Using dimensions of teaching practice to contextualise equity and transition: A case study in first-year Human Biology

Ms Kelly E. Matthews, Teaching and Educational Development Institute, The University of Queensland

Dr. Roger W. Moni, Griffith Institute for Higher Education, Griffith University

Associate Professor Karen B. Moni, School of Education, The University of Queensland

Abstract

Academics need to better understand how managing equity issues can benefit their students. Easing transition for all students into the first year of university is best addressed though effective teaching and assessment practices of a discipline. In the content-heavy and empirically-focussed Biosciences, issues of student equity and transition are often not considered. Using an exemplary case study of a large, first year human biology course, we explore the interplay between disciplinary context, content, pedagogy and assessment through the lens of student equity and transition into university. The use of a discipline-specific model to align content, skills and assessment within this course is presented along with six dimensions of effective practice for addressing the needs of diverse learners. While we argue that equity and transition should be conceptualised at the discipline level, the six dimensions of practice are likely applicable to a broader range of first year courses.

Introduction

Much of the literature on student experience arises from research examining the underlying factors contributing to educational excellence and student attrition in the first year of university. Often referred to as the 'first year experience' (FYE), the transition period into university plays a critical role in forming students' attitudes and behaviors towards learning (James, Jennings & Krause, 2009; Krause, Hartley, James & McInnis, 2005; McInnis & James, 1995) and therefore, helps to determine whether students will persist at an institution, in addition to the learning outcomes that they will achieve (Pascarella & Terenzini, 2005). However, a review of the past 15 years into the experience of first year students across Australia found that students from under-represented groups were experiencing university differently compared to students from traditional groups (James et al, 2009). Where lower rates of participation and higher rates of attrition exist for students from under-represented groups, issues of student equity arise. While the transition into the first-year of tertiary study presents challenges to most students, these issues are believed to be confounded for students from under-represented backgrounds (low socio-economic, geographically remote and rural areas, non-English speaking backgrounds, and/or students with disabilities).

Issues involving transition in the first-year for all students, including students from diverse backgrounds, are manifested in the context of specific discipline-based programs and courses. Increasing the student experience and the significant period of transition into the first year of tertiary study are being conceptualised at the curriculum level (Kift, 2009; Tinto, 2009). Therefore, strategies to address transitional issues need to be implemented at the level of

learning, teaching and assessment as well as at the level of general support services. From this perspective, issues of student transition and student equity need to be conceptualised and embedded in the curriculum and expressed through carefully designed and innovative teaching and assessment practices within the context of the discipline. However, equity is still perceived by most academics in terms of deficit models where students from under-represented groups are perceived as being of 'lower quality' than their peers, needing additional extra-curricular support and requiring special learning assistance outside of regular course delivery that is, not the responsibility of the individual academics (Gale, 2009; Treisman, 1992). Consistent with these beliefs, issues associated with student equity and the needs of diverse learners are seldom considered when curriculum is being developed. However, there is a movement forming around the FYE agenda in Australia to focus on reconceptualising curriculum as the most effective strategy for addressing student transition and student diversity (Gale, 2009; Kift & Nelson, 2005). This shift in academics' responsibilities to address transition in the first year curriculum from within a discipline perspective, requires a re-thinking of how to accommodate students' diverse needs, while maintaining the focus on developing disciplinary knowledge and skills. Thus, there is a growing need for strategies that effectively engage academics at the course level, particularly given the context of the Bradley Review (Bradley et al, 2008), which has highlighted issues of student equity.

We argue that issues associated with student transition for *all* students can be appropriately addressed through effective teaching, learning and assessment practices at the discipline level. However, academics designing, developing, teaching and evaluating first year courses would benefit from disciplinary-specific, practical examples of how issues of transition and diversity can be addressed. We present a discipline-based model focussed on the core approaches to teaching a large first year course in *Human Biology*. Then we describe six dimensions of practice in the broader terms of addressing student diversity. Finally, the implications of these practices beyond science are discussed along with the implications for embedding effective equity practices within the first year curriculum.

