

## **Aren't we all 60% water? or How does higher education address diversity in first year science students?**

*Ms Susan Salter, Ms Tracy Douglas, Dr Simon Brown and Ms Christa Moch  
School of Human Life Sciences, University of Tasmania, Launceston*

In recent years, the University of Tasmania (UTAS) undergraduate student intake has included increasing numbers of culturally and linguistically diverse (CALD) students, who are often undertaking a science based unit for the first time. In addition, some may not have had access to the full spectrum of formal secondary education. This Roundtable discussion will mainly address this particular first year student cohort, focussing on specific learning and teaching strategies which can be used to successfully introduce these and other students to a science based unit and to complement their learning at a tertiary level. The session will also be of value in identifying effective learning and teaching strategies for the wider student cohort who have completed a secondary education, but who have not been exposed to science content subjects. A general discussion of the decline in pre-tertiary and tertiary academic skills will also underpin the session, as solutions to this issue will generically support all students.

First year students are generally expected to be able to read and write, construct basic arguments, carry out appropriate calculations and learn to make coherent judgments based on the available evidence. The lack of such academic skills impedes the ability of first year students to successfully undertake and complete their units. Expansion in student numbers and student diversity has compounded this problem, especially in terms of resources and time<sup>1</sup>. These issues relate directly to university provision of support for first year students and student retention<sup>2</sup>. In the absence of longitudinal data to provide formal direction for the development of support structures<sup>3</sup>, intervention by first year unit co-ordinators is required to address student learning needs. These needs include addressing a lack of the necessary meta-cognitive skills to make learning for first year students an engaging and rewarding experience. The increasing student-teacher ratio often exacerbates the problem and allows student dissatisfaction and multi-factorial frustration to develop. Unless such first year students have been able to form one or more specific linkages or attachments to a particular unit, the result is usually withdrawal from undergraduate study<sup>4</sup>.

*What are the contributing factors to a decline in academic skills?*

A number of contributing factors have been identified in the literature.

- Changes in the secondary syllabus have been responsible for the decline in academic literacy, because the changes have usually involved the removal of some material which is expected to be part of a student's repertoire, such as basic literacy and numeracy<sup>5</sup>. Current teaching methodology in secondary schools, coupled with the narrower range of subjects which support and underpin tertiary science units, may send students into

---

<sup>1</sup> Cooke, A., Leckey, J. (1999).

<sup>2</sup> Pitkethly, A. & Prosser, M. (2001). Rowell, J. A., Dawson, C. J. & Pollard, J. M. (1993).

<sup>3</sup> McInnes, C. (2001).

<sup>4</sup> Harrison, N. (2006).

<sup>5</sup> Engineering Council (2000). Lawson, D. (2003). Todd, K. (2003). Todd, K. L. (2001).

undergraduate degrees with inappropriate exposure to basic concepts and study skills in science<sup>6</sup>.

- On a global scale, contributing factors include the rising number of international or CALD students and government policy which contributes to growing student diversity<sup>7</sup>. It has been debated that the rising number of these students contributes to the lack of skills among students<sup>8</sup>.
- Computerisation exacerbates the tendency for a poorer interaction between teacher and student. It impedes the identification of struggling students as face to face teaching is reduced.<sup>9</sup>

### *Issues within a first year science based unit*

The majority of science units at undergraduate level require prerequisite science subjects to have been successfully completed at college level (TCE or equivalent). However, the science based unit, CXA161 “Introduction to Human Biology”, offered by the School of Human Life Sciences (HLS) at UTAS has no such prerequisites. Students use this unit as a pathway to science-based courses, such as Bachelor of Health Science, Bachelor of Exercise Science and Bachelor of Biomedical Science.

Culturally situated pedagogy, transformative learning and experiential learning have been previously discussed around the themes of commonality and diversity<sup>10</sup>. It may be argued that the unit CXA161 could have several streams which allow for several teaching/assessment pathways, dependent on the ultimate aim of the student. The inherent problem with this strategy is that CXA161 is a prerequisite for progressive units within more than one degree program. To restructure the content and assessment to provide students with a range of streams and outcomes within a constructivist framework, could set the student up for failure when they undertake the next contiguous science unit and fail to recognise and build on cross unit content.

### *Literature-based evidence*

Once non-traditional students have been enrolled, the university must take a responsible role in providing for their ongoing support. The implications of the acceptance of non-traditional students brings with it an implicit commitment by the university to address all “the internal and external factors that affect the learning process”<sup>11</sup>.

The following quote will be used as a reading during the Roundtable Discussion.

*You allowed me into your training because you said I was good enough, but once in it you fail me, over and over. You fail me because I cannot express myself in your language, as well as the English speaking students, and I fail because I have to learn more than the words of your teaching – I have to give back to you the way you think. This is what you are really testing, this is how you assess my ‘intelligence’. You test to see whether I have learnt to think like you yet. I find the losing of my identity too big a price to pay. Yet I want this degree, for my family – and in truth I want to pass myself, just to show you.*<sup>12</sup>

---

<sup>6</sup> Op.Cit. Cooke (1999)

<sup>7</sup> Archer, L. (2007).

<sup>8</sup> Birrel, B. (2006). Breytag, T. (2007). Wyatt-Smith, C. & Burke, E. (1996).

