

Measuring the value of educational technologies in schools

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Introduction

Understanding the costs and value of educational technologies in schools is important for school leaders to be able to lead strategic planning processes. This paper provides an overview of the *Measuring the value of educational technologies in schools project*, which is a collaborative international research project investigating ways to measure the value of educational technologies or information and communication technologies (ICT) in schools. Three case studies are being developed in 2007: one in a school in each of Australia, the United States of America (USA) and the United Kingdom (UK). The data for the US and Australian case studies have been collected and the data for the UK case study will be collected in the first week of July 2007.

The case studies involve document analysis of strategic plans, reports and curriculum documents; total cost of ownership analysis; a staff capability survey; and interviews with school education staff and students. The project involves synthesising data to inform data-driven decision-making processes in schools and school districts, and will provide insights into the value of technologies in school education across three countries. An analysis of the research method itself, will enable judgements to be made about the applicability of a structured case study approach for making international comparisons on the value of educational technologies across different countries.

The purpose of the research is not to reproduce what is already happening in each country but to leverage from it and to contribute to it. In each of the participating countries there is interest in ways of collecting and analyzing data about the value of educational technologies because it is anticipated it will

- Enable data-driven decision making by school leaders about deploying educational technologies in schools and school districts;
- Inform education planning processes about the nature and extent of technologies deployments over time;
- Inform accountability requirements to central or regional departments of school education; and
- Inform approaches for strategic planning and improvements in school education that include educational technologies.

The project has been structured as a small project initially but with a view to enable additional partners and schools to join the project over time. It is anticipated that this study will be of immediate benefit to policy-makers and school leaders in the three countries involved but with the potential to be 'scaled up' over time.

Research partners

This research project is taking a collaborative approach involving partners located in Australia, USA and UK.

The Australian partners are:

- University of Canberra
- **Education.au ltd**
- Department of Education and Children's Services (DECS) South Australia.

The partner in the USA is the Consortium for Schools Networking (CoSN). The partners in the UK are:

- The British Educational Communications and Technology Agency (BECTA); and
- The University of Nottingham.

The partners to the project have formed an international reference committee. The role of this committee is to:

- Provide support for the project;
- Provide input and feedback to the respective stages of the project;
- Facilitate in-country work to collect data for the case studies;
- Contribute to the web presence for the project;
- Provide support and advice to the researcher;
- Monitor the progress of the project; and
- Promote the project.

The partners in the research are considering options for future work in 2008, both within the countries of the current partners and in other countries.

Objectives

A key motive for this research is to develop better understandings about the conceptualization and measurement of the value of technologies in school education. The research model is taking into account both 'tangible' and 'intangible' assets. Tangible assets are those items that have traditionally been measured and are usually defined as physical assets owned by an organization or individual which can be seen or touched. Technology tangibles include computer hardware, software, peripherals and bandwidth costs. The worth of such assets is usually presented in quantitative terms. Schools can determine the costs of the purchases of the tangibles from their financial records and can map these costs over time. 'Intangible assets' include 'goodwill' and the social capabilities of employees and strategies such as organizational learning. Related to this type of asset are employees' competencies.

The complex issue of valuation of tangible and intangible technology assets in schools has not been researched in any detail previously, but school leaders must regularly make pedagogical, financial, infrastructure and accountability judgments about the value of technologies in school education.

The objectives of this research then are to:

- i. Investigate, analyze and interpret the nature of the 'tangibles' and 'intangibles' in measuring the value of educational technologies in schools;
- ii. Examine the inter-relationships between teaching and learning with educational technologies, teacher capacity; school infrastructure and financial models to determine the value of technologies in schools;
- iii. Synthesise practices and research from Australia, US and UK schools on issues related to undertaking measurements of cost and value of educational technologies in schools; and
- iv. Investigate research methods and their costs that are appropriate to making international comparisons about the value of educational technologies in schools.