Context

The University of Queensland (UQ) is a member of the research-intensive Group of Eight universities in Australia and achieves highly in research and teaching. Enrolments are about 38,000 students, supported by approximately 2,400 academic staff. It is ranked as one of the top three Australian universities in terms of research income. The university's 2007- 2011 Strategic Plan had as its first key operational priority, 'to attract and retain the most able undergraduate and postgraduate students, in the context of achieving equity and diversity in the student population, and in particular, to address under-representation of students from disadvantaged groups' (http://www.uq.edu.au/about/key-operational-priorities-strategic-plan-2007-2011). This priority raised questions about how this strategic goal might be achieved in the programs and courses in a research-focussed School of Biomedical Sciences (SBMS).

SBMS at UQ encompasses the disciplines of Physiology, Pharmacology, Anatomy and Developmental Biology. In 2004, one of the authors (RWM) facilitated the establishment of the Educational Research Unit (ERU) within an otherwise traditional discipline-departmental governance structure. In doing so, they enabled a closer integration of the research and teaching cultures in the School (Moni, Poronnik, Moni, Lluka & Hryciw, 2006). The development, implementation and evaluation of the model reported in this article was an ERU initiative to enhance undergraduate teaching, learning and assessment practices relevant to the work of scientists. Given the emphasis on the FYE and timetabling of the course

Human Biology in both first and second semester of a first year bachelor's degree, the team decided that this course should be the focus of renewal.

The course and the students

Human Biology is a one-semester, first-year course delivered by SBMS. This is offered in semester one to approximately 400 students enrolled in Pharmacy and Human Movement Studies degree programs, and in semester two, to over 800 Science students. Entry into these programs is competitive and based on state-wide standardized testing at the end of high school. Based on these test scores, Pharmacy students fall within the top 4% of academic ability, Human Movement Studies students are within the top 6%, and Science students within the top 17%. The course aims to build foundational disciplinary knowledge, conceptual frameworks and practical skills in *Human Biology*. The curriculum emphasises engaged learning of broad biological concepts rather than the recalling of many facts, an approach that has long been shown to improve students' understandings and attitudes towards biology in first-year classes (Sundberg, Dini & Li, 1994). Further, this approach is necessary because the students come from a range of different educational and cultural backgrounds (Matthews, Moni & Moni, 2007). For example, in 2005 low socio-economic students represented 10% of the enrolments in semester one and 5% in semester two. In each semester, 25% of the class was identified as being from a non-English speaking background. Students from rural or isolated areas represented 17% and 14% of enrolments in semester one and two, respectively (as defined by the Department of Education, Employment and Workplace Relations). Information on students with disabilities was not accessible and is not made available to course coordinators as general practice. Most of the course content was delivered through face-to-face lectures organised into thematic units. We now describe how a model of curriculum renewal was developed for this course, which also allowed us to embed pedagogical practices that more effectively addressed the needs of our students.

The discipline-specific model to drive development of assessment

After initial discussions centering on how to reframe the course, the second author developed a model which drew upon traditional emphases of scientific literacy and upon notions of linguistic and cultural diversity that have increasingly characterised higher education (**Figure 1**). Traditional emphases included *knowing* and understanding content and processes, laboratory (*doing*) skills, and the use of *evidence* as a key feature of inquiry-based learning in Science. Notions of linguistic and cultural diversity included *language* use which Lee and Fradd (1998) recommended as a key teaching and learning consideration in developing scientific literacy. The model also emphasised that students should also know about science through defining and using evidence. This was considered to be a pedagogical model because it focussed learning and teaching around the basic processes of conducting modern scientific research (Justi & Gilbert, 2000). Following the first iteration of

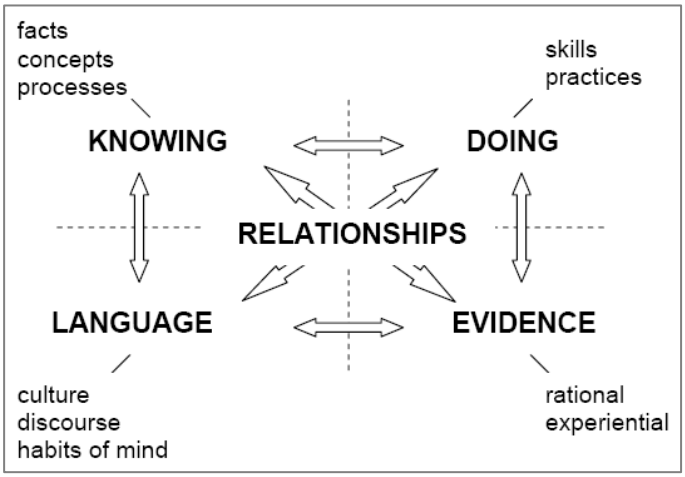

Figure 1: Five domain model of discipline-related learning and teaching

the course and evaluation of the model, a fifth domain was incorporated as the relationship between the learners and teachers around the four domains emerged as a key factor.

