist of a mix of internationally recognised tests and locally run courses. For example:

- TEE (Tertiary Entrance Examination) English & English Literature (50% pass mark)
- TER (Tertiary Entry Rank) English as a Second Language (64.35% pass mark)
- TOEFL (Test of English as a Foreign Language)
- IELTS (International English Language Testing System)
- CELT (Centre for English Language Teaching UWA) (B grade pass level)
- UWAFY (UWA Foundation Year)
- WAUFP (WA Universities Foundation Program)

The questions covered in the survey and interviews were identical. The interviews, however, allowed further discussion and explanation of the responses received. A total of 23 complete survey and/or interview response sets were received, equating to a response rate of 26% for this part of the study. The questions asked included:

- What method of entry did you follow to satisfy the university's English language requirements (eg. TOEFL, IELTS, UWAFY, etc.)?
- Why did you choose this entry method?
- Do you believe your English ability was good enough before starting the IPE unit?
- Was there enough help available within the IPE unit for any English language difficulties you had?

Part of the study aimed to identify entry avenues that were poor indicators of the minimum level of English language competency required to pass the unit. UWA policy states that "Literacy entry standards should be set at levels which prevent the admission of students who will not be able to cope with the demands of the particular course for which they enrol" (UWA, 2001). The study by Cotton & Conrow (1998) on the predictive validity of the IELTS entry test showed no statistically significant correlation between any of the test or subtests and any difficulties encountered with course work and academic performance. Examination of the correlation between IPE marks and English language related tertiary entrance subject scores is in general agreement with this finding. Only around 13% of the variance in performance in IPE related to students English TEE mark obtained. The remaining 87% of the variance was attributable to other influences. The correlation between UWA Physics 101 and TEE Physics (index of fit $R^2 = 0.37$), where a reasonably strong correlation might be expected, further illustrates the notion that there are many other factors involved in predicting the relative success of students in higher education courses. The entry test scores did not appear to be accurate indicators of relative academic performance in IPE. Thus we did not attempt to determine improved entry levels for these.

3 RESULTS AND DISCUSSION

Two measures of the relative academic success of international students in the professional development component of the engineering degree examined were the mean marks obtained and the student pass rates in the foundation unit. The data for academic years 2001 to 2005 is presented in tables 1 to 3.

Throughout the present study, the pre-scaling scores for the years 2001 to 2004 are utilised since they are most directly comparable to the data for 2005 to 2007. The UWA Faculty of Engineering, Computing

Table 1: International IPE enrolments pass rates and marks 2001-2005.

Year	Students	Percentage of enrolments	Mean IPE mark (%)	SD	Pass rate (%)
2001	33	8.68	55.94	12.63	75.76
2002	32	8.44	54.17	12.40	65.63
2003	42	11.83	53.23	16.79	61.90
2004	46	11.92	53.41	13.76	65.22
2005	44	12.15	52.50	14.48	63.64

Note: Pre-scaling data 2001 to 2004

Table 2: Standard IPE enrolments pass rates and marks 2001-2005.

Year	Students	Percentage of enrolments	Mean IPE mark (%)	SD	Pass rate (%)
2001	345	90.79	62.74	10.79	92.51
2002	347	91.56	62.61	9.59	91.07
2003	313	88.17	64.17	11.31	89.46
2004	340	88.08	61.83	12.32	88.82
2005	312	86.19	65.16	10.74	93.27

Note: Pre-scaling data 2001 to 2004

Table 3: Overall IPE enrolments pass rates 2001-2005.

