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Measuring Learning with ICTs: An external evaluation of Education Queensland's ICT Curriculum Integration Performance Measurement Instrument

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Abstract

From a review of national and international methodologies for describing and measuring ICT integration, there was found to be a lack of substantial history and development with most studies undertaken since 1998. Moreover, most studies have focussed on input indicators such as student to computer ratios, expenditure on ICTs, and the training and professional development of teachers. Within a context of emerging large scale investigations (e.g. SITES, EnGauge and Becta) there have been accompanying pressures for the development of methodologies for measuring ICT use and student outcomes at classroom, school and system levels. This paper provides a summary of the methodology used to evaluate Education Queensland's *ICT Curriculum Integration Performance Measurement Instrument.* The evaluation involved three major data sources - statistical analysis of the data collected from 929 Education Queensland teachers in 38 schools who used the Instrument in 2003; a peer review process; and school-based teacher interviews involving 42 teachers from 6 selected Queensland schools. The resulting recommendations derived from the evaluation informed the refinement of the Instrument which is now called *Learning with ICTs: Measuring ICT Use in the Curriculum.* This paper also summarises the recommendations and significant features of the Instrument.

Introduction

As indicated elsewhere (Cuttance, 2001; Ainley, Banks and Fleming, 2002; Becta, 2003; Proctor, Watson and Finger, 2003; Finger, Proctor and Watson, 2004; Becta, 2005), there has been the emergence of an important trend toward the development of methodologies to measure Information and Communication Technologies (ICTs) curriculum integration in schools. School systems internationally (see, for example, Kommers, 2000; DfES, 2002; ISTE, 2003; Becta, 2005) as well as throughout Australia (see Finger and Trinidad, 2002; MCEETYA ICTs in Schools Taskforce, 2003; Education Queensland, 2004) demonstrate a considerable and imposing range of ICTs initiatives. Significant investments in ICTs infrastructure and resources have been made by those systems and this has been accompanied by attempts to measure the impact of ICTs on teaching and learning. While attention has been drawn to measuring ICT curriculum integration, in *A Review of the research literature relating to ICT and attainment,* Cox and Abbott (2004) cautioned that:

> *In some studies there has been a mismatch between the methods used to measure anticipated gains and the nature of the learning which is promoted by the use of different ICT environments. Researchers have sometimes measured the 'wrong' things, looking for improvements in traditional processes and knowledge instead of new reasoning and new knowledge which might emerge from the ICT use. (Cox and Abbott, 2004, p. 8)*

That review by Cox and Abbott (2004) and an ICT Pedagogy report (Cox et al., 2004) carried out simultaneously, resulted in the production of an extensive set of references and bibliography relating to ICTs and attainment and ICT pedagogy. Similarly, in a cross-national study of ICTs in school education, Fluck (2003a) proposed that there are three identifiable stages of development of ICT use in schools, moving from Phase 1, an introductory phase where students in schools first use ICTs and is characterised by ICTs being a subject choice, to Phase 2, which is an integrative phase where ICTs are used to enhance teaching and learning in traditional curriculum areas, to Phase 3, which is a

transformative phase where the curriculum is transformed through the use of ICTs. Fluck, in asking questions about the tensions posed by ICT integration and transformation, highlights the challenges for conceptualising ICT use in schools and the subsequent difficulties this creates for measuring ICT use. Fluck (2003b) refers to the instruments developed in the USA for measuring ICT integration (Jones, Valdez, Nowakowski & Rasmussen, 1994; Lemke & Coughlin, 1998; Edmin.com, 1998; National Study of School Evaluation, 1998; Bender, 2000). In addition, large scale investigations such as the *Second Information Technology in Education Study (SITES)* (IEA, 2003), enGauge (NCREL, 2003), and Becta (2005) are further evidence of the emphasis now being given to developing methodologies to measure student use of ICTs to improve learning outcomes.

