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Task profiling: A task-based approach to measuring the integration of ICT in the classroom

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Abstract

The measurement of ICT (information and communication technology) integration is emerging as an area of research interest with such systems as Education Queensland including it in their recently released list of research priorities. Studies to trial differing integration measurement instruments have taken place within Australia in the last few years, particularly Western Australia (Trinidad, Clarkson, & Newhouse, 2004; Trinidad, Newhouse & Clarkson, 2005), Tasmania (Fitzallen 2005) and Queensland (Finger, Proctor, & Watson, 2005). This paper will add to these investigations by describing an alternate and original methodological approach which was trialled in a small-scale pilot study conducted jointly by Queensland Catholic Education Commission (QCEC) and the Centre of Learning Innovation, Queensland University of Technology (QUT) in late 2005. The methodology described is based on tasks which, through a process of profiling, can be seen to be artefacts which embody the internal and external factors enabling and constraining ICT integration.

The measurement of the integration of information and communication technology (ICT) in the curriculum has come to the attention of educational systems and researchers within Australia. This paper will describe an original methodology for measurement of ICT integration trialled in a pilot study in late 2005.

The key difference between the methodology described in this paper and that of extant studies lies in its focus on the tasks completed by students, with a task being defined as any purposeful learning experience, rather than on the classroom teacher. Tasks – or what students actually do – are regarded here as artefacts which embody the technical and human factors which enable and constrain ICT integration in a school setting. A task may be a cumulative set of activities, major or minor projects, problem-solving activities, reporting of an event such as a field trip, participation in an online curriculum project or webquest or preparatory skill-building activities. The use of ICT can take any form or any role from development to presentation, from simulation and hypothesis to communication. The act of mapping the dimensions of a task is here called profiling with the resultant measures referred to as the task profile(s). The process of profiling changes the ‘target’ from a vulnerable professional to a neutral object, that is, from the first to the third person perspective of being about ‘me’ (the teacher) to being about an ‘it’ (the task).

Corollary to tasks’ being central to the measurement of ICT integration is the acceptance that they cannot be isolated from their environment. This is consonant with those definitions of curriculum which describe dynamic interactions between teacher, student, content and learning environment. Computer-mediated learning environments add the potent notion that ‘technological change is not additive; it is ecological. A new technology does not merely add something; it changes everything’

(Postman, 1995) and can therefore be seen to radically affect learning environments. It is simplistic to suggest that there is only one interaction within this environment or that only one actor, usually the teacher, is the most reliable informant. Asking a teacher what use is made of ICT in a classroom or an administrator about school use would undoubtedly generate a different set of responses to asking the students about their experiences. When, however, tasks are examined, they reveal, in forensic ways, traces of the whole environment.

The research design of the pilot study included the profiling of tasks through teacher interviews, a student survey (after Hakkarainen et al., 2000), a student focus group, an administration focus group, classroom observations and a school audit. While this paper will focus on the process of profiling, it will also outline the school auditing process which allowed triangulation of findings from the profiles and enabled a contextualisation of the tasks into the school environment. This paper will begin by briefly defining ICT integration before providing details of auditing and profiling.

Defining ICT integration

The problematic defining of the term 'ICT integration' has been considered elsewhere (see, for example, Fluck, 2003; Lloyd, 2005) but it can be emphatically stated that it is not equivalent to use but, instead, implies a more complex phenomenon (see Downes et al., 2002; Trinidad, Clarkson, & Newhouse, 2004). Our working understanding of ICT integration was premised on the following notions:

1. Integration is a process rather than an endpoint (Trinidad, Clarkson, & Newhouse, 2004; Trinidad, Newhouse & Clarkson, 2005);
2. ICT integration is where the use of ICT becomes critical to the support of the learning environment (Reimann & Goodyear, 2004; Trinidad, Clarkson, & Newhouse, 2004); and,
3. As integration implies a seamless combining of elements into a complex but harmonious whole, ICT integration is the degree to which ICT 'vanishes into the background' of the classroom (Fluck, 2003).