Research method

Measurement presupposes that what is to be measured can be defined. Measuring 'value' means making judgements about the degree to which outcomes statements that include statements of value compare with the evidence that those value statements are being fulfilled. Values are framed in discourse, and are 'in the eye of the beholder'. Hence the value of educational technologies in schools rests in what is articulated as being 'of value'. The concept of 'value' gives rise to questions such as

- Value for whom?
- What value?
- How is the value expressed?
- How do we know if the value has been achieved?

This research is premised on the view that to investigate the value of educational technologies in the schools sector requires an examination of the relationships between teaching and learning with educational technologies and

- the infrastructure required for deploying educational technologies;
- the costs of deploying educational technologies;
- the value placed on the investments in educational technologies in schools; and
- the alignment between the staff capabilities, organizational and cultural arrangements, and the value placed on the technologies.

These inter-relationships render this research complex. To measure linkages between policy and outcome variables, and to assess policy options requires a conceptual framework within which they can serve to assess a current state (Grootaert 1998). The types of data required and the analytical approaches necessary to enable schools to gain meaning from their deployment data requires a multi-dimensional conceptual framework that sits at the intersections of teaching and learning with educational technologies in school education; schools IT infrastructure; organizational development, knowledge creation and finances and asset management.

The research is also premised on the view that the capacity of a school or school district to achieve their value statements can be tracked organizationally through policy statements and strategic planning documents, and synthesized with evidence collected through

- Cost of the investments (eg through Total Cost of Ownership (TCO) reports);
- Teacher self-assessment surveys;
- Interviews;
- Analysis of teacher program plans; and
- The outcomes for the students.

It is argued that the achievement of value statements can be seen in evidence such as clear links between

- What teachers set out to do (as demonstrated in their teaching programs, assessment requirements); and
- The outcomes students achieve.

As such the data for a set of three structured case studies are being collected in 2007: one each in the US, UK and Australia. A 'proof of concept' case study was conducted in Australia in late 2006 to pilot the method in the Australian context before applying it in the US and UK. The purpose of the case studies is to trial the research method; and to establish 'baseline' data from which these schools can then measure their progress. The research model of this project draws upon a model developed by academics at Harvard Business School that measures value of IT in private sector companies (Kaplan & Norton 2006, 2004a, 2004b). This research model has been adapted to the school sector to trial in this project.

Kaplan & Norton point to the importance in the business sector of intangible assets for the success or otherwise of an organization (Kaplan & Norton 2004a). They combine intangible assets into the following groupings: human, information and organizational capital. They use the following definitions.

- Human capital refers to the skills, knowledge, talent of the people in the organization's workforce;
- Information capital refers to the databases, networks and technology infrastructure; and
- Organization capital refers to the organization's culture, leadership, the ability for staff to share information, and how the human capital (ie the people) are aligned with the strategic goals of the organization (Kaplan & Norton 2004a, 2004b).

Kaplan & Norton (2004b) argue that measuring intangible assets is problematic if attempts to do so try to measure the intangible assets on a 'stand alone' basis. They indicate that the value of intangible assets sits within the context and strategic approaches of the organization. As such, measuring the value of intangible assets involves estimating how closely aligned the intangible assets are to the organization's strategic approaches to their work: ie if the intangible assets and the organization's strategic operations are closely aligned then the intangible assets will create value for the organization. They propose an approach to systematically measuring the alignment of an organization's human, information and organizational capital and link these to an organization's strategy and performance in order to determine strategic readiness and the value of these intangible assets to the organization.

Informed by the work of Kaplan and Norton, this research is using a structured case study approach. The case studies are being clearly defined and developed within an agreed conceptual and operational framework with indicators that are applicable in Australia, USA and UK. They are limited in number but with the capacity for aggregation. The research method is based upon achievable data collection requirements (ie either the data is available or data collection will be undertaken at limited cost); and capable of being used to identify gaps in information. It is intended that the case studies will enable easy to understand, holistic perspectives to be developed that draw together the following perspectives:

- value on strategic planning approaches to analyzing the deployment of technologies in schools;
- total cost of ownership of educational technologies in schools; and
- approaches to capacity analysis and capacity building of staff and students.