Those attempts to develop and employ methodologies to measure the impact of ICTs on learning parallel the doubts raised by Cuban (1986; 2000; 2001) that are reflected in the titles of some of his publications, such as*: So much high-tech money invested, so little use and change in practice: how come?* (2000) and *Oversold and underused: reforming schools through technology, 1980-2000* (2001). Although contested to some extent by Becker and Ravitz (2001) in their paper,*Computer use by teachers: are Cuban's predictions correct?* , presented at the American Education Research Association's Annual Meeting, similar questions have been raised in Australia by Bigum and Rowan (2004) in their theorising about the myths and muddles of computers and computer based technologies (CCTs) when they challenge the assumption that CCTs will improve teaching and learning.

Within that context, this paper forms part of an Australian Association for Research in Education 2005 symposium focusing on *Measuring the integration of ICT in the classroom*. This paper provides a summary of the methodology used to evaluate Education Queensland's *ICT Curriculum Integration Performance Measurement Instrument*, referred to in this paper as the 'Instrument'. The evaluation, summarised in this paper, involved three major data sources - statistical analysis of the data collected from 929 Education Queensland teachers in 38 schools who used the Instrument in 2003; a peer review process; and school-based teacher interviews involving 42 teachers from 6 selected Queensland schools. The resulting recommendations derived from the evaluation informed the refinement of the Instrument which is now called *Learning with ICTs: Measuring ICT Use in the Curriculum.* This paper also summarises the recommendations and significant features of the Instrument as they were developed from and relate specifically to current national and international directions for the measurement of ICT use in schools.

The Development of an *ICT Curriculum Integration Performance Measurement Instrument*
Education Queensland's *ICTs for Learning* strategy (Education Queensland, 2004) identified six key ICT drivers which "reflect the necessary conditions for successful learning with ICTs" (Education Queensland, 2004, p. 12). Those key ICT drivers were Learning, teaching and the curriculum;

Learning and development; ICT infrastructure; Connectivity; ICT support; and Innovation. An *ICTs for Learning School Census* annually requires all schools to measure their progress against foundation and preferred futures benchmarks for each of the six drivers. Collection of data related to the driver learning, teaching and the curriculum provided challenges for Education Queensland and, prior to 2003, Education Queensland had limited processes for obtaining data related to actual student use of ICTs. Data had been collected on the effectiveness of ICT integration through student, staff and parent satisfaction surveys which contained several items relating to student access to computers, and confidence in using them. Data sought through the *ICTs for Learning School Census 2002* included the numbers of subjects where the school planning reflected the use of ICTs for teaching and learning within learning area clusters; level of teacher use of ICTs for curriculum planning, assessment, reporting, and online content and services; level of student use of ICT for student learning, assessment, and online content and services; levels of integration of ICT by year level: strategies to ensure equitable access and participation for students; and role of ICT literacy within the teaching of literacies.

In order to advance the collection of information relating to the key ICT driver of learning, teaching and the curriculum, Education Queensland initiated the development of an *ICT Curriculum Integration Performance Measurement Instrument*. This initiative was undertaken by a team from Griffith University (Jamieson-Proctor, Watson, and Finger, 2003) and required the presentation of a report which reviewed recent literature with respect to ICT curriculum integration, examined national and international methodologies for describing and measuring ICT curriculum integration, and identified issues associated with measuring the quantity and/or quality of ICT curriculum integration in a school context. The report evaluated Education Queensland's current methodology of describing and measuring ICT curriculum integration, and provided recommendations for the development of Education Queensland's *ICT Curriculum Integration Performance Measurement Instrument.*

Summaries of sections of that report (Jamieson-Proctor, Watson, and Finger, 2003) have been published and presented elsewhere (Proctor et al., 2003; Finger et al., 2003; Watson et al., 2004). Importantly, the recommendations for the development of the Instrument were that:

1. The development of Education Queensland's *ICT Curriculum Integration Performance Measurement Instrument* needs to be guided by sophisticated understandings of ***describing*** ICT curriculum integration in the Key ICT driver of Learning, Teaching and the Curriculum.

2. The theoretical underpinnings and the framework of Productive Pedagogies are utilised to guide the construction of Education Queensland's ICT Curriculum Integration Performance Measurement Instrument.

3. The *ICT Curriculum Integration Performance Measurement Instrument* should provide a critical role in assisting in the strategic improvement of ICT integration in schools, district and at the systemic

level through the collation and presentation of data to provide 'current use' and 'preferred use' positions. The Instrument should enable the generation of class, school, district and system reports.