Year	Total number students	Overall pass rate (%)
2001	380	90.53
2002	379	88.92
2003	355	86.20
2004	386	86.01
2005	356	89.61

Note: Pre-scaling data 2001 to 2004

and Mathematics scaling policy dictates that a level 1 unit must have a mean between 60% and 65%. The pre-scaling scores from 2001 to 2004 and the marks from 2005 to 2007 abide by this policy. The student marks for the years 2001 to 2004 were subjected to significant upward scaling (even beyond the upper limit specified in the faculty scaling policy). This was done despite the pre-scaling score means falling within the limits for a first-year unit. In addition, the standard deviation was decreased in the scaling process from 2001 to 2004, further upwardly scaling those students below the mean. Since the international student mean mark was lower than the Australian student mean mark, the applied scaling primarily positively affected international student pass rates, giving a false indication of the relative performance of this student group. From 2005 to 2007 the pre-scaling scores differ very little from the reported marks with no significant difference in pass rates. Utilising the pre-scaling scores for 2001 to 2004 ensures all means are within the faculty dictated limits and no modifications in mark variance are included in the data being compared.

Immediately evident from tables 1 to 3 is the disparity between international and standard enrolment marks and pass rates. The mean of the Australian student pass rate is significantly greater than the international student pass rate (p-values range from 0.997 for 2001 to 1.000 for 2002 to 2005). International students clearly did not perform as well as their Australian counterparts. A peak difference of almost 13% in the mean mark and 30% in the unit pass rate was observed in 2005. Observation of international students indicates that this trend continued throughout the remainder of the professional development component of the engineering degree. Since the technical component of most other units required for degree completion far outweighs the professional development component, the disparity in performance is not so apparent in these other units.

A large number of international students surveyed and/or interviewed in the study (57%) reported that they believed their English language ability prior to commencement was insufficient to pass the unit. Several students also reported that they had attempted more than one avenue of university entry in an attempt to satisfy the university's English language entry requirements. Some students performed poorly on an internationally recognised English language competency test on their first attempt and then proceeded to satisfy the university entry requirements through an "easier" test with little further effort to improve their English.

In order to determine the relative success at predicting international student ability to cope with the English language requirements of the engineering degree, we examined the pass rates in the professional development foundation unit (IPE) for each entry avenue used by international students enrolling in engineering (see table 4).

Table 4: International IPE enrolments by entry avenue 2001-2006 (pre-scaling data 2001 to 2004).

Year	Entry avenue													Total
	WUAPP	UWAFY	Other	WA TEE/TER	O level	IELTS	SA TEE/SAM	TOEFL	TEE (Vic)	CELT				
2001	Number	8	-	5	11	6	1	-	-	-	1	32		
	Fails	2	-	1	2	2	0	-	-	-	0	7		
	Pass rate (%)	75.00	-	80.00	81.82	66.67	100.00	100.00	-	-	100.00	78.13		
2002	Number	15	3	1	9	2	1	1	-	-	-	32		
	Fails	6	1	0	3	1	0	0	-	-	-	11		
	Pass rate (%)	60.00	66.67	100.00	66.67	50.00	100.00	100.00	-	-	-	65.63		
2003	Number	6	11	1	8	10	4	1	-	-	1	42		
	Fails	4	3	0	4	3	0	0	-	-	0	14		
	Pass rate (%)	33.33	72.73	100.00	50.00	70.00	100.00	100.00	-	-	100.00	66.67		
2004	Number	16	7	4	10	4	2	2	1	-	-	46		
	Fails	9	2	1	0	2	2	0	0	-	-	16		
	Pass rate (%)	43.75	71.43	75.00	100.00	50.00	0.00	100.00	100.00	-	-	65.22		
2005	Number	13	6	5	5	3	3	7	-	-	-	42		
	Fails	5	4	1	3	0	1	0	-	-	-	14		
	Pass rate (%)	61.54	33.33	80.00	40.00	100.00	66.67	100.00	-	-	-	66.67		
2006	Number	17	3	2	7	12	10	-	-	-	-	54		
	Fails	7	0	0	2	0	0	-	-	-	0	9		
	Pass rate (%)	58.82	100.00	100.00	71.43	100.00	100.00	-	-	-	100.00	83.33		
Total	Number	75	30	18	50	37	21	11	1	3	2	248		
	Fails	33	10	3	14	8	3	0	0	0	0	71		
	Pass rate (%)	56.00	66.67	83.33	72.00	78.38	85.71	100.00	100.00	100.00	100.00	71.37		
	% of fails	46.48	14.08	4.23	19.72	11.27	4.23	0.00	0.00	0.00	0.00	100.00		

WUAPP – Western Australian Universities Foundation Program (run by Canning/Tuart Colleges); UWAFY – University of WA Foundation Year (run by Taylor’s College); TEE/TER – Tertiary Entrance Examination / Tertiary Entrance Rank; O level – Ordinary Level; IELTS – International English Language Testing System; SAM – South Australian Matriculation; TOEFL – Test of English as a Foreign Language; CELT – Centre for English Language Teaching (UWA).