<sup>9</sup> Absalom, D. & Golebiowski, Z. (2002).

<sup>10</sup> Bowser et al., (2007)

<sup>11</sup> Bamber, J., Tett, L. (2000)

<sup>12</sup> Mpumlwana, N. (2000).

This quote is from an article by a South African student studying in an undergraduate allied health unit as part of her Speech and Hearing Therapy degree in Durban, Republic of South Africa. It highlights the contradictions that arise when conflicting systems of knowledge construction and transmission occur.

The fundamental goal of a university teacher is to provide an environment where all students feel engaged, encouraged, challenged and enthusiastic about learning. The goal is also to develop and nurture the skills which students bring with them, and to applaud and embrace the diversity in the student cohort. Intellectual proficiency and quality in students is multifaceted. The challenge is to recognise this, and consequently build diversity into the assessment processes of units, whilst still retaining the core concepts of the unit material and the requirements of all contiguous continuing units. First year students need to be assessed to examine and analyse the level of their individual learning and problem solving skills. Access to any teaching and learning resources to support the students in addressing deficiencies can then be assured. However, the resources and teaching methodology need to be formal, have challenge and innovation built into them, yet still maintain accessibility.

### *Roundtable Discussion*

The proposed Roundtable discussion would include:

1. Consideration of the following issues, in order to benchmark the focus areas of discussion:
  - Have you seen a decline in literacy and numeracy in your own areas of teaching?
  - Have you seen an increase in the diversity in first year students, particularly in science based units?
  - Is there a difference in the percentage failure rates of the non-traditional student cohort to the remainder of the student cohort?
  - What is your teaching approach and methodology to include a diverse cohort of students?
2. The discussion would then specifically focus on:
  - Specific methodology for science based units in diverse student cohorts
  - Novel innovations as part of methodology for diverse student cohorts
  - Stage of evaluation of these methodologies
3. It is anticipated that these themes would result in the documentation of possible innovations of change and development in strategies to address science based learning in diverse student cohorts.

### *Conclusion*

For many students, going to university can be both an exciting and a daunting experience. Students accepted into undergraduate programs have expectations that the university will supply the necessary support to make the transition from previous levels of education to that required at a tertiary level. Success in the engagement of students during their first year is important to their retention at university. The role of the unit co-ordinator in helping to recognise student needs and in directing the student to specific solutions, and in then monitoring the student's progress as they complete complementary programs, can help the experience to be one of challenge and achievement.

## References

- Absalom, D., Golebiowski, Z. (2002). Tertiary literacy on the cusp. *Australian Review of Applied Linguistics* 25: 5-17.
- Archer, L. (2007). Diversity, equality and higher education: a critical reflection on the ab/uses of equity discourse within widening participation. *Teaching in Higher Education*, 12: 5-6, 635-653.
- Bamber, J., Tett, L. (2000) Transforming the Learning Experiences of Non-traditional Students: a perspective from higher education. *Studies in Continuing Education*, 22:1, 58-75.
- Birrel, B. (2006). Implications of low English standards among overseas students at Australian universities. *People and Place* 14, 53-64.
- Bowser, D., Danaher, P., Somasundaram, J. (2007). Indigenous, pre-undergraduate and international students at central Queensland University, Australia: three cases of the dynamic tension between diversity and commonality. *Teaching in Higher Education*, 12:5, 669-681.
- Breytag, T. (2007). The emperor's new clothes: yes, there is a link between English language competence and academic standards. *People and Place* :15, 13-21
- Cooke, A., Leckey, J. (1999). Do expectations Meet reality? a survey of changes in first-year student opinion. *Journal of Further and Higher Education*, 23:2, 157-171.
- Engineering Council (2000). Measuring the mathematics problem. Engineering Council, London.
- Harrison, N. (2006). The impact of negative experiences, dissatisfaction and attachment on the first year undergraduate withdrawal. *Journal of Further and Higher Education*, 30:4, 377-391.
- Lawson, D. (2003). Changes in student entry competencies 1991-2001. *Teaching Mathematics and its Applications* 22, 171-175.
- McInnes, C. (2001). Researching the first year experience: where to from here? *Higher Education Research & Development*, 20:105-114.
- Mpumlwana, N. (2000). The Monster of Professional Power. *Teaching in Higher Education*, 5: 4, 535-540.
- Pitkethly, A. & Prosser, M. (2001). The first year experience project: a model for university-wide change. *Higher Education Research & Development* 20, 186-198.
- Rowell, J. A., Dawson, C. J. & Pollard, J. M. (1993). First year university physics: who succeeds? *Research in Science & Technological Education* 11, 85-94.
- Aren't we all 60% water? or How does higher education address diversity in first year science students. *Salter, S. et al, Facilitated Roundtable Discussion*

- Todd, K. (2003). Historical study of correlation between A-level grades and subsequent performance. In *Diagnostic testing for mathematics* (ed. Maths TEAM), pp. 16-17. Learning and Teaching Support Network, Birmingham.
- Todd, K. L. (2001). An historical study of the correlation between GCE advanced level grades and the subsequent academic performance of well qualified students in a university engineering department. *Mathematics Today* 37, 152-156.
- Wyatt-Smith, C. & Burke, E. (1996). Rethinking literacies in university education: perceptions of Australian non-English speaking background students. *English in Australia* 115, 43-51.