4. Support materials for school personnel involved in the use of the instrument are produced to enhance their capacity to assess the level of ICT integration in their classrooms and schools. To achieve this, we recommend the development of support materials to accompany the instrument which enable training *prior* to the administration of the instrument as well as advice to assist *during* the process of completing the instrument.

5. Ongoing development of the *ICT Curriculum Integration Performance Measurement Instrument* is undertaken to address the challenges presented by the dynamic changes in ICTs.

6. Close attention needs to be paid to the recommendations in *Raising the Standards* (DEST, 2002). While this framework applies to the development of teacher standards of ICT competency, it also has relevance for an *ICT Curriculum Integration Performance Measurement Instrument.* Particularly relevant concepts include:

*   a basis of particular aspects of successful professional performance involving the use of ICT;

*   a comprehensive set of context rich ICT exemplars be an integral part;

*   enabling both performance management and professional development;

*   be generic in nature i.e. non-subject and non-level specific;

*   support different groups of educators; e.g. beginning teachers, beginning users of ICT, accomplished users of ICT, educational leaders, teacher educators;

*   emphasise the specific relevant dimension of ICT use;

*   take account of those dimensions of ICT competence and use that may transform education;

*   articulate the need to embrace change but also adequately reflect the concept of leading and shaping change in response to new technology and new educational ideologies;

*   ownership of the process for those whose performance is being measured; and

*   take account of other initiatives at the national level.

Following the endorsement of that report, the recommendations informed the development of the Instrument, with literature relating to ICT curriculum integration, and with pedagogical and curriculum frameworks. The resulting Instrument, constructed as an online collation tool, contained two parts. – The first part contained background information about the teacher, and the second comprised 45 items, commencing with the item stem *In my class, students use ICTs to* …. Each item was accompanied by practical examples to assist teachers to interpret the item. In 2003, schools were provided with the option of completing this Instrument. The data from a total of 929 teachers from 38 schools were supplied to Education Queensland.

Evaluation of Education Queensland's *ICT Curriculum Integration Performance Measurement Instrument*

In 2004, tenders were called to undertake a formal evaluation of the Instrument under the auspices of the Institute of Educational Research, Policy and Evaluation (IERPE) on behalf of Education Queensland. The evaluation required an independent, external evaluation involving a statistical analysis of the 2003 *ICTs for Learning School Census* data obtained with the Instrument, a peer review process, and teacher interviews about the Instrument undertaken in a cross-sectional representation of urban, regional and rural; primary and secondary; high, medium and low ICT integration schools. An outcome of the evaluation was to provide recommendations for improvement to the Instrument, and following endorsement of those recommendations, the development of an Instrument to be used by all Queensland government schools annually to measure ICT integration.

Summary Report on the Statistical Analysis

The 2003 Census Data from 38 schools and 929 teachers were received from Education Queensland. The previous version of the Instrument used by those schools and teachers had been theorised around four dimensions of ICT use derived from *Good Practice and Leadership in the Use of ICT in Schools* (DETYA, 2000) and *The Queensland School Reform Longitudinal Study* (QSRLS) (Lingard et al., 2001). Those four dimensions of ICT use in schools were identified as overlapping dimensions whereby ICTs are used as a tool for use across and within the curriculum, and a reform component for student learning and reorganisation of schooling. The Productive Pedagogies derived from the QSRLS (Lingard et al., 2001) utilised a pedagogical framework which referred to classroom practices in terms of intellectual quality, connectedness, supportive classroom environment, and recognition of difference.

In the evaluation, Confirmatory Factor Analysis (CFA) as recommended by Burnett and Dart (1997) was performed. In summary, the analysis produced a simple and conceptually sensible 20-item, two-factor solution with highly acceptable goodness of fit indices (exceeding the 0.90 threshold of acceptance). The first factor comprised 14 items that defined ICT as *a tool for the development of ICT-related skills and the enhancement of learning outcomes*. The second factor comprised 6 items that defined ICT as *an integral component of reforms that change what students learn and how school is structured and organised*. Based on these statistical analyses, the evaluation recommended that the Instrument be modified to comply with this 20-item model.