The locally run courses (ie. WAUFP and UWAFY) account for a total of over 60% of all international student failures. In 2005, the student group consisting of those who had gained university entry through UWAFY had a pass rate below 34%. University policy dictates that international students should be at the same English competency level as the standard enrolments. Section 1.7 of the Policy Guidelines for the Marketing, Recruitment and Support of International Students states that "No student shall be admitted as a full cost fee student at an academic standard lower than that required of other students" (UWA, 1995). The variation in the pass rate with entry avenue raises serious concern regarding the consistency of this standard. With such variance in the English competency entry level requirements, it is not surprising that student expectations of study in Australia do not align well with the reality, as discussed in the study by Dalglis & Chan (2005). Some of the entry avenues provided appear to endow false confidence in international student English language ability with subsequent academic consequences.

In addition to the relatively poor pass rate of international students, most survey and interview respondents (65%) commented that they did not feel there was adequate English language support available throughout the semester. Although the university offers English language assistance services centrally, international students seemed reluctant to independently seek this help when required, even when encouraged by their IPE lecturers and tutors to do so. Doing so seemed to be seen as an admission of failure on the students' part. UWA guidelines on literacy state that "As literacy is critical to all students' learning, the teaching of it should not be considered merely a remedial activity" (UWA, 2001). To address the aforementioned reluctance to seek literacy assistance independently, we implemented a communication focus stream in the IPE unit in 2006. We envisaged that with the introduction of this stream within the unit, the sort of help provided by Student Services could be brought to the students.

4 IPE COMMUNICATION FOCUS STREAM

In order to sort students into the communication focus stream, we developed a streaming test, the English Language Competency Assessment (ELCA). While the ELCA had to be successfully completed by students to pass the unit, marks in this assessment did not affect final grades. The assessment required students to listen to a brief lecture, take notes and write a summary in concise, clear English; tasks which are of primary importance to student success in IPE.

In 2006, the ELCA test streamed approximately 15% (n = 57) of students into special tutorials. In 2007 this

was increased to almost 17% (n = 100). The student workload in this stream was complementary to the standard content of the unit. In these tutorials, students were given English language assistance in addition to the normal course work. This assistance focused on techniques for effective listening and note taking, critical reading and thinking, using sources and summarising information, and planning and writing assignments. In addition, the implementation of this stream within IPE included tutor training on teaching students from diverse cultures and backgrounds, along with practical strategies to assist student learning. Communication focus stream students were also issued with supplementary text books on writing skills and provided with online writing guides.

The English Language and Learning Skills Adviser from Student Services taught alongside subject tutors in communication focus stream tutorials and was available to provide guidance throughout the semester. Regular meetings were held to examine samples of student work and to discuss student progress. The initial streaming test was re-administered in the final week of semester. This provided feedback on the effectiveness of the communication focus stream. The progression rates of various student groups (in particular those of international students) was also monitored to evaluate the usefulness of the communication focus stream.

The results of this initiative on international student performance and progression rates were extremely positive. Based on the streaming test results and student performance analysis, there was clear support for the predictive validity of the streaming test and support for the effectiveness of the communication focus stream assistance provided. The introduction of a communication focus stream within IPE resulted in markedly improved student performance in this group over the course of the semester. All communication focus stream students demonstrated at least 5% improvement in their English language ability (some up to 55%) as measured by the ELCA. The control group (those not participating in the communication focus stream) showed relatively little improvement (see table 5). The individual student improvement field in table 6 was calculated by examining only those students who sat the initial test and the re-test.