Data collection

To measure the value of educational technologies in schools then, data are being sought on the relationships between and alignment of

- Teaching and learning with educational technologies;
- Infrastructure;
- Financial models; and
- Asset management.

The following data collection tools are being used:

- Total Cost of Ownership (TCO) surveys;
- EdCAP – an online self-assessment audit tool;
- Documents; and
- Group and individual interviews.

Total Cost of Ownership (TCO) surveys

The TCO model was developed by Gartner Incorporated, based upon assumptions applicable in the corporate sector. The phrase 'total cost of ownership' was originally developed by Gartner to refer to all the costs associated with the use of computer hardware and software including the administrative costs, licence costs, deployment and configuration, hardware and software updates, training and development, maintenance, technical support and any other costs associated with acquiring, deploying, operating, maintaining and upgrading computer systems in organizations (Gartner Incorporated 2007).

Over the past few years, independently of each other, schools in the US, UK and Australia have been investigating how the Gartner TCO model may be applied to their contexts to assist leaders make decisions about educational technologies deployments in schools. Since 1999 the Consortium of School Networks (CoSN) in the USA has been working with schools and school districts to provide advice about undertaking TCOs. The CoSN initiative *Taking TCO to the Classroom* (www.classroomtco.org), has involved CoSN worked with Gartner to build an online TCO tool for schools. Since 2003, 1800 USA schools have been using Gartner TCO tool to assist in their management and decision-making about the cost of deploying educational technologies in schools. Similarly, schools in South Australia have trialled models of data collection consistent with the Gartner TCO approach.

In the UK, schools and agencies have also been investigating models and tools to assist in TCO calculations appropriate to their respective settings. British Educational Communications and Technology Agency (BECTA) has developed an online tool to assist in the gathering of cost-based data called the ICT investment planner (BECTA 2006). This BECTA tool is designed to allow schools to gain an in-depth view of technologies costs over the past three years. The tool shares similarities with the Gartner TCO tool, but the BECTA tool includes not only mechanisms for collecting financial data but also includes a questionnaire for staff to ascertain teachers' perceptions of technology-reliability, access to facilities and services, and an evaluation of the ease of use of the ICT tools for teaching and learning purposes (BECTA 2005).

The respective TCO models have offered schools the capacity to quantify data previously left uncollected and analyzed.

EdCAP – an online skills audit tool

EdCap is online self-assessment survey tool developed by the South Australian Department of Education and Children's Services (DECS) that enables teachers to determine against a set of criteria, their level of capability in integrating educational technologies into their classroom practices. It provides an individual assessment against a continuum of teaching practices that include technologies, and also provides an anonymous assessment compared to others who have completed the survey.

Documents

Any or all of the following types of strategic planning and curriculum, assessment and reporting documents are sought for analysis

- District and/or department plans
- Whole school plans
- Educational technologies plans
- Teachers programs and assessment plans
- Role statements of the educational technologies committee
- Total cost of ownership reports.

Group and individual interviews

The 'in-country' partners provide guidance on which schools are selected to participate in the case studies. The data for the case studies are jointly collected by Associate Professor Kathryn Moyle and one 'in country' person identified within each country by the 'in-country' partner.

The following people are interviewed for the following reasons.

Who	How	Why
District leaders (where applicable)	Individual interview	Member(s) of the leadership team with responsibility for educational technologies across teaching and learning.
Principal or Assistant principal	Individual interview	Member of the school leadership team with responsibility for educational technologies across teaching and learning within the school. If there is not a specific person with that responsibility then it is by default, the principal
The technologies coordinator	Individual interview	Member of the school with both across curriculum and technical leadership responsibilities
Three members of the school's technologies committee	Three individual interviews	Depending on the level of responsibility of the technologies committee – these people may have decision-making roles within the school
The finance officer	Individual interview	Member of the school community who can track the flows of income and costs for ICT
The teacher/librarian	Individual interview	Member in the school community with capacity for 'future watching' but they may also have trouble-shooting responsibilities
6 Teachers:	6 individual interviews	Teachers of the students that are interviewed
16-24 Year 10 or 11 students	Group interviews (3 groups)	Students views of how educational technologies are included in their study

Table One: People interviewed, how they were interviewed and for what reasons

The purpose of the interviews is to gather as rich a set of data as possible: by talking to staff and students and gathering artifacts. The visits have involved

- Liaison with the researchers prior to the data collection visits;
- Provision of access to the documents requested prior to and during the visit;
- Provision of permission for the two researchers to visit the school to interview staff and students; and
- Agreement with informed consent that the interviews be recorded.