Summary Report on the Peer Review Process

A 15-member expert Peer Review Team was established to reflect a diverse range of interests, educational contexts, and organisations to review the Instrument. The task of the Peer Review Team

was to provide expert feedback, provide independent evaluations of the Instrument and its underpinning theoretical framework, and inform the formulation of recommendations suggesting any possible changes to the Instrument.

The Peer Review process involved 4 phases; namely, (1) the establishment of a Peer Review Team and effective online communication mechanisms for team members, (2) the provision of necessary documentation to team members, (3) the collection of the *Evaluation Proformas* and *Submissions*, and (4) the collation and analysis of those evaluations.

Key Issues

Resulting from the Peer Review Process, key issues were identified. These included the need to define the concept of ICT integration, define terms and clarify the use of language, the challenges of measuring what actually happens in classrooms; especially the limitations of self-reporting, and the subsequent need for additional forms of data collection. An additional key issue related to understanding the Instrument's role in performance measurement and professional development. While the Instrument was primarily designed to measure performance with respect to the quantity and quality of ICT integration in classrooms, a tension was expressed between the complex relationship between performance measurement and teacher professional development.

Considerable feedback and discussion focused on the validity of using Productive Pedagogies and the four dimensions of ICT use outlined earlier in this paper. While the majority of Peers agreed that utilising these was a sound basis to guide the development of the items, especially the desirable focus on ICTs and pedagogy, a strong counter argument was provided by one of the peer Review team members who cautioned that the dimensions should not be seen as ordinal, hierarchical, discrete entities, as they intersect.

Further suggestions included a reduction of the number of items, rewording and improving items and examples to overcome overlap, redundancy and ambiguity, and to be suitable for all educational settings, to improve alignment with Education Queensland's ICT strategies. While the Instrument was designed for Education Queensland, and the Peer Review team was composed of members from other educational jurisdictions, members of the Peer Review team suggested that there should be consideration of the Instrument's applicability to other education systems and settings. Finally, there were some suggestions made relating to the more practical considerations such as addressing technical issues, engaging teachers to understand and complete the Instrument, and to consider the possible overlap of students; e.g. students being taught by more than one teacher.

Commendations

The Peer Review team members commended the Instrument in terms of it having a strong theoretical basis; its taking into account Education Queensland's and broader systemic frameworks; its attempt to define ICT Curriculum Integration; and the included examples to assist teachers in completing the items. They saw the Instrument as being a useful tool for assisting ICT strategic planning in schools and commended the electronic format. The instrument trialing, development and evaluation process was seen as being commendable, and overall, represented a good attempt at a difficult task.

Recommendations

The Peer Review Team recommended that:

• Defining of ICT curriculum integration continues to be clarified, and reconsiderations of the conceptualisation of Dimensions of ICT use and Productive Pedagogies be undertaken;

• The Instrument is seen as one of an array of ICT curriculum integration performance data collection strategies;

• The number of items are reduced;

• Improvements are made to the wording of the items and the quality of the examples;

• Modifications are made to the interface design and the display of results; and

• For completion of the Instrument, strategies are developed for enabling and supporting teachers to engage with the Instrument.

Summary Report on the Teacher Interviews

The teacher interviews were undertaken with 42 teachers from 6 Queensland schools, selected as a cross-sectional representation of urban, regional and rural; primary and secondary; high, medium and low ICT integration schools. The teachers participated in focus group interviews about the Instrument and Collation Tool after using them to reflect upon their own pedagogy with respect to ICT curriculum integration. All focus group interviews were conducted by an external independent consultant. The transcribed interview data were both analysed manually by the researchers for themes as well as being analysed using *Leximancer* a software package for identifying the salient dimensions of discourse by analysing the frequency of use of terms and the spatial proximity between those terms.