Improved results in the ELCA also translated into significantly improved pass rates in this group. The progression rate of the communication focus stream students, all of whom were selected because they were deemed at risk of failing the unit, was over 85% and 87% in 2006 and 2007, respectively (see table 6).

A large proportion (approximately 50%) of the communication focus stream students in 2006 and 2007 were international enrolments. Importantly, the

Table 5: English Language Competency Assessment scores.

	2006 Communication stream			2007 Communication stream			Control group		
	Mean (%)	SD (%)	No.	Mean (%)	SD (%)	No.	Mean (%)	SD (%)	No.
ELCA 1 (screening test week 1)	33.33	7.58	57	36.81	13.58	103	72.74	9.88	287
ELCA 2 (re-test week 13)	58.57	14.98	56	60.28	11.46	99	70.23	15.22	86
Individual student improvement	25.19	12.55	54	23.96	14.23	99	8.44	11.67	40

Note: The mean of the ELCA 2 marks is greater than mean of ELCA 1 (for both 2006 and 2007) with a p-value of 1.00.

Table 6: IPE mark distribution for 2005, 2006 and 2007.

		Mean IPE mark	Total number	Pass number	Pass rate (%)
2005	<i>Enrolment type</i>				
	International	52.5	44	28	63.64
	Standard	65.16	312	291	93.27
	<i>Stream</i>				
	Communication	–	–	–	–
	Other	–	–	–	–
2006	<i>Enrolment type</i>				
	International	54.8	54	46	85.19
	Standard	66.08	324	312	96.3
	<i>Stream</i>				
	Communication	56.3	57	49	85.96
	Other	65.92	320	307	95.94
2007	<i>Enrolment type</i>				
	International	59.01	89	78	87.64
	Standard	65.82	509	495	97.25
	<i>Stream</i>				
	Communication	57.65	100	92	92.00
	Other	66.24	498	481	96.59

gap in the pass rate of standard and international enrolments narrowed from 30% to just over 10% from 2005 to 2006. Continued refinement of the communication focus stream intervention further reduced the difference in pass rates to just below 10% in 2007. The additional English language assistance provided in this stream thus manifested itself in improved pass rates of international enrolments. The trend in student pass rates in the professional development foundation unit pre- and post-intervention is illustrated in the plot in figure 1. The progression or pass rate is normalised in this plot by the overall pass rate.

Evident from the data in table 7 is the reduction in the tail of the final grade distribution without significant effect on the number of higher grades awarded. Despite the similar higher grade distribution

consistent with previous years, the percentage of students failing the unit decreased by over 50% from 2005 to 2007. This reduction in the number of failures logically follows the communication focus stream assisted improvement of the students who might in previous years have been expected to fail the unit.

The communication focus stream initiative resulted in improved communication ability of students, in line with the university and the faculty education principle that states students should be “facilitated to develop the ability and desire to communicate in English clearly, concisely and logically” (UWA, 2004). It is anticipated that subsequent engineering units at higher levels are likely to experience a reduced burden with student English language requirements as a result of this initiative.