The methodology of the pilot study was based on three concomitant critical operational premises. These are that ICT integration:

1. has multiple dimensions;
2. cannot be seen in isolation, that is, outside the technical infrastructure and human capacity of the school; and,
3. can be seen in the tasks set by teachers.

The first of these premises was enacted through the design of our task profile. The dimensions adopted were (a) curricular integration, (b) temporal integration, (c) spatial integration, and (d) pedagogical integration. The second premise relating to the extended environment was operationalised through a school audit (after Milton, 2003) which considered the school's (a) connectivity, (b) content and (c) capacity. Both dimensions and environmental factors will be defined later in this paper.

The third – and most critical - premise relates to the centrality of the task to the research design. Teachers (selected by the school in the pilot study) were asked to present 3-4 ICT related tasks their students had completed and to discuss them, in interview, using a prepared profile based on the identified dimensions. Profiling provided the main data source for the study and changed the nature of interaction between the researchers and the subject from one where teachers felt vulnerable to one where they were engaged as equal discussants. Teachers interviewed saw the profiling process as a positive professional development experience.

By asking for 3-4 tasks rather than asking holistically about classroom use of ICT, we were able to 'drill down' into the everyday activities which represent integration, in both its semantic sense and in accord with Fluck's (2003) defining of integration as being part of the background. This was

interesting as we were shown both webquests and the daily spelling lists, students' use of learning objects and journal entries (which, in one instance, were made using a discussion board). There was an immediate richness and depth in asking about and profiling tasks.

The following sections of this paper will deal, in turn, with auditing and profiling. It should be noted that all measures were made using continua specially designed for the pilot study with subjects' responses converted to ordinal equivalents for later comparative analysis.

Auditing

The environmental factors being audited were firstly, but not most importantly, the school's technical infrastructure and access. *Connectivity* was our catch-all term to describe the school's hardware, peripherals and infrastructure and to consider such concerns as the (a) speed and reliability of the school network, (b) student: computer ratios, and (c) distribution of computers and peripherals through the school. Connectivity, using data from interviews and observation, was rated as being either inadequate, adequate, effective or exemplary in terms of its meeting current needs and in allowing for potential growth or change. It could be measured against published benchmarks and policy guidelines but here was more measured in terms of their allowing the school to meet its curricular goals.

The second factor, *content*, was software including learning object repositories and communication media such as email and discussion forums. We accepted that content 'cannot be considered separately from educational purpose, teaching strategies and networked classrooms' (Milton, 2003, p. 4) but believed it should be measured independently to show its interrelationship with other factors. The school's ICT content was rated as inadequate, adequate, effective or exemplary with absent, ad hoc, effective or sustained grounding in educational planning. Software applications used in classrooms were noted for descriptive and comparative purposes. The direct data sources were interviews and observation while indirect evidence emerged from task profiles and the student surveys.

The third – and most complex – factor was *capacity* which was defined by Milton (2003) as the attitudes, knowledge and skills required for the effective use of ICT as a tool for learning. Capacity was rated directly as low, medium, high or exemplary while capacity support was rated as absent, ad hoc, effective or sustained. Other measures related to capacity trialled in the pilot study, but outside the scope of this paper, were:

- (a) the perception of the level of ICT adoption (after Trinidad, Clarkson, & Newhouse, 2004);
- (b) attitudinal integration (Ham et al., 2002); and,
- (c) school readiness (BECTA, 2003).

What emerged from the findings of the study was the previously ignored notion of student capacity. This measure, evident through the whole school survey and selected student focus groups, provided corroboration of our findings and general conclusions.

The data sources for the measures of capacity included direct questioning in teacher interviews and the administration focus group, student survey responses, findings from task profiles particularly those measuring pedagogical integration, and researcher observations. Additional sources were the open-ended comments of students and informal conversations with teachers.

Profiling

Tasks were profiled against their integration dimensions. The intention was to build class profiles, and, in turn, a school profile from the task profiles collected. As noted, we adopted the dimensions of ICT integration identified by Ham et al. (2002) in a study for the New Zealand Ministry of Education. These were (a) curricular integration, (b) temporal integration, (c) spatial integration, and (d) pedagogical integration. A further dimension, attitudinal integration, appeared in the original list but was deemed to be more appropriately measured within the investigation of *capacity*. We decided,

also, to split pedagogical integration into two components – with the first related to teacher philosophy and the second related to learner attributes. We also devised, and this is critical to the pilot study and the methodology described in this paper, a metric for measuring each dimension. These, as noted, took the form of continua with appropriately scaled verbal descriptors.