The time commitment of the researchers' visits to the schools was two days.

Data analysis

The data for two of the three case studies has been collected and the third will be collected shortly. The following table summaries the nature of the data being collected, its purpose, how the data relates to indicators of value and possible data sources.

Data	Purpose	Indicators of value	Possible data sources
Strategic plans - whole school or district plans - technology plans Teaching programs	To identify the value propositions	Specific value statements	Analysis of school, district and/or state/national policy and planning documents
Transcripts from interviews: - Students talking about their work - Teachers talking about what work they set students	To link value propositions to practice	Actions with evidence	Analysis of transcripts from interviews
Transcripts from interviews		Artefacts	Analysis of transcripts from interviews
Existing TCO analysis	To identify the cost of educational technologies/ICT	Costs incurred with the deployment of technologies	TCO analysis
Existing TCO analysis Existing infrastructure 'maps'		IT infrastructure model in place within the school/district	TCO analysis
EdCap	To examine the organizational readiness to implement the value propositions	Staff capabilities	EdCap data analysis
Transcripts from interviews		Leadership capabilities	Analysis of transcripts from interviews
		Budget approaches	Budget papers & budget scheduling
Transcripts from interviews	To triangulate/verify data	Consistent 'messages' emerging from the data	Interviews

Table Two: Nature of the data to be collected, its purpose, how the data relates to indicators of value and possible data sources

To determine the alignment of and relationships between the components of the conceptual framework, the following indicators and 'gauges of presence' have been identified for assisting in the analysis of data measuring the value of educational technologies in schools. The 'indicators' and 'gauges of presence' are informed by the work of the Australian *Leadership and Learning with ICT* project (Moyle 2006). The indicators are not intended as 'required criteria' for pointing to the relationships between the aforementioned characteristics but rather as indicators of evidence. It is noted that other indicators may emerge through the analysis of the data collected.

Indicators:

1. The culture values the integration of educational technologies into teaching and learning
2. There is an organizational approach to integrating educational technologies with learning
3. The financial models include educational technologies in budgets as recurrent items
4. There are strategies for knowledge sharing and development
5. Organizational strategies support educational technologies in teaching and learning.

Gauges of presence:

1. The culture values the integration of educational technologies into teaching and learning
 - Leadership about educational technologies is generated from the school leaders as well as ‘teacher-leaders’ and middle level coordinators
 - Members across the school community can articulate why educational technologies are important for the school community;
 - There is an expectation that all teachers will include technologies within their teaching and learning;
 - Innovation and risk-taking are valued and encouraged;
 - A culture of inquiry is fostered, underpinned with processes of reflection, conversations and action;
 - The school has a focus on professional learning of all staff which is varied according to the different requirements the respective staff members have;
 - As appropriate, the student outcomes include technologies;
 - A culture of collaboration and cooperation exists where it is acceptable to challenge existing paradigms and structures;
 - There is an environment of respect and trust;
 - Professional conversations occur incidentally and formally about technologies and students learning;
 - There is confidence and satisfaction in the culture and infrastructure of the school; and
 - A lifelong learning approach is evident across the school community.
2. There is an organizational approach to integrating educational technologies with learning
 - Strategic thinking opportunities that engage with technologies are provided for all members of the school community;
 - Technology issues form parts of other in-school committee agendas;
 - The IT infrastructure is a non-issue;
 - There is a perception of balance between educational technologies and other in-school demands;
 - There is a multi-faceted approach to in-school processes aimed at supporting educational technologies in teaching and learning including:
 - Budget allocations for educational technologies;
 - Staff meetings conducted around educational technologies issues;
 - Professional development activities held to address issues pertaining to learning with technologies;
 - Processes for ensuring equity of access to the technologies for the whole school community;
 - In-school curriculum planning processes which are well understood and include educational technologies;