Three summative assessment tasks were designed – the *Personal Response*, the *Biohorizons* eConference and individualised assessment of core manipulative skills required in laboratory sessions. These complemented an end-of-semester exam weighted as 50% of the course. We have previously reported the details of these three innovative assessment tasks – the *Personal Response* as an early written assignment (Moni, Moni**,** Lluka & Poronnik**,** 2007a); *Biohorizons* – a web-dependent eConference (Moni, Moni, Poronnik & Lluka, 2007b); and individual assessment of core, manipulative laboratory skills (Moni**,** Hryciw, Poronnik, Lluka & Moni, 2007c). These prior publications were examining the learning activities separately from a discipline-based perspective. This paper is offering an original, holistic overview of the course from the critical lens of student equity and transition. In **Table 1**, we now evaluate the key components of each task using principles of assessment to provide a summary of their overall quality.

Table 1: Evaluating the quality of three innovative assessment tasks using principles of assessment (James, McInnis & Devlin, 2002).

Assessment Task	Integrated to promote meaningful learning	Explicit and Transparent Criteria	Validity	Reliability	Equitable
Personal Response	Individual interests were acknowledged.	Detailed task description, rubric and model answers provided.	Prior knowledge and experiences are incorporated into the criteria.	Markers were trained using model answers and moderation of final marks.	Students could select one from eight audio files. Values individual knowledge. Just-in-time, face-to-face peer support.
eConference: • Paper • Presentation • Discussion	Conference clusters represented professional interests of students. Learning scaffolded by interactions with on-line tutors and peers.	Detailed task description, rubric and model answers provided.	Professional requirements and activities for conference participation incorporated into the task description and criteria.	Markers were trained using model answers and moderation of final marks.	Multi-modes of communication. Opportunities for collaborative learning in pairs and within clusters. Just-in-time, face-to-face peer support.
Manipulative laboratory skills	Working safely, competently and autonomously in lab settings.	Detailed task descriptions, rubric, explicit teaching.	Skills were demonstrated and learned in laboratories during completion of practical tasks.	Tutors were trained to assess each skill.	Individualised with multiple opportunities to demonstrate mastery of skills.

Six dimensions of practice

Matthews, Moni and Moni (2007) identified six dimensions of practice that addressed the needs of diverse learners in a single element of the course, the eConference. Through retroactive analysis of the eConference and student outcomes, these six practices were identified and articulated. These dimensions are practice-based, focussing on teaching practice and pedagogy. While the discipline-specific model (**Figure 1**) allowed for intentional design of assessment in the course, it offers little in the way of guiding teaching activities and practice. For most academics, with little or no training in teaching and learning, practical and tangible examples of effective practice are invaluable and thus add an extra element of usefulness.

In this section of the article, we extend this earlier framework of the six dimensions of practice against the other assessment tasks in the same course to further validate this approach. In addition, we more broadly explore how the dimensions of practice relate to a discipline-specific model for conceptualising assessment (**Figure 1**). In so doing, we show how these dimensions interact, overlap and complement one another, while relating each dimension explicitly to issues around learning and teaching students from diverse backgrounds.

Dimension 1: Aiding the transition into a new learning environment

The issues associated with the first year experience in Australia are well-documented: adjusting to new approaches to learning, the social aspect of university life, use of technology as an educational tool, lack of understanding of university expectations, reliance on self-management and the financial implications of studying. These issues can be confounded for those from under-represented groups and diverse backgrounds (Krause et al., 2005). Recognising and acknowledging students prior teaching, learning and assessment experiences in the university classroom is crucial. However, this recognition should go beyond the classroom, informing curriculum design (learning activities, pedagogies and assessment). Kift and Nelson (2005) have proposed "transition pedagogies" as a model for considering student transition in first year. Gale's "southern theory of higher education" suggests that the *ways of knowing* brought to universities by under-represented students should be valued and integrated into the curriculum (2009).

