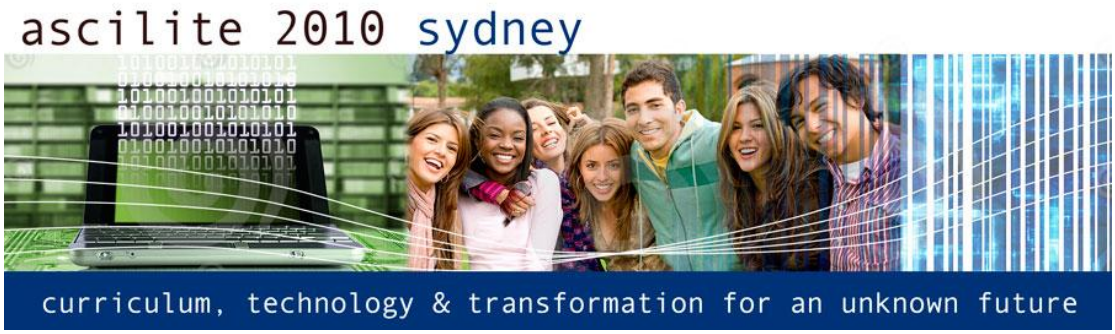

What do we mean by ICT graduate attributes? Exploring mappings to course objectives

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Developing information and communication technology (ICT) skills is embedded in Australian curricula from early primary through to tertiary education. This study examines curriculum documents from introductory university courses in two programmes of study at the University of Queensland, to explore the nature of ICT skills development as students transition to University. The curriculum documents indicate a variety of interpretations of curriculum design and the development of ICT skills. The majority of course objectives mapped to developing effective ICT skills do not explicitly relate to technology and little consistency is evident in the implicitly linked aspects and uses of ICT, raising further questions as to what ICT skills institutions refer to in outcomes statements.

Keywords: graduate attributes, ICT, learning objectives, curriculum mapping

Background

There is evidence of effectiveness in developing graduate ICT skills. 70% of students completing the Australian University Survey of Student Experience believe their university contributes at least "quite a bit" to the development of their ability to use a computing and information technology (ACER 2010). Debuse and Lawley identify employer required skills as identified in job advertisements emphasising experience and technological skills and these requirements being general met by graduates (2009). However many lecturers overestimate the abilities of their students to use technology for professional and educational purposes (Kennedy et al., 2008). This over-estimation of students' skills results in students not being supported in developing abilities in the professional and educational uses of these tools. These challenges and promises of improvements with technology highlight the need to consider ICT skills as part of transitional experiences for first year studies.

First year experiences are not only critical for retaining students but for building a solid foundation for the later years of study (Krause, et al. 2005, Kuh 2007). By examining the curriculum documentation for course implementation of curriculum relating to ICT abilities, this study aims to identify the current development of ICT skills in the first year curriculum.

Methodology

The electronic course profile (eCP) is a mandated public document for courses offered by the University of Queensland (available online at https://www.courses.uq.edu.au/). An objective in developing the eCP was to "map graduate attributes for programs" (UQ, 2006). The eCP is arranged in seven sections: course information, aims and objectives, learning resources, learning activities, assessment, policies and guidelines and a learning summary. Course learning objectives are explicitly mapped to the graduate attributes identified at the University of Queensland. Curriculum alignment is encouraged through the mapping of assessment and learning activities with the course objectives. The Australian Universities Quality Agency's (AUQA's) 2009 review of the University of Queensland with the theme Academic Quality Assurance – Curriculum and Assessment including a commendation for

the "thorough implementation of Electronic Course Profiles to improve the curriculum information available to students" (AUQA, 2009, p36).
To explore the development of information and communication technology skills in the transitional curriculum, two programs were selected to provide a diverse perspective, the Bachelor of Science (BSc) and the Bachelor of Education (BEd) (Primary). The BEd (Primary) is one of the newest programs at the university of Queensland and students undertaking this program move through first year as a cohort studying the same four courses. The Bachelor of Science is one of the eldest programs on offer at the University of Queensland and offers flexibility with nineteen different majors and twenty-six core first year courses on offer.