- Technology-rich tasks are embedded into students learning;
 - Technical support officers and 'help' strategies are available;
 - Understood mechanisms exist for sharing information among staff on educational technologies;
 - In-school research and development strategies inform teaching and learning approaches; and
 - Monitoring, review and evaluation strategies are in place.
3. The financial models include educational technologies in budgets as recurrent items
- The educational technologies budget accompanies a strategic plan and approach and is part of the overall school/school district budget;
 - The budget takes into account the life cycle of the technologies in schools;
 - The budget takes into account the requirements of the integration of technologies into teaching and learning;
 - Budgetary processes are understood by the school community;
 - The cost of keeping abreast of technological changes are budgeted; and
 - Educational technologies budget is specific but allows for growth.
4. Strategies for knowledge sharing and development
- The school/school district has an 'expert team' as the core for development in educational technologies;
 - A Curriculum/Teaching and Learning team and/or school leadership team encourages and supports teachers to share ideas;
 - Communities of practice are established to support professional learning for teachers across classrooms;
 - Staff are 'buddied' up for mentoring and ongoing professional support;
 - The Executive Team of the school includes someone who holds the responsibility and oversight for addressing educational technologies issues across the school;
 - The teacher/librarian takes the role of 'future watching' and shares information with other staff and students; and/or
 - Across-faculty teams share ideas and strategies about incorporating technologies into teaching and learning.
5. Organizational strategies support educational technologies in teaching and learning
- There is a sound and broad understanding of education and technologies issues influencing school organization;
 - There is integration between different organizational structures: eg
 - IT infrastructure
 - Curricula, assessment, reporting and teaching and learning processes
 - Educational technologies budget
 - Asset management
 - Decision-making structures
 - Professional learning approaches
 - Structures for managing teaching and learning.
 - School organization enables staff to undertake professional learning activities;
 - Teachers and mentoring relationships are matched in the school organization so that time can be created that enables these teachers to get together; and/or
 - School organization allows students and teachers to regularly access computers.

It is with this conceptual framework then, the data for the case studies are being analyzed. The data from the case studies are being analyzed to determine whether there are common themes emerging, and to identify the commonalities and differences between each of them.

Where to from here?

The data will shortly be collected for the third of the three initial case studies. The analysis of the case studies will be fed back to the partners for their information and interpretation. It is anticipated that the outcomes from this research will operate at several different levels and will include:

- The establishment of a solid foundation for ongoing international collaboration with the respective partners on the issues concerning the measurement of the value of educational technologies in schools;
- The findings of the research will inform the school leaders' involved about approaches to data-driven decision-making concerning the deployment of educational technologies in schools; and
- The collection and comparison of the three case studies from the three countries will enable the identification of similarities and differences in their respective approaches to integrating educational technologies into school education.

The research may provide the background for the potential development of practices, standards and tools suitable for use in schools within the partner countries with which to collect, analyze and report school education performance outcomes in relation to educational technologies. Furthermore, the research may provide indicators of evidence upon which data-based decision-making about educational technologies in schools may be based.

Keywords

Informed consent

Consent forms are required from all participants in research both adults and the parents of children. Informed consent means that the participants are informed about the nature of the research. An information sheet about the project is usually prepared for circulation prior to consent being provided.

Intangible assets

Intangible assets of an organization include 'goodwill', brand names and the social capabilities of employees and strategies such as organizational learning.

Tangible assets

Physical or tangible assets owned by an organization or individual can be seen or touched. Technology tangibles include objects such as computer hardware, software, peripherals and bandwidth costs.

Structured case study approach

Case studies arise from a research method which involves an in-depth examination of a given phenomenon. A structured case study approach involves the identification of the types of data to be sought prior to collecting the data.

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