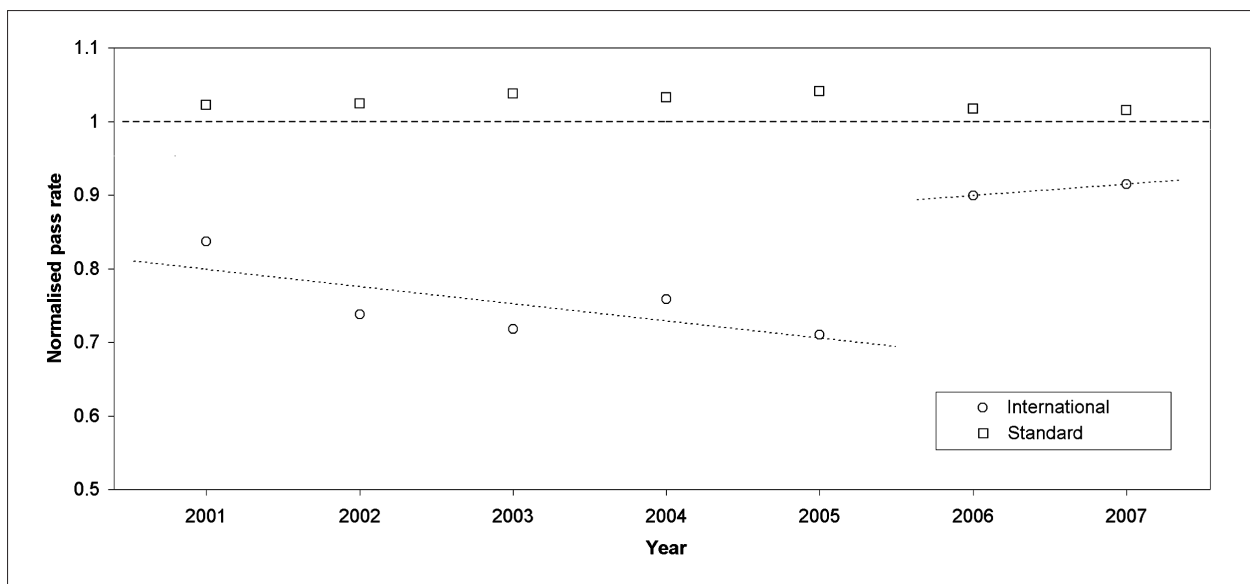


Figure 1: Normalised student pass rates in the IPE unit; 2001-2007 (pre-scaling data 2001 to 2004).

Table 7: IPE grade distribution for 2005 to 2007.

Grade	2005		2006		2007	
	No.	%	No.	%	No.	%
HD	32	8.84	32	8.47	38	6.35
D	89	24.59	113	29.89	170	28.43
CR	115	31.77	111	29.37	234	39.13
P	83	22.93	101	26.72	131	21.91
Fail	36	9.94	21	5.56	25	4.18
Total	355	100.00	378	100.00	598	100.00

In addition to improved pass rates of international students in 2006, overall student satisfaction improved, indicating higher levels of student engagement. Student Unit Reflective Feedback (SURF) survey results for the unit rose from between 2.3 and 2.8 (on a 4-point scale) with a mean of 2.5 to between 2.8 and 3.1 with a mean of 3.0. Student perception of IPE as a good educational experience improved from barely reaching the neutral point on the survey scale to being better than or equal to the engineering average on five out of the six survey questions. SPOT (Student Perceptions of Teaching) survey scores also improved an average of around 20% from 2005 to 2007. Survey comments indicated that students appreciated the extra assistance they received in the communications focus stream tutorials and the advice on how to do things right the first time around.

In its 2007 review of engineering degrees, Engineers Australia spoke highly of the changes within IPE. UWA received a commendation in the September 2007 Engineers Australia Report of Accreditation Visit (Engineers Australia, 2007) for "The effectiveness of the recently improved GENG1003 'Introduction

to Professional Engineering' unit as a means of developing, for all first-year students, a better appreciation of the nature and diversity of the engineering profession and the development of foundation generic skills" and "The quantifiable benefits resulting from English language streaming in this unit."

5 CONCLUSIONS

In order to ensure that the professional development component of engineering courses adequately develops the communication skills of all students, we may need to treat some unequally. The risks of not ensuring that English language levels are maintained at a suitable level are two-fold. These risks include poor academic, industry and public opinion of the university and its graduates if students with poor literacy are permitted to pass, and poor progression and lower retention rates of international students in the professional component of the engineering degree if they are not. Early intervention such as streaming of tutorial classes allows the additional

input required to ensure all students are equipped with the English language skills they need to progress through their degree.

IPE has historically represented a stumbling block for some international students wishing to complete an engineering degree at UWA. A number of the international students have repeatedly failed the unit despite their best efforts. Different treatment of international students and of others who require it in English language intensive units has had the effect of resulting in a more equitable outcome as far as student performance is concerned. In this way, student expectations are more likely to be met and the quality of international student graduates has improved. As IPE historically represents a major obstacle for some international students in progressing through the engineering degree, the improved progression rates are expected to also have an impact on international student retention rates.

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