The curriculum for each core first year course (four first semester course in the BEd(primary) and twenty-six core first year courses in the BSc) were examined. The mappings of learning objectives and graduate outcomes were used to examine the interpretation and implementation of the graduate attribute: B4: *the ability to engage effectively and appropriately with information and communication technologies, in transitional courses.*

Results

Within both programs there is a great diversity in the objectives and mapping to graduate attributes. Course objectives range in quantity (from three to twenty-two) and knowledge forms. The courses reference the entire range of forms of knowledge classified by Johnston (Gilbert et al., 2004):

- Abstract knowledge: such as "Describe the features of the planet's major ecosystems"
- Abstract procedural knowledge skills: such as "calculate the limits of sequences and series, and use them to approximate functions;"
- Action knowledge: such as "neatly wire-up and operate simple digital circuits, and use the LogiSim software application to draw and simulate digital circuits"
- Tacit or habitual knowledge: such as "use collaborative digital technologies for discussion, group study and communication"
- Cultural understanding: such as "Be familiar with the contexts of research within UQ, and in particular, the various research activities that take place within the Faculty's schools and research centres."
- Embedded knowledge: such as "Demonstrate practical competencies in a basic set of laboratory techniques."

The mapping of these objectives to graduate attributes also varies significantly. In EDUC1704 at least five of the six outcomes are mapped to each graduate attribute, while objectives in PSYC1040 are mapped to only six of the seventeen attributes. Figure 1 provides a comparison between the ICT attribute and E5: *A knowledge of other cultures and times and an appreciation of cultural diversity*, indicating a difference in both the number of subjects and objectives mapping to different attributes.

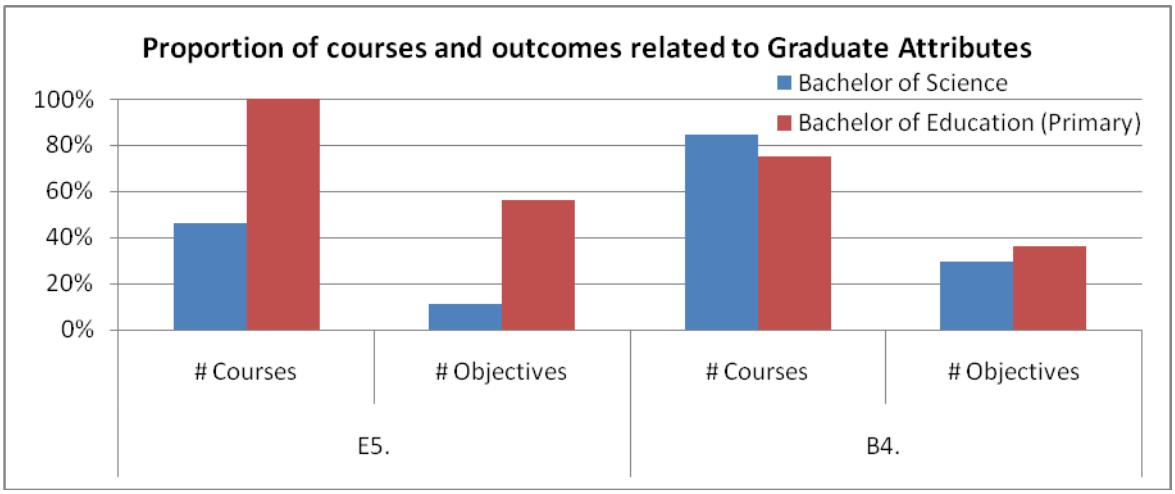

Figure 1: Proportion of learning outcomes mapped to Graduate attribute "B4. The ability to engage effectively and appropriately with information and communication technologies." and "E5. A knowledge of other cultures and times and an appreciation of cultural diversity."

Of the objectives specified and mapped to the ICT graduate attribute 27% (17 of 209) explicitly mentioned either technology, or a form of technology, with only 11% (1 of 9) in the BEd (primary). Aspects of engagement with ICTs were derived from the mapped outcomes as shown in Table 1. 29% (18 of 62) of BSc course objectives and 78% (7 of 9) BEd course objectives did not have an identified aspect of the ICTs attribute.

Table 1: Aspects of Information and communication technology identified in learning objectives as a proportion of all objectives mapped to the ICT Graduate attribute B4.