The *Personal Response* assignment was introduced in week two of each semester. It required students to describe their existing or past perceptions of the roles of Biology in their lives and the lives of significant others. This task was explicitly taught as a means of legitimating these perceptions, to help students understand personal versus professional perspectives, to diagnose early significant academic writing needs, and as a deliberate strategy to transition students to the epistemologies of the Biosciences developed further through the eConference, which shifted discourses from the personal to professional while maintaining similar assessment rubrics. The core lab skills clearly defined not only a small suite of essential skills to enable further lab-based progress in Bioscience courses but also enabled students to repeat skills until they were assessed as being competent.

Dimension 2: Blended learning communities

Australian university students are working more and spending less time on campus, compared to ten years ago (Krause et al., 2005). For students with family or carer responsibilities, a disability, financial disadvantage or living at greater distances from the

university campus, the blended learning environment allows them to remain engaged and connected both on and off campus. The use of information and communication technologies in higher education in Australia has been increasing significantly, so the initial concern that students might not have access to computer technology has not been fully realised. A early Australian study found that student from non-English speaking backgrounds (NESB) had significant gaps in understanding the content and intent of lectures, and more than a quarter did not understand much of the lectures at all (Mulligan & Kirkpatrick, 2000). More recently, this has been supported by Krause et al. (2005) who found that students from NESB had difficulty in adjusting to the style of university teaching, impacting on their understanding of the material and causing them to feel uncomfortable in class discussions. The asynchronous modes of communication provide students from NESB with more time to process questions, for example online discussions forum. This type of communication can also benefit students with learning disabilities who require more time to process information before responding.

The mix of face-to-face and media-based instructional tools was a strong feature of the *Personal Response* and the eConference. In the former, each student received a CD with multiple audiofiles from which they selected a favourite course topic to explore. Students were encouraged in peer-based small group sessions to explore the range of options, share their understanding of model answers and reach more clear understanding of academic standards underpinning the assessment. The eConference required ongoing and extended drafting and asynchronous sharing of document and ideas using a learning management system.

Dimension 3: Collaborative learning

Collaborative learning describes learning when students of varying levels work together for a shared purpose. They take on responsibility for each others learning so that formal and tacit knowledge is gained during the process (Gokhale, 1995). Collaborative learning strategies, when implemented properly, have a profound impact on student learning by encouraging inquiry, articulation of rationale, justification of opinions, reflection on knowledge, and exposure to different perspectives (Soller, 2001; Warren, Ballenger, Rosebery & Hudicourt-Barnes, 2000). With the increasing diversity of students in large courses such as this one, collaboration exposes students to diverse perspectives and a variety of approaches to learning. Recent research in the USA found that exposure to collaborative learning had a positive impact on student outcomes and openness to diversity (Cabrera, Crissman, Bernal, Nora, Terenzini & Pascarella, 2002). The collaborative learning approach fosters the notion of "diversity as an intellectual resource" (Warren et al., 2000). Therefore, diversity among students is viewed as an asset and integrated into learning activities by design, which is an example of how Gale's (2009) "southern theory in higher education" can be translated into practice.

All three assessment tasks explicitly encouraged peer interactions and the negotiation of understanding around academic achievement standards. These timetabled collaborations were face-to-face for the *Personal Response* and assessment of the lab skills but mostly online (student-to student- and student-to-mentor) for the eConference. In addition, small group peer learning sessions were organised to facilitate effective collaboration strategies amongst students.

Dimension 4: Differentiated instruction

Differentiated instruction is a form of responsive teaching that aims to achieve the maximum learning potential for each student. It hinges on the philosophy that individuals learn in a variety of ways, and effective teaching should address the diversity of student preferences in terms of learning, readiness and interests (Tomlinson, 2005). Implementing differentiated instruction might seem challenging given the large enrolments in some university courses and the increasing diversity within the student population. It is for these very reasons that differentiating the instruction is essential. Otherwise, students who are not accustomed to, or learn best within the context of traditional teaching modes, will be disadvantaged (Lee and Luykx, 2006).

The *Personal Response* and eConference offered students a wide selection of either audiofiles or eConference topics. In these, markers were trained to acknowledge diverse approaches to addressing assessment tasks. The lab skills assessment centred on five core competencies where students were offered multiple opportunities to demonstrate these skills via a hands-on assessment task.