The adopted dimensions had originally been described with the leading phrase ‘measures the extent to which’ although no measures had been offered. In developing the continua for the task profile, verbal descriptors (after Reeves, 1997) were added to facilitate mapping during an interview. These ratings were self-selected by the teachers and were accompanied, in interview, with an explanation which validated their placement.

The following section will describe each of the integration dimensions and their continua. The integration measures were deemed to be effective instruments, particularly in their ease of use by teachers during the interviews and the reliability of their resultant findings. The assumptions made, in regard to the task profiles were validated and would, therefore, not need revision in future iterations of the study. The textual descriptors were similarly meaningful and very little familiarisation was required by teachers completing the profiles. As noted, ordinal equivalents (0-10) were given to the continua which allowed quantitative analysis and comparative mapping of dimensions. This will be formalised through an amendment of survey instruments.

- **Curricular integration**

Curricular integration measures the extent to which, and ways in which, an ICT task relates directly to appropriate curriculum goals, and to the same or complementary *curriculum content or skills* as other learning activities in a given unit or sequence of lessons. The ratings are presented as a continuum in Figure 1.



Figure 1: Curriculum integration continuum

The curricular integration continuum marks the increase in degree of match to a published syllabus goal or the ICT Literacy Strands (MCEETYA, 2005). At *exact – specific referent* the teacher may point to a specific syllabus/work program outcome and explain how ICT was used to meet this goal. They may also articulate a clear connection to other student activities. A *complementary* activity is one which may not directly have curriculum application but be supportive in building skills or dispositions e.g. critical literacy, design of digital texts, participation in online communities.

- **Temporal integration**

Temporal integration is the extent to which, and ways in which, a given ICT task relates directly to other prior, concurrent or subsequent learning activities occurring in the classroom. The ratings are presented as a continuum in Figure 2.



Figure 2: Temporal integration continuum

The temporal integration continuum marks the increase in degree of management of task so that ICT is synchronous with other learning activities. It is generally related to mid- to long-term planning, organisation and accessibility and a lower degree of temporal integration is expected in primary

classrooms where rotations/rosters are used. This is not, however, seen as a deficiency or a lower degree of integration. The temporal integration continuum was used as a self-reporting measure in teacher interviews.

- **Spatial integration**

Spatial integration is the extent to which the use of computers or ICT is separated in place or location from other learning activities in a unit of work. The ratings are presented as a continuum in Figure 3.



Figure 3: Spatial integration continuum

- **Pedagogical integration**

Pedagogical integration is the extent to which the choice of particular ICT, and the ways in which they are used in classes, are consistent with and between the pedagogical philosophies, orientations and intentions of the teacher, and the learning styles, abilities and motivations of the students. The decision was made to represent pedagogical integration two interdependent continua presented (see Figures 4 and 5).

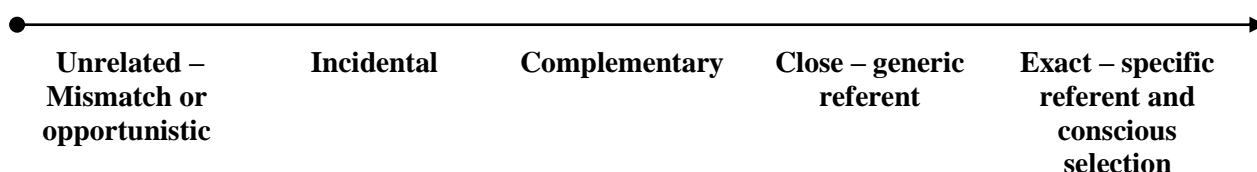


Figure 4: Pedagogical integration continuum (teacher philosophy)

This measure shows an increase in degree of articulation of philosophy into outcome. While teachers may be able to purposefully control the connectivity and content for their tasks, what takes place is more likely to be a pragmatic response to circumstance rather than teacher planning or decision-making.