Aspect of Information and Communication Technology	Bachelor of Science	Bachelor of Education (Primary)
Communicate	15%	0%
Collaborate Team / Group work	5%	0%
Present & Report	11%	11%
Research, search	3%	0%
Analyse	10%	11%
Use a Laboratory	11%	0%
Programming Practice	11%	0%
Programming Theory	18%	0%
Organise	2%	0%
Model	6%	0%
Evaluate digital resources	2%	0%
Not identified	29%	89%

To explore the implications of course objectives not mapped to engaging with ICTs, mathematics courses in the BSc were examined as examples of contrasting mappings. Closer examination of specific mappings shows apparently similar objectives both mapped and not mapped to the ICT attribute. MATH1052 has every objective mapped to the ICT attribute while MATH1050 has no objectives mapped to this attribute. MATH1051 and MATH1601 have one objective mapped to this attribute. All objectives relating to Matlab (a mathematics software tool and modelling language) mapped. Abstract knowledge objectives (for example: *calculate the limits of sequences and series, and use them to approximate functions, find the maxima and minima of functions of two variables* and *calculate the solution to inequalities and express them graphically*) were mapped inconsistently. Only MATH1061 identified communication (*communicate clearly a logical sequence of reasoning using appropriate mathematical notation and language*) and collaboration (*interact effectively with others in order to work towards a common goal, by discussing mathematical problems)* objectives, neither of which were mapped to the ICT attribute.

Discussion

Throughout these courses, developing abilities in using ICTS include developing abilities in communication, collaboration and group work, presenting information, research, analysis, utilising laboratory technologies, programming theory and practice, information management, data modelling and information literacy. This breadth of aspects is not comprehensive. Aspects of *information literacy and effective engagement with ICTs* are arguably missing. For example, ICT skills including tactical knowledge of the genre and etiquette of digital communication in the growing range of forms available are absent from the curriculum documents. While a comprehensive approach to developing graduate ICT skills is not expected in transitional subjects, the diversity of implementation in Table 1 was surprising. The low proportion of objectives mapped to any particular sub-group of aspects indicates that a variety of substantially different perspectives exist in regards to the development of students' technology related abilities. The variety of interpretations represented by the mapping of learning outcomes to the ICT attribute may represent an extremely flexible yet valid implementation for developing ICT abilities across diverse subjects. However this variety may indicate a lack of purpose in developing students' ICT abilities.

These curriculum documents aim to communicate to students, staff and the general public the learning objectives of and attributes gained from university study. The lack of explicit references to technology raises questions as to the level in which the development of ICT abilities is embedded in first year courses. Inconsistencies within and between subjects with regards to similar objectives, suggest a contrasting interpretation of ICT abilities undermining purposes for the graduate attribute. As students progress through their university studies, these conflicting messages regarding the skills they are developing may affect both the development of ability regarding ICTs and students' capacity to effectively communicate their capabilities.

The conflicting evidence of the curriculum mappings of the ICT attribute may not be unique to conceptual understandings of ICT. "Australian universities' endeavours to describe generic attributes of graduates, continues to be characterised by a plurality of viewpoints, and to lack a clear theoretical or conceptual base" (Barrie p.1, 2004). Similarly large variation of implementation is suggested in figure 1 for another attribute. The lack of clarity in implementing the ICT attributes may be an artefact of the lack of clarity for graduate attributes in general. The inconsistency observed with regards to ICT may be an effect of systematic issues with the curriculum approach embedded in the eCPs. The variety of modes and interpretations of objectives and mappings present both advantages and challenges in the curriculum specification.

Conclusion

Information technology, while providing benefits, has significant costs for both institutions and individuals. Maintaining currency with the rapid changes in educational and professional uses of technology takes a significant commitment which is rarely recognised in academic workloads. Institutional costs for information technology are significant in 2009 computing supplies and services and telecommunication expenses exceeded $23million for the University of Queensland (UQ, 2009). A challenge for institutions is ensuring these investments provide benefits for student learning. The economic and social focus on new technologies and the costs involved (both institutional and individual) in providing and maintaining currency with technology infer ICT curriculum is a strategic issue institutions should prioritise.

"The curriculum is a core strategic issue, which must be clearly articulated and valued as a cornerstone of the university's contribution to education and society." (Johnston, P2, 2009) The evidence in this study supports the view that graduate attributes lack consistency of interpretation. The inconsistency observed with regards to ICT may be an effect of systematic issues with the graduate attribute approach to curriculum; however the specifics of the data observed indicates a lack of clarity regarding the specific ICT abilities that universities should be developing in their students. This lack of clarity begs the question of whether there are valuable skills and understandings regarding information and communications technologies all our graduates need and whether we are developing these attributes.

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