The thematic analysis showed that generally the reaction from the teachers to the Instrument was positive and the Instrument was seen as valuable in terms of advancing ICT integration. There was, however, considerable disparity between the generally positive attitudes with respect to the Instrument expressed by participants from the primary school sector, compared with the more negative attitudes from the participants from the secondary school sector. This is reported more comprehensively elsewhere (see Proctor et al., 2005, pp. 44 - 54). Overall, it appeared that the teachers viewed the

Instrument and the focus interviews as a professional development exercise of some merit, as they considered the most powerful attribute of the Instrument to be its ability to define ICT integration through each of the individual items and the accompanying examples. The value of this Instrument as a tool for teacher reflection was the most prevalent and powerfully delivered message *in every interview.*

The relatively large number of items was not a concern noted by these teachers. They also did not indicate that the items were difficult to understand. They did however, commend the examples very highly as providing "new ideas" with one teacher commenting that she read all the examples not just the ones pertaining to her teaching context. An extension of these examples to account for a wider range of teaching contexts was recommended however.

From these focus interviews, it was recommended that:

- Education Queensland undertake some form of professional development for teachers clearly outlining the value of the Instrument and the Collation Tool to individual teachers, schools, districts and the system at large. Teachers will need to fully understand the use to which the collated data will be put at the school, district and system level, in order to overcome their suspicions as to the purpose to which the collated data may be applied.

- As the length of the Instrument was of little concern to the teachers and their primary concern was the ability of the Instrument to provide "new ideas", it was recommended that the examples be enhanced to include as wide a sample as possible to cater for all teaching contexts by linking the Instrument to a range of other materials and resources available on the Education Queensland ICTs for Learning website, developed since the Instrument was created.

- Part A needs clarification for secondary teachers and special education teachers so that they are directed to focus on a particular class, year level, subject or chronological age group.

- The scale (Never to Very Often) may need some clarification, however, how this could be achieved across such a diverse demographic may be difficult to ascertain.

Recommendations for Modifications to the *ICT Curriculum Integration Performance Measurement Instrument*

Based upon a synthesis of the findings of the Statistical Analysis, Peer Review and Teacher Interviews, eight recommendations were made to refine and improve the Instrument further. It was recommended that:

1. The purpose of the Instrument be clarified first and foremost as a measurement instrument that can be used by individual teachers to reflect on their students' *Learning With ICTs,* and from an aggregation of teacher reflections, schools, districts and the system at large can gather data with respect to the quantity and quality of ICT use in classrooms.

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2. The two statistically different dimensions of use for *Learning With ICTs* that were identified through the statistical analysis be adopted. Specifically, these are comprised of (1) items that define ICT as a tool for the development of ICT-related skills and the enhancement of curriculum learning outcomes; and (2) items that define ICT as an integral component of curricular reforms that will change what students learn and how school is structured and organised. In order to reflect this "two-dimensional" orientation it was further recommended that the name of the Instrument be changed to *Learning With ICTs: Measuring ICT Use in the Curriculum*.

3. The number of items be reduced to 20 based on the findings of the statistical analysis and that these items be reworded based on the recommendations of the Peer Review process. The overall meaning of each will be retained so as not to alter the statistical results.

4. The quality of the supporting information be enhanced by linking the Instrument to Education Queensland's existing electronically published examples of practice, such as:

- The *Online Database of ICT Integration Examples* (Education Queensland, 2005a) at http://education.qld.gov.au/tal/curriculum_exchange/index.html;
- *Practical Ideas for Teachers* (Years P-3; Years 4-9; Years 10-12; Girls and ICTs; Indigenous Education and ICTs; Students with Disabilities and ICTs) (Education Queensland, 2005b) at http://education.qld.gov.au/tal/tips/02246.html;
- *The Excellence Showcase* (Education Queensland, 2005c) at http://education.qld.gov.au/itt/learning/success/excellenceshowcase.html;
- *The ICT Teacher Awards for Excellence* (Education Queensland, 2005d) at http://education.qld.gov.au/itt/learning/success/teacherawards.html; and
- *The ICT Innovation Showcase* (Education Queensland, 2005e) at http://education.qld.gov.au/itt/learning/success/showcase.html.