Dimension 5: Scaffolding to guided student inquiry

Scaffolding enhances the cognitive growth of learners by utilising teachers or more capable peers to assist students in performing tasks they would not usually be able to do independently (McLoughlin & Marshall, 2000). *S*caffolding strategies include providing clear and explicit instructions, on-going guidance and timely feedback, and criteria for marking. Learning activities and assessment tasks are designed to provide early feedback, incorporating both formative and summative assessment. As the course proceeds, the level of guidance is reduced as students become accustomed to the academic learning environment. These scaffolding practices ease student frustration, increase motivation, bridge the gap between student abilities and intended goals, and develop higher-level cognitive strategies (McLoughlin & Marshall, 2000; Rosenshine & Meister, 1992).

The scheduling of the *Personal Response* and the following eConference were explicitly designed to further develop academic literacies as practiced within the Biosciences. The model was used to highlight how personal and professional discourses drew upon the knowing, evidence and language dimensions of the Biosciences. All assessment tasks in the course were developmental, with one leading to the next. The goal was to scaffold activities, starting with an activity acknowledging learners' prior knowledge and perspectives (*Personal Response*) then shifting towards an introduction to professional use of language in the Biosciences (eConference). Finally, through the lab skills, students demonstrated their abilities and use of the scientific language as each was assessed individually by a tutor.

Dimension 6: Metacognitive learning strategies

Assisting students in developing their own awareness of how they learn, particularly in the context of a specific discipline or content, can lead to increased learning expertise and content expertise (White & Frederiksen, 1998). More sophisticated learners are able to evaluate, reflect, and negotiate the processes by which they approach learning and adjust them when needed (Georghiades, 2004).

Metacognitive strategies were integrated throughout the *Biohorizons* eConference and were a major component of effective collaborative learning because students had to articulate and defend their knowledge and understanding. The small group learning sessions facilitated this meta-cognitive approach.

Evidence of learner outcomes and sustainability

Most students achieved high grades for the eConference, which employed the six dimensions of practice (range of mean percentage scores was 81- 96% across both semesters in 2005). In analysing the scores, no significant relationships existed between particular equity or diversity indicators and performance. The academic outcomes demonstrated that the eConference did not disadvantage students from under-represented groups and was designed and implemented in such a way that all students had equal opportunities to perform at a high level. Refer to Moni et al. (2007) for further information regarding student survey results.

In addition to academic achievements on the eConference assessment tasks, the overall academic results from semester two in 2005 were compared with those from semester two in 2004, before the course was renewed. The university entry scores from both cohorts were not significantly different ($P = 0.9509$). The mean ± SD percentages were: 54.76% ± 18.38%, $N = 787$ for 2004 cohort; 65.21% ± 14.45%, $N = 817$ for the 2005 cohort (t-test, $P<0.0001$). Academic achievement in the renewed course has remained high in each semester since 2005.

The final evidence to indicate success for this model and the six dimensions of practice is sustainability. Five years after its inception, this model and approach to first year curriculum is still being implemented in the *Human Biology* course. The course has changed hands from the original development team and is still being implemented and assessed according to the model and pedagogical practices established in 2005.

Conclusion

We have argued that effective teaching, learning and assessment practices within the disciplinary context can effectively address issues associated with student transition into tertiary study for *all* students. This is evidenced by learning outcomes showing no significant differences between students from traditional and non-traditional backgrounds. We used an exemplar case study to demonstrate how a discipline-based model (**Figure 1**) can assist academics to focus on core aspects of teaching, learning and assessment. Then we articulate six dimensions of practice derived from an effectively designed assessment task, and we mapped these practices more broadly to different assessment tasks within the same course.

Our aim is to demonstrate that academics can take responsibility for issues of student diversity and address them through teaching and assessment practices. Our strategy incorporates the disciplinary context with broader dimensions of effective practice. Thus, effective teaching and assessments practices offer *all* students an opportunity to achieve academic success in the first year. While our case study is contextualised in science, we believe that other disciplines can adopt this approach to catering for diverse learners in the first year. The first step is to develop, adopt or create a model that identifies the *ways of thinking* within the discipline that drives the design of effective assessment within the course. The next step is to align the assessment activities with the learning activities and teaching practices using the six dimensions of effective practices. Further research in this area could involve the application of this approach to other disciplines at the first year level, and to evaluate the subsequent impact on learning outcomes for all students.

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