The second component of pedagogical integration is a measure of learner attributes. In this measure (see Figure 5), there is an increase in degree of articulation of student attributes into outcome and teachers may consciously use software/processes antithetical to philosophy to achieve outcome. This item might also be concerned with adaptive or assistive technologies and accessibility options.



Figure 5: Pedagogical integration continuum (learner attributes)

If we accept that pedagogy is a praxis, where theory (here philosophy) is informed and reflexively affected by practice, and where practice informs theory, it is easy to see these dimensions as discrete but interdependent. The differences which emerged in the pilot study validated the methodological decision to split the pedagogical integration measure into two separate dimensions. Teachers in interview had little difficulty in articulating the differences between these dimensions.

Mapping a school profile

The simple equation was that a number of task profiles would make a class profile which, in turn, would provide a school profile. The pilot study showed that deriving class profiles was not necessary and that task profiles, if representatively selected would provide a school profile. The ICT integration mapping from the school in our pilot study is shown in Table 1 and Figure 6.

Table 1

School profile for pilot school

Integration dimension	Max	Min	Mean	SD	Text descriptor
Curricular	9.0	4.7	6.71	1.95	close - generic referent
Temporal	9.0	2.8	6.51	1.59	series -structured
Spatial	9.0	3.9	6.99	1.72	series - structured
Pedagogical (teacher philosophy)	9.0	4.8	7.83	1.23	close – generic referent
Pedagogical (learner attributes)	9.0	4.8	7.53	1.22	close – generic referent

These statistics can also be mapped into a figurative diagram making use of the profiling continua. The mapping for the pilot school in this study is shown in Figure 6.



Figure 6: School profile - mapping of task continua

It is important to note that continua dimensions are not causally linked. However, a mapping with all indicators at the far left-hand of each of the continua would be considered problematic viz. unrelated curricular integration, random temporal and spatial integration, unrelated or mismatched teacher philosophy and learner attributes. A mixed mapping is expected from the centre to the right-hand side of the continuum as some indicators are out of the control of the classroom teacher. A careful reading of the continua should provide feedback to schools and more broadly to systems about such issues as scheduling and resource access.

The particular strength of the pilot study school was in teacher philosophy (close - generic referent). Those interviewed saw the benefits of integrating ICT rather than treating it as peripheral to student learning. The pedagogical dimension relating to learner attributes (close- generic referent) indicated that teachers were comfortable in making adaptations to meet the needs of their students.

The audit and profile together provided a comprehensive report on the school's integration of ICT. As well as providing a snapshot of current practice, it also gave guidance on how the school might proceed towards more transformative practice. Areas of need in teacher professional development could be noted or the need for changes to technical infrastructure could also be identified. The following, and final, section of this paper is concerned with evaluating the methodology of the pilot study.

Evaluating the method

The study generally met its intended aims and purposes, the focus on tasks appeared to be successful and the instruments we designed produced useful and meaningful data. There was strong and sufficient triangulation between the instruments to give validity to the conclusions drawn. The assumptions made in regard to the research environment have been validated and our complex defining of ICT integration has been confirmed. The decision to present 3-4 tasks allowed the profiling of a range of activities from projects to simpler or more formative activities and the importance of the school audit has been confirmed in describing the complexity of integration, although it is not yet clear how these can be quantitatively linked.

Because the pilot was conducted in one school, the study was not able to establish benchmarks or generate a list of expectations, for example, in the number or range of activities students listed in open-ended responses. Similarly, as this school was a primary school, no benchmarks could be set for secondary settings.

What this paper has presented is another way of looking at an emergent research question. It is self-evident to point out that what you see is determined by your viewpoint. If you shift, here metaphorically from the teacher to the task, a whole different set of understandings become apparent. Just as one drop of rain water can reveal the environmental health of the planet, looking at student tasks can tell you about the integration of ICT in a school. What is absent tells you as much as what is there. If we want ICT to be a seamless but integral part of schooling, then we must begin to look for the raindrops and to learn how to analyse them to inform us about the whole environment.

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