These examples will provide a rich repertoire of ideas, examples, and case studies for teachers to draw upon when using the Instrument. In terms of the two identified factors within the Instrument, the *ICT Teacher Awards for Excellence*, the *Excellence Showcase* and the *ICT Innovation Showcase* provide excellent examples for the dimension specifically related to curricular reforms and the other examples from the online database and practical ideas for teachers provide examples spanning both dimensions of ICT integration identified by the Instrument. Similarly, the Instrument can be linked to other Education Queensland ICT resources, professional development programs, and support, as these are developed to encourage a dynamic, constructivist approach to *Learning With ICTs*. The identification and linking of the rich sources and practical ideas from the online databases to each of the twenty items in the Instrument, is beyond the scope of this project. A model of the suggested approach exists in the *ICT Continua* (Education Queensland, 2005e) at http://education.qld.gov.au/itt/learning/use/tool.html. The examples provided for each of these 4 levels on the Continua are hyperlinked to (1) the Curriculum Exchange online database of examples of ICTs

curriculum integration, and (2) examples of classroom and professional practices at the level identified by the user of the ICT *Continua*. Additional synergies could be obtained by aligning the Continua's four levels of competence, namely Minimum, Developmental, Innovator and Leader with the Instrument. Minimum and Developmental levels could align with Instrument dimension (1) while Innovator and Leader align with dimension (2) as described above. Adoption of this strategy is outside the scope of the modifications involved in this project and future changes would become the responsibility of Education Queensland.

5. The design of the Collation Tool should be altered to include all 20 items on one screen (with scrolling if necessary) in accordance with the suggestions received from the Peer Review process. Coupled with this the questions from both dimensions should be intermingled to minimise the likelihood of individuals providing a global response to either or both Dimensions rather than individually to each item.

6. The concept of displaying the results as a graph should be retained, but two (2) graphs should be displayed, one for each of the dimensions of ICT integration. The explanation of each of the four quadrants of the graphs should also be altered to reflect the individual dimensions that are being reported in each graph.

7. Part A of the Instrument be reviewed with respect to aligning the questions with international benchmark data such as the PISA and TIMMS studies, as per the suggestions from the Peer Review process, teacher interviews and advice from the IERPE Advisory Committee.

8. Education Queensland be advised to develop strategies for enabling and supporting teachers to engage effectively and knowledgeably with the Instrument as per information gathered through this research. In particular, Education Queensland should:

• promote the Instrument as one of an array of ICT curriculum integration performance data collection strategies that can be used to identify the quantity and quality of ICT curriculum integration in Queensland classrooms, and

• develop additional supporting documentation to assist in the implementation and use of the tool and for use in professional development activities.

These strategies should be implemented in a way that also promotes the Instrument as a tool for teacher reflection and professional development.

Further Development of the Instrument

All of the recommendations were presented to the IERPE Advisory Committee and were approved by Education Queensland. Subsequently, the previously called *ICT Curriculum Integration Performance Measurement Instrument* was refined to reflect those recommendations and resulted in a revised instrument called *Learning With ICTs: Measuring ICT Use in the Curriculum*. The revised instrument was designed as an online collation tool, consisting of 2 sections similar to the original *ICT*

Curriculum Integration Performance Measurement Instrument. The substantive change relates to Part B, which now contains 20 items and measures 2 dimensions of ICT use rather than 4.

Conclusion

The evaluation resulted in the further refinement of the Instrument to ensure a statistically and theoretically sound instrument for the measurement of the quantity and quality of *Learning With ICTs* in Education Queensland classrooms, based on sophisticated national and international understanding of the power of ICT use to both *enhance* and *transform* learning. In terms of the Australian Association for Research in Education 2005 symposium focusing on *Measuring the integration of ICT in the classroom,* this paper has provided a summary of one Australian State's attempt to address the important theoretical and practical methodological challenges of measuring student use of ICTs in the curriculum. The conceptualisation, development and evaluation of the Instrument *Learning With ICTs: Measuring ICT Use in the Curriculum* reflects two enabling 'stories' of ICT use, namely:

a. an 'improvement' story, through the formulation of items and examples which define ICT as a tool for the development of ICT-related skills and the enhancement of curriculum learning outcomes; and

b. an 'innovation' story, through the formulation of items and examples which define ICT as an integral component of curricular reforms that will change what students learn and how school is structured